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Glossary - Acoustic terms

Abbreviation	Definition
CoRTN	The UK Department of Transport 's Calculation of Road Traffic Noise (1988)
dB	Decibel is the logarithmic unit used for expressing the sound pressure level (SPL) or power level (SWL) in acoustics.
dB(A)	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 very low and very high frequencies.
External traffic noise	Defined in the DIER Traffic Noise Management Guideline as traffic noise measured outside a building.
$L_{A10\ (period)}$	The sound pressure level that is exceeded for 10% of the measurement period.
$L_{A90\ (period)}$	The sound pressure level that is exceeded for 90% of the measurement period.
L_{Amax}	The maximum sound level recorded during the measurement period
L_{Amin}	The minimum sound level recorded during the measurement period
$L_{A10\ (18\ hour)}$	The arithmetic average of the LA10 levels for the 18-hour period between 0600 and 2400 hours on a normal working day. It is a common traffic noise descriptor.
$L_{Aeq\ (Time)}$	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. This is considered to represent ambient noise.
$L_{A90\ (Time)}$	The A-weighted sound pressure level that is exceeded for 90 per cent of the time over which a given sound is measured. This is considered to represent the background noise e.g. LA90 (15 min)
Rating Background Level (RBL)	The overall single-figure background level representing each assessment period (day/evening/night) over the whole monitoring period.
Residential use	Defined in the DIER Traffic Noise Management Guideline as land on which a domestic house has been or may be built
Sensitive use	A residential use or a use involving the presence of people for extended periods such as in a caravan park, child care centre, dwelling, hospital or school, except in the course of their employment.
Sound Pressure Level (SPL)	20 times the logarithm to the base 10 of the ratio of the RMS sound pressure level to the reference sound pressure level of 20 micropascals.
Traffic volume	The number of vehicles using a given section of road in a specified period, usually measured as the Average Annual Daily Traffic (AADT)

1. Introduction

1.1 Background

The Department of State Growth has engaged GHD Pty Ltd (GHD) to undertake a baseline noise monitoring and modelling assessment as part of the Midland Highway duplication project (the project).

1.2 Scope of work

The noise assessment involved a noise survey to establish the existing noise environment parameters, noise contour modelling to generate traffic noise predictions and an assessment of potential blasting impacts during construction. The detailed scope of work is presented below.

1.2.1 Baseline noise survey

The baseline noise survey involved the following tasks:

- An initial desktop review was conducted to identify key environmental noise sources and receivers from aerial photography, proposed alignment drawings and the previous noise assessment for the project. Potential noise logging and monitoring locations were also identified at this stage.
- A site visit was undertaken in order to determine the most appropriate noise monitoring locations within the selected properties. State Growth stakeholder engagement personnel assisted with property access for noise logging locations.
- During the site visit unattended noise logger equipment was deployed to conduct a noise survey with consideration to the Department of Environment, Parks, Heritage and the Arts Environment Protection Policy (Noise), 2009 and Noise Measurement Procedure Manual, Second Edition 2008 (NMPM).
  - The monitoring was conducted using noise loggers concurrently at five (5) locations within the study area. Monitoring was undertaken for a period of 2 weeks outside of school holiday periods as per the NMPM.
  - Logger results were used to establish the existing ambient noise environment and also capture existing road traffic noise for assessment of impacts and for noise model validation.
  - Two 15-minute duration operator attended noise measurements were undertaken adjacent to each logger on deployment for identification of specific local noise sources and their relative noise levels.
- Noise was assessed and filtered to remove invalid data due to extraneous noise or adverse weather conditions. Concurrent weather data was captured from the Bureau of Meteorology's Launceston Airport Automatic Weather Station (approximately 2 to 3 km east of the study area).
- The noise goals set in the DIER State Noise Strategy (2011) and the Tasmanian State Road Traffic Noise Management Guidelines (2011) have been outlined in this report.

1.2.2 Noise contour modelling

The following noise modelling scenarios have been prepared for the study area:

- An existing traffic noise model was prepared to predict the existing level of road traffic noise in the vicinity of the project for the current year of noise logging (Year 2015).

The current year existing noise model was used for the road traffic noise model verification process considering data obtained from the road traffic noise monitoring and from the concurrent traffic counts.

- Build 'Opening Year' and '10 year Horizon' scenarios –These scenarios included the 'Build' design only and did not include noise contributions from the surrounding road network for the relevant design year. Opening year was modelled based on anticipated traffic volumes within one year of the project becoming operational while the *horizon* scenario was based on traffic volumes at least 10 years from opening.
- No Build 'Opening Year' and '10 year Horizon' scenarios – The 'No Build' scenarios were developed to assess the increase in total traffic noise associated with the project. These models were based on the existing alignment and corresponding traffic volumes if the project were to not proceed.

The predicted noise levels from the detailed noise modelling were assessed against the noise criteria with a brief discussion of the results.

1.2.3 Operational noise mitigation options

The predicted noise levels from the detailed noise modelling were assessed against the noise criteria. Where the noise criteria were predicted to be exceeded, mitigation options have been discussed. One additional modelling scenario of 'Build, 10 year horizon' was undertaken including concept level potential mitigation options.

1.2.4 Noise and vibration assessment – blasting

A blasting noise and vibration assessment was undertaken in accordance with Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration Australian and New Zealand Environment and Conservation Council (ANZECC).

1.3 Limitations

This report: has been prepared by GHD for Department of State Growth and may only be used and relied on by Department of State Growth for the purpose agreed between GHD and the Department of State Growth as set out in Section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than Department of State Growth 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 Section 4.1.1 of this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Department of State Growth and others who provided information to GHD, which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

The findings of this report represent the findings apparent at the date and time of the assessment. It is the nature of environmental assessments that all variations in environmental conditions cannot be accessed and all uncertainty concerning the conditions of the ambient noise environment cannot be eliminated. Professional judgement must be exercised in the investigation and interpretation of observations.

Site conditions (including the presence of insect noise or other noise sources) 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 Study area and sensitive receivers

The proposal is located along the Midland Highway between the town of Perth and the roundabout at Breadalbane.

The study area for this assessment is defined by the construction footprint of the proposal and the nearby potentially affected noise sensitive receivers.

Receivers near to the proposal consist of the northern residential areas of Perth, rural/residential receivers of Devon Hills and scattered along the eastern side of the Midland Highway. A residential receiver located at the northern end of the study area is the only sensitive receiver location on the western side of the proposed road. Locations nearer to the proposal have been assessed for traffic noise.

The nearest sensitive receiver locations are identified in Figure 2-1 and Figure 2-2 with residential receivers denoted by 'R##'. Proposed blast locations are identified as B1 and B2. Logger locations are denoted L1 to L5.

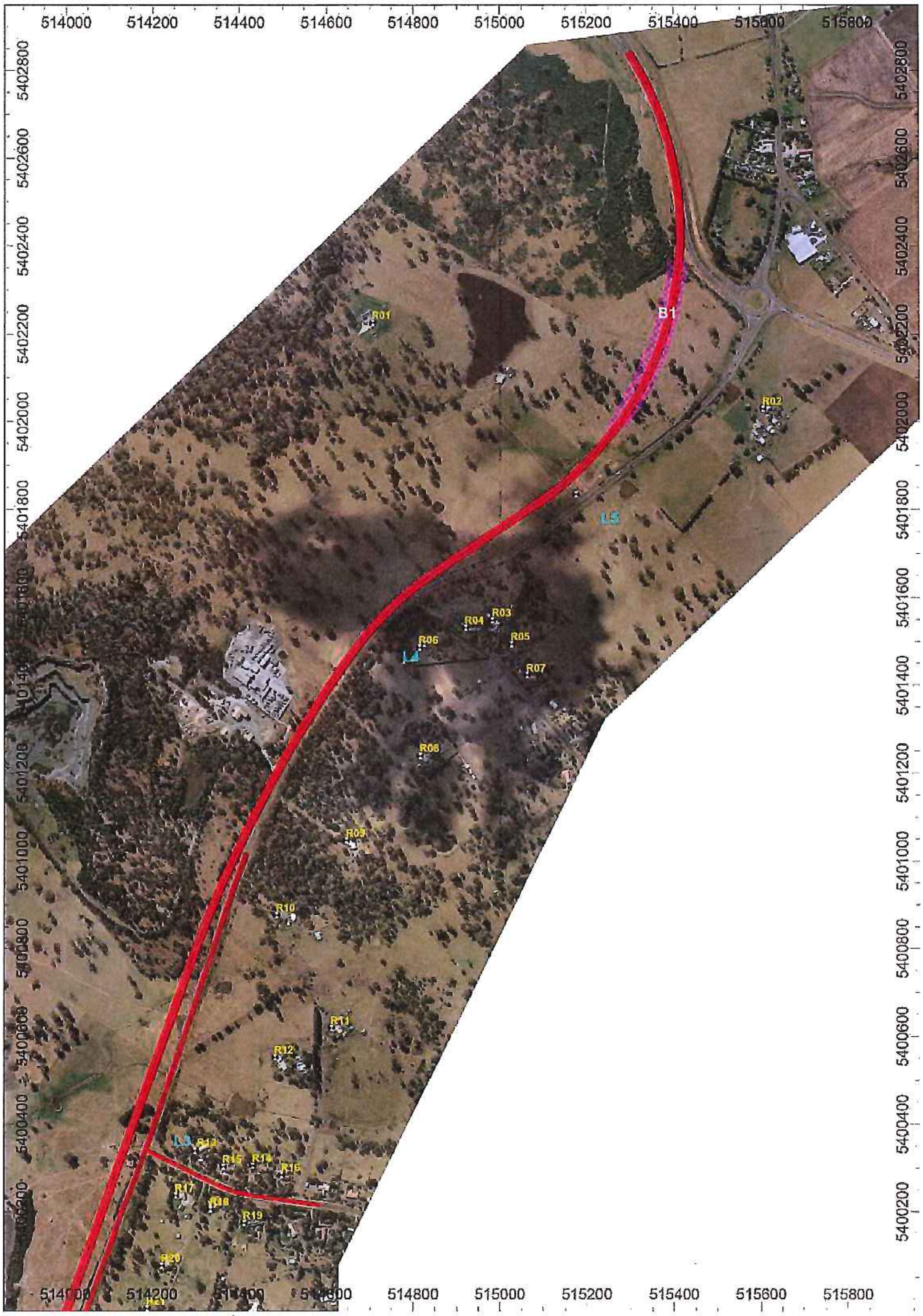


Figure 2-1 Proposed road alignment and locations (north)

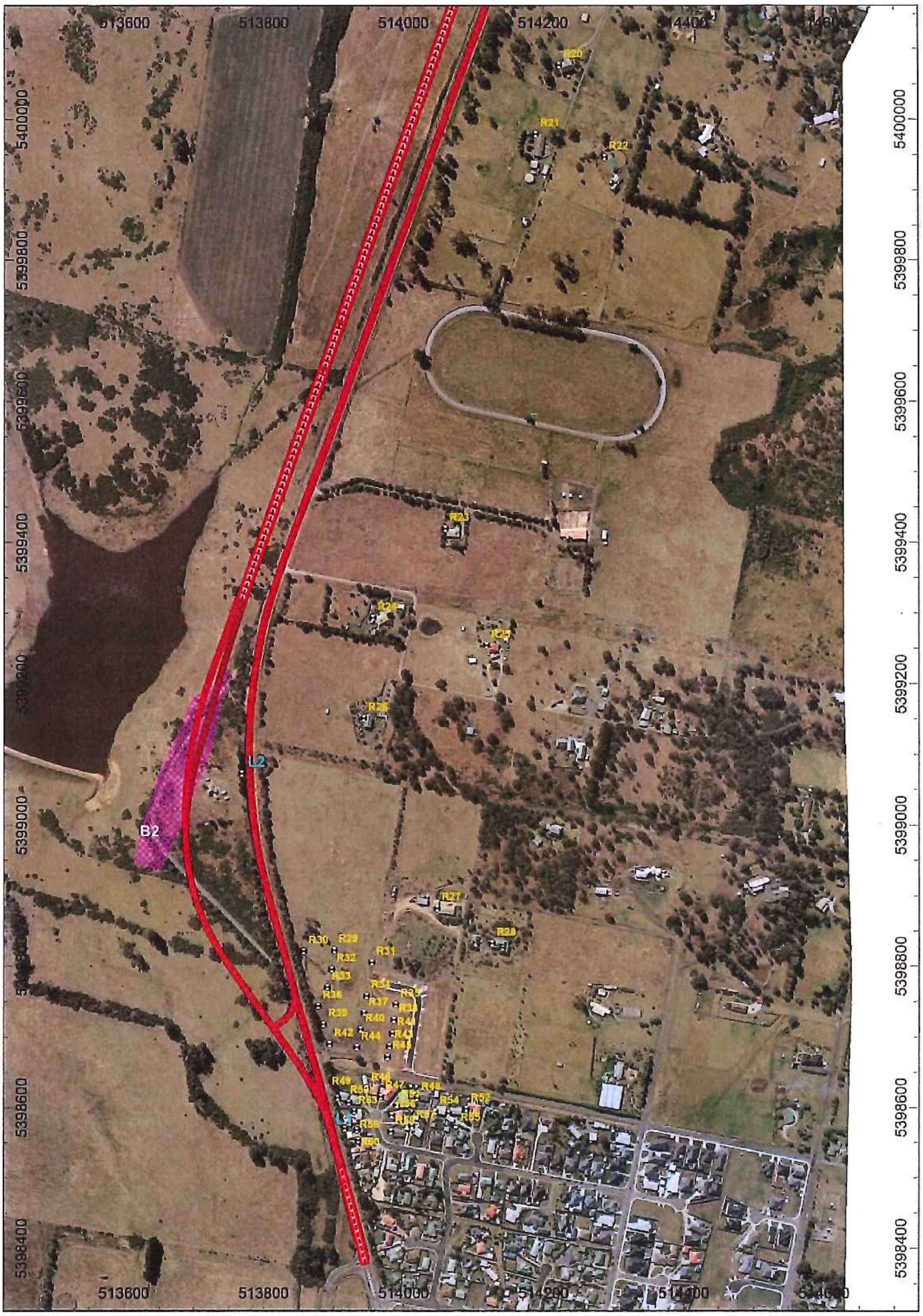


Figure 2-2 Proposed road alignment and locations (south)

2.2 Noise monitoring methodology

2.2.1 Unattended noise monitoring

Unattended noise monitoring was undertaken between 4 February 2014 and 11 July 2014 at five (5) monitoring locations (L1 to L5). These locations were considered to be representative of the existing ambient noise environment and suitable to capture road traffic noise levels from the Midland Highway adjacent to the respective logger location. Additionally, the monitoring locations were private properties identified as being a safe and secure place for unattended equipment. Loggers were deployed on 3 and 4 February 2015 following the end of the school holiday period to capture noise levels during a period of typical traffic volumes.

Noise monitoring was undertaken using SVAN 955 environmental noise loggers within current calibration, capable of measuring continuous sound pressure levels and L_{A90}, L_{A10} and L_{Aeq} noise descriptors. The instruments were programmed to accumulate environmental noise data continuously over sampling periods of 60 minutes for the entire monitoring period.

Field calibration checks were undertaken immediately before and after the monitoring period with a sound pressure level of 94 dB at 1 kHz using a Bruel and Kjaer Acoustic sound level calibrator (serial number 2542101).

The data collected by the loggers was downloaded and analysed, and any invalid data removed. Concurrent weather data for the monitoring period was sourced from the nearest Bureau of Meteorology Station in Launceston (Approximately 2 to 3 kilometres east of the study area).

Details of the noise loggers and locations are provided in Table 2-1. All sampling activities were undertaken with consideration to the Department of Environment, Parks, Heritage and the Arts *Environment Protection Policy* (Noise), 2009 and *Noise Measurement Procedure Manual*, Second Edition 2008 (NMPM).

Table 2-1 Unattended noise logger details

Noise logger	Location 1	Location 2	Location 3	Location 4	Location 5
Monitoring location	41 Sassafras Street	16267 Midland Highway	2 Devon Hills Road	46 Summit Drive	Lot 2 Midland Highway
Location ID	L1	L2	L3	L4	L5
Logger type/ Serial No	SVAN 955 / 27624	SVAN 955 / 27615	SVAN 955 / 27622	SVAN 955 / 27625	SVAN 955 / 27621
Measurement started	04/02/2015 4:00pm	03/02/2015 5:00pm	04/02/2015 5:00pm	03/02/2015 6:00pm	04/02/2015 12:00pm
Measurement ceased	18/02/2015 9:00am	18/02/2015 9:00am	18/02/2015 10:00am	18/02/2015 10:00am	18/02/2015 11:00am
Pre calibration	94.0	94.0	94.0	94.0	94.0
Post calibration	93.9	93.7	93.7	93.8	93.7
Frequency weighting	A	A	A	A	A
Time response	Fast	Fast	Fast	Fast	Fast
Photographs					

2.2.2 Attended noise monitoring

Attended noise measurements were conducted on 3 and 4 February 2015 at all five monitoring locations on deployment of the loggers. Attended monitoring was conducted for two measurements of 15 minute durations in order to identify ambient noise sources and validate logger data. Instantaneous noise levels for operator identified noise sources were observed and noted during measurements.

The attended measurements were taken using a Bruel and Kjaer 2250 sound level meter (SLM). This is a Type 1 Instrument which is capable of measuring continuous sound pressure levels and able to record L_{Amin}, L_{A90}, and L_{Aeq} noise descriptors. Field calibration checks were undertaken immediately before and after the survey with a sound pressure level of 94 dB at 1 kHz using a Bruel and Kjaer Acoustic sound level calibrator (serial number 2542101).

2.2.3 Simultaneous traffic counts

Traffic counts were conducted from 10 to 18 February on the existing Midland Highway within the study area. This enables the noise model to be calibrated for the existing scenario using actual traffic parameters such as speed, heavy vehicle percentages and overall volumes experienced by the noise loggers at the time of the survey. The traffic parameters utilised in the noise modelling are presented in Section 4.1.2.

2.3 Summary of noise monitoring results

2.3.1 Unattended noise monitoring

A summary of the calculated background L_{A90} (day, evening and night) noise levels, ambient L_{Aeq} (day, evening and night) noise levels and road traffic descriptors for the monitoring period at the unattended logger locations with all invalid weather affected data removed are provided in Table 2-2 with daily data presented in Table 2-3 to Table 2-7. Noise monitoring charts are presented in Appendix A.

Table 2-2 Summary of logger results, dB(A)

Logger location	Background L_{90} noise levels			Ambient noise levels L_{eq}			Road traffic noise descriptor
	Day (7am to 6pm)	Evening (6pm to 10pm)	Night (10 pm to 7am)	Day (7am to 6pm)	Evening (6pm to 10pm)	Night (10 pm to 7am)	$L_{10(18hr)}$ (6am to 12am)
L1	45	35	20	64	60	57	65
L2	50	43	23	69	66	63	72
L3	48	40	21	57	56	52	59
L4	48	41	25	58	55	53	60
L5	48	45	30	66	63	60	68

Table 2-3 Location L1 – 41 Sassafras Street, dB(A)

Date	Background L_{90} noise levels			Ambient noise levels L_{eq}			Road traffic noise descriptors
	Day (7am to 6pm)	Evening (6pm to 10pm)	Night (10 pm to 7am)	Day (7am to 6pm)	Evening (6pm to 10pm)	Night (10 pm to 7am)	$L_{10(18hr)}$ (6am to 12am)
Tuesday-3-Feb-15	50	37	23	63	60	58	63
Wednesday-4-Feb-15	47	35	20	65	60	58	65
Thursday-5-Feb-15	44	38	21	65	60	58	65
Friday-6-Feb-15	44	39	20	64	60	55	65
Saturday-7-Feb-15	38	35	20	62	59	54	63
Sunday-8-Feb-15	36	34	25	62	60	57	63
Monday-9-Feb-15	44	33	20	64	59	58	64
Tuesday-10-Feb-15	42	33	20	64	59	58	65
Wednesday-11-Feb-15	45	37	25	64	62	58	64
Thursday-12-Feb-15	45	33	20	64	61	58	65
Friday-13-Feb-15	45	34	20	66	63	56	66
Saturday-14-Feb-15	49	36	21	63	59	55	64
Sunday-15-Feb-15	39	29	20	62	59	57	63
Monday-16-Feb-15	46	35	20	64	59	58	64
Tuesday-17-Feb-15	45	36	20	63	60	58	64
Wednesday-18-Feb-15	48			64			67
RBL	**45**	**35**	**20**	-	-	-	-
$L_{eq,\ (day/evening/night)}$	-	-	-	**64**	**60**	**57**	-
Road traffic noise descriptors (weekdays)	-	-	-	-	-	-	**65**

Table 2-4 Location L2 – 16267 Midland Highway, dB(A)

Date	Background L_{90} noise levels			Ambient noise levels L_{eq}			Road traffic noise descriptors
	Day (7am to 6pm)	Evening (6pm to 10pm)	Night (10 pm to 7am)	Day (7am to 6pm)	Evening (6pm to 10pm)	Night (10 pm to 7am)	$L_{10(18hr)}$ (6am to 12am)
Tuesday-3-Feb-15	55	41	28	70	66	64	69
Wednesday-4-Feb-15	53	44	21	70	67	64	72
Thursday-5-Feb-15	49	47	23	70	67	64	72
Friday-6-Feb-15	49	48	21	69	67	61	72
Saturday-7-Feb-15	48	46	25	68	65	61	70
Sunday-8-Feb-15	46	39	34	68	66	63	69
Monday-9-Feb-15	49	42	19	69	66	64	71
Tuesday-10-Feb-15	49	41	19	69	66	63	72
Wednesday-11-Feb-15	51	43	31	69	66	64	71
Thursday-12-Feb-15	49	46	22	70	67	63	72
Friday-13-Feb-15	50	47	23	70	68	62	73
Saturday-14-Feb-15	54	41	22	69	65	61	69
Sunday-15-Feb-15	45	37	23	69	66	63	70
Monday-16-Feb-15	52	42	24	69	66	63	71
Tuesday-17-Feb-15	50	44	20	69	67	64	72
Wednesday-18-Feb-15	54			70			74
RBL	**50**	**43**	**23**				
$L_{eq, (day/evening/night)}$				**69**	**66**	**63**	
Road traffic noise descriptors (weekdays)							**72**

Table 2-5 Location L3 – 2 Devon Hills Road, dB(A)

Date	Background L_{90} noise levels			Ambient noise levels L_{eq}			Road traffic noise descriptors
	Day (7am to 6pm)	Evening (6pm to 10pm)	Night (10 pm to 7am)	Day (7am to 6pm)	Evening (6pm to 10pm)	Night (10 pm to 7am)	$L_{10(18hr)}$ (6am to 12am)
Wednesday-4-Feb-15	47	42	21	55	56	53	58
Thursday-5-Feb-15	48	43	20	57	56	55	59
Friday-6-Feb-15	49	44	20	57	57	52	60
Saturday-7-Feb-15	46	39	24	56	55	50	58
Sunday-8-Feb-15	45	37	27	54	53	49	56
Monday-9-Feb-15	47	36	19	55	54	53	58
Tuesday-10-Feb-15	48	42	20	56	55	53	58
Wednesday-11-Feb-15	50	41	25	57	55	51	59
Thursday-12-Feb-15	46	40	20	56	54	54	57
Friday-13-Feb-15	48	42	20	57	57	50	59
Saturday-14-Feb-15	49	39	19	55	52	49	56
Sunday-15-Feb-15	43	34	26	57	58	52	58
Monday-16-Feb-15	51	39	22	59	55	50	59
Tuesday-17-Feb-15	49	43	23	58	55	53	58
Wednesday-18-Feb-15	50			58			61
RBL	**48**	**40**	**21**				
$L_{eq, (day/evening/night)}$				**57**	**56**	**52**	
Road traffic noise descriptors (weekdays)							**59**

Table 2-6 Location L4 – 46 Summit Drive, dB(A)

Date	Background L_{90} noise levels			Ambient noise levels L_{eq}			Road traffic noise descriptors
	Day (7am to 6pm)	Evening (6pm to 10pm)	Night (10 pm to 7am)	Day (7am to 6pm)	Evening (6pm to 10pm)	Night (10 pm to 7am)	$L_{10(18hr)}$ (6am to 12am)
Tuesday-3-Feb-15	51	37	25	59	56	54	59
Wednesday-4-Feb-15	47	43	25	59	56	54	61
Thursday-5-Feb-15	48	43	23	59	55	55	61
Friday-6-Feb-15	49	43	25	59	55	51	61
Saturday-7-Feb-15	43	40	23	57	55	49	59
Sunday-8-Feb-15	44	34	30	56	55	52	58
Monday-9-Feb-15	47	36	20	58	54	54	60
Tuesday-10-Feb-15	48	41	22	58	55	54	60
Wednesday-11-Feb-15	48	40	28	58	55	53	60
Thursday-12-Feb-15	47	41	23	58	56	54	60
Friday-13-Feb-15	49	44	28	59	58	52	61
Saturday-14-Feb-15	47	39	23	56	53	49	58
Sunday-15-Feb-15	40	39	34	57	54	53	59
Monday-16-Feb-15	49	42	28	58	55	53	60
Tuesday-17-Feb-15	48	41	31	59	55	54	60
Wednesday-18-Feb-15	49			60			63
RBL	**48**	**41**	**25**				
$L_{eq,\ (day/evening/night)}$				**58**	**55**	**53**	
Road traffic noise descriptors (weekdays)							**60**

Table 2-7 Location L5 – Lot 2 Midland Highway, dB(A)

Date	Background L_{90} noise levels			Ambient noise levels L_{eq}			Road traffic noise descriptors
	Day (7am to 6pm)	Evening (6pm to 10pm)	Night (10 pm to 7am)	Day (7am to 6pm)	Evening (6pm to 10pm)	Night (10 pm to 7am)	$L_{10(18hr)}$ (6am to 12am)
Wednesday-4-Feb-15	50	44	20	67	63	62	68
Thursday-5-Feb-15	48	47	27	66	63	62	68
Friday-6-Feb-15	49	47	23	65	62	58	68
Saturday-7-Feb-15	44	46	34	63	61	56	65
Sunday-8-Feb-15	44	42	33	64	64	60	66
Monday-9-Feb-15	48	40	19	66	61	61	68
Tuesday-10-Feb-15	47	45	29	66	63	61	68
Wednesday-11-Feb-15	48	46	33	67	62	62	67
Thursday-12-Feb-15	49	44	27	67	65	61	69
Friday-13-Feb-15	48	43	31	67	65	59	69
Saturday-14-Feb-15	52	38	33	66	62	58	67
Sunday-15-Feb-15	45	44	38	65	62	60	66
Monday-16-Feb-15	48	45	36	65	62	61	67
Tuesday-17-Feb-15	49	46	28	66	63	62	68
Wednesday-18-Feb-15	50			67			71
RBL	**48**	**45**	**30**				
$L_{eq, (day/evening/night)}$				**66**	**63**	**60**	
Road traffic noise descriptors (weekdays)							**68**

2.3.2 Attended noise monitoring

A summary of the attended noise monitoring results is provided in Table 2-8.

Table 2-8 Attended monitoring results

Monitoring location	Date	Measurement time		Measured noise levels			Comments
		Start	Stop	L_{Aeq}	L_{A1}	L_{A90}	
L1	3/2/2015	14:42	14:57	61	71	49	Road traffic noise
		14:57	15:12	62	74	49	Road traffic noise
L2	3/2/2015	15:35	15:50	67	76	55	Road traffic noise
		15:51	16:06	67	76	55	Road traffic noise
L3	4/2/2015	16:04	17:04	56	63	47	Road traffic noise
L4	3/2/2015	16:42	16:57	57	64	52	(Adjacent to logger) Road traffic noise, birds, dogs
		17:05	17:20	69	78	48	(Adjacent to road) Road traffic noise, birds, dogs, aeroplane
L5	4/2/2015	11:37	11:52	67	77	50	Road traffic noise
		11:53	12:08	66	76	51	Road traffic noise, aeroplane

3. Noise criteria

3.1 Road traffic noise criteria

In Tasmania transport related noise emissions on State roads are managed in accordance with the *Environmental Management and Pollution Control Act 1994* (EMPCA) under a subsidiary policy, *Environmental Protection Policy (Noise) 2009* released by the Department of Environment Parks Heritage and the Arts (DEPHA).

The Tasmanian Department of Infrastructure and Energy Road Traffic Noise Management Guidelines (TNMG) set the target criteria for State roads and provide guidance to road and land use planners, road designers and the community on how traffic noise on the state road network is managed.

The TNMG discusses an assessment location of 1.5 metres above ground at 1 metre from the most exposed façade of a dwelling. However as there are multiple two-storey residential dwellings present in the study area this assessment includes calculated noise levels to 4.5 metres height at identified two-storey residence locations. While these additional locations are not specified by the TNMG, it is recommended that they be considered when formulating noise mitigation measures.

The target criteria adopted for this assessment for new and major road upgrades is shown in Table 3-1.

Table 3-1 Target traffic noise criteria for new roads and major road upgrades, dB(A)

Target traffic noise level	Application	Comments
$L_{A10(18\ hour)}$ 63	On road construction and upgrade projects a design traffic noise levels $L_{A10(18\ hour)}$ 63 dB(A) or below for noise sensitive land uses will be considered, subject to what is considered both feasible and reasonable.	A traffic noise level of 63 dB(A) or less (measured at the building façade), is considered to be acceptable for most adjacent uses for people.
$L_{A10(18\ hour)}$ 68	Outside road construction and upgrade projects where increases in traffic noise levels occur an operation traffic noise level of $L_{A10(18\ hour)}$ 68 dB(A) will be considered to be a practical upper limit	As levels increase above 63 dB(A) impacts become less acceptable to more people. A level above 68 dB(A) (measured at building façade) is considered to be undesirable for sensitive uses.

3.2 Blasting overpressure and vibration criteria

Typically, when dealing with potential blasting noise and vibration, assessment is undertaken with regard to Australian and New Zealand Environment and Conservation Council (ANZECC) Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration (1990). This guideline recommends the following noise and vibration limits.

Table 3-2 Recommended ANZECC 1990 Blasting limits

Airblast Overpressure	Ground Vibration
115 dB(lin) peak	5mm/s PPV
The level of 115 dB may be exceeded on up to 5% of the total number of blasts over a period of 12 months, but never over 120 dB(lin) peak.	The level of 5mm/s may be exceeded on up to 5% of the total number of blasts over a period of 12 months, but never over 10 mm/s.

4. Road traffic noise assessment

4.1 Noise modelling methodology

Acoustic modelling was undertaken using Computer Aided Noise Abatement (CadnaA) to predict the traffic noise levels generated from vehicles along the Midland Highway within the study area.

CadnaA is a computer program for the calculation, assessment and prognosis of noise propagation. The CadnaA noise model was configured using The United Kingdom Department of Environment's Calculation of Road Traffic Noise (CoRTN). Using the physical properties of traffic volume and mix, ground topography, road gradient, air and ground absorption and source and receiver height, scenarios were modelled using CoRTN to predict the $L_{10(18hr)}$ noise indices.

To predict the traffic noise levels emanating from the subject roads at the noise monitoring locations, three scenarios were modelled:

- An existing traffic noise model – Year 2015 - to verify the operational noise model with consideration to data obtained from the road traffic noise monitoring.
- A traffic noise model for the year of anticipated project completion – Year 2015 - to assess compliance with the noise criteria and assess any increases in road traffic noise.
- A traffic noise model for 10 years after the project completion – Year 2025 - to assess compliance with the noise criteria and assess any increases in road traffic noise.

The noise models incorporate three-dimensional alignments of the proposed road upgrades, noise sensitive buildings and receivers, traffic volumes, vehicle posted speeds, heavy vehicle percentages and road surface characteristics.

The assessment has been modelled based on available data at the time of assessment.

4.1.1 Model inputs and assumptions

The inputs and assumptions included in the noise models are outlined below and presented in Table 4-1.

Table 4-1 Noise model inputs

Inputs	Assumption
Traffic speeds	• 91km/h, Existing Midland Highway, Perth to Breadalbane (Mean speed, weekday traffic, Feb2015 survey) • 60km/h, Devon Hills Road (posted speed) • 110km/h, Design speed
Road surface	Existing: 14 mm dense graded asphalt , texture depth =1 mm Build: texture depth =2 mm
Australian Road Research Board corrections for Australian conditions (standard corrections)	-1.7 dB(A) for 'façade' -0.7 dB(A) for 'free-field'
Façade correction	+2.5 dB(A) to account for sound reflected from the façade
Source heights above road surface	Light vehicles and heavy vehicle rolling noise – 0.5 m Heavy vehicle engines – 1.5 m Heavy vehicle exhaust – 3.6 m
Receiver heights	Ground floor – 1.5 m above building ground level
Ground topography, existing alignment and design	Existing: LIDAR 10 m contours merged with 0.5m survey Design: DXF design strings and terrain

Inputs	Assumption
Road gradient	Taken into account based on road design model and road survey
Ground absorption	G = 1.0
Atmospheric conditions	10°C and 70 % humidity

4.1.2 Traffic volumes

The CoRTN algorithm calculates traffic noise emissions levels based on traffic flows, heavy vehicle percentages, vehicle speeds, road gradients and road pavement types. The CoRTN algorithm requires 18-hour traffic volumes (6 am to 12 am midnight).

Traffic counts were conducted from 10 to 18 February on the existing Midland Highway within the study area. This data has been processed to identify the relevant parameters for noise model input including heavy vehicle percentage and average speeds.

A traffic report was prepared separately for the site by DIER in 2014 (DIER traffic report) which included peak hour counts undertaken in September 2013 and traffic modelling parameters for the area. This report has been used to inform projected traffic growth rates and volumes on side roads including Devon Hills Road. The peak hour values were converted to 18-hour values using the multiplication factor obtained from the February 2015 traffic counts undertaken during noise logging.

The following assumptions have been made regarding traffic volumes:

- Peak-hour (AM/PM average) × 11.2 = 18-hour volumes.
- Traffic volumes and heavy vehicle percentages for the year 2025 (10 year horizon) have been determined by applying an annual growth rate of 1.5 % for the Midland Highway and 0.5% for Devon Hills Road based on information provided in the DIER traffic report.
- Heavy vehicle percentages:
  - Midland Highway = 9.3%. (based on Feb 2015 traffic counts).
  - Other roads = 9% based on DIER traffic report.
- Following implementation of the project it is assumed that the existing Midland Highway will provide access to Devon Hills Road for local traffic only. The traffic volumes used in the noise models are summarised in Table 4-2 to Table 4-3.

Table 4-2 Noise modelling traffic volumes -Year 2015

Road	18 hour vehicles totals	Heavy vehicle percentage
Existing: Midland Highway	13310	9.3%
Existing: Devon Hills Road	1237	9%
Project: Midland Highway upgrade section	13310	9.3%
Project: Midland Highway access to Devon Hills Road	1237	9%

Table 4-3 Noise modelling traffic volumes -Year 2025

Road	18 hour vehicles totals	Heavy vehicle percentage
Existing: Midland Highway	15447	9.3%
Existing: Devon Hills Road	1300	9%
Project: Midland Highway upgrade section	15447	9.3%
Project: Midland Highway access to Devon Hills Road	1300	9%

4.1.3 Model validation

The predicted noise levels from the Year 2015 existing traffic noise model were verified against measured noise levels at five noise logging locations L1 to L5. Noise levels were predicted at the same location and height as the noise loggers. The model is deemed to be verified if the difference between the measured and calculated values of the descriptors is within +/- 2.0 dB (A).

Verification of calculated noise receivers at noise monitoring locations are shown in Table 4-4. The average difference between the measured and calculated results are within 2.0 dB (A) therefore the noise model is considered to be verified.

Table 4-4 Summary of verification results, dB (A)

Location	Measured $L_{10,18\ hour}$	Calculated $L_{10,18\ hour}$	Difference (measured – calculated)
L1	64.7	64.4	0.3
L2	71.6	71.8	-0.2
L3	58.8	59.3	-0.5
L4	60.3	60.4	-0.1
L5	68.0	67.7	0.3

4.2 Predicted noise levels

A summary of façade corrected noise modelling predictions is presented in Table 4-5 for receivers within the noise study area. Predicted noise contours are presented in Figure 4-1, Figure 4-2 and Figure 4-3 respectively for the 2015 'existing', 2025 'no build' and 2025 'build scenarios.

Table 4-5 Predicted noise levels, dB(A)

Name	Criterion $L_{10,18\ hour}$	No Build (Existing) – Year 2015[1] $L_{10,18\ hour}$	No Build – Year 2025 $L_{10,18\ hour}$	Build – Year 2015 $L_{10,18\ hour}$	Build – Year 2025 $L_{10,18\ hour}$
R01	63	51	51	55	55
R02	63	59	60	56	57
R03	63	60	61	62	62
R04	63	61	62	63	63
R05	63	57	57	59	60
R06	63	60	61	63	63
R07	63	54	55	57	57

[1] Existing noise levels presented in the table are modelled levels.

Name	Criterion $L_{10,18\ hour}$	No Build (Existing) – Year 2015[1] $L_{10,18\ hour}$	No Build – Year 2025 $L_{10,18\ hour}$	Build – Year 2015 $L_{10,18\ hour}$	Build – Year 2025 $L_{10,18\ hour}$
R08	63	53	54	56	56
R09	63	57	57	59	60
R10	63	60	61	62	63
R11	63	53	54	56	56
R12	63	56	56	58	59
R13	63	60	60	61	61
R14	63	55	56	57	58
R15	63	58	58	59	60
R16	63	54	55	56	57
R17	63	60	61	60	61
R18	63	57	58	58	59
R19	63	55	56	57	57
R20	63	59	60	59	60
R21	63	59	59	59	59
R22	63	54	55	55	56
R23	63	55	56	56	57
R24	63	57	58	58	58
R25	63	53	53	54	54
R26	63	56	57	57	57
R27	63	55	55	55	56
R28	63	53	53	54	54
R29	63	63	64	61	61
R30	63	70	71	64	64
R31	63	59	60	59	59
R32	63	64	65	61	62
R33	63	66	67	63	64
R34	63	60	61	60	60
R35	63	57	58	58	58
R36	63	70	71	66	66
R37	63	61	61	60	61
R38	63	58	58	58	58
R39	63	69	70	66	66
R40	63	61	62	61	62
R41	63	58	58	58	59
R42	63	68	69	66	67
R43	63	58	59	59	59
R44	63	63	63	63	63
R45	63	59	60	60	60
R46	63	62	63	64	64
R47	63	61	62	62	63
R48	63	57	57	58	58
R49	63	71	72	72	72
R50	63	67	68	68	69

Name	Criterion $L_{10,18\ hour}$	No Build (Existing) – Year 2015[1] $L_{10,18\ hour}$	No Build – Year 2025 $L_{10,18\ hour}$	Build – Year 2015 $L_{10,18\ hour}$	Build – Year 2025 $L_{10,18\ hour}$
R51	63	59	60	60	61
R52	63	54	55	55	56
R53	63	66	67	68	68
R54	63	56	56	57	57
R55	63	55	56	56	57
R56	63	60	61	61	62
R57	63	58	58	59	60
R58	63	67	67	69	69
R59	63	60	61	62	62
R60	63	67	67	69	69

Note 1: Values highlighted and in **bold** indicates an exceedance of the target criteria of 63 dB $L_{A10\ 18hr}$

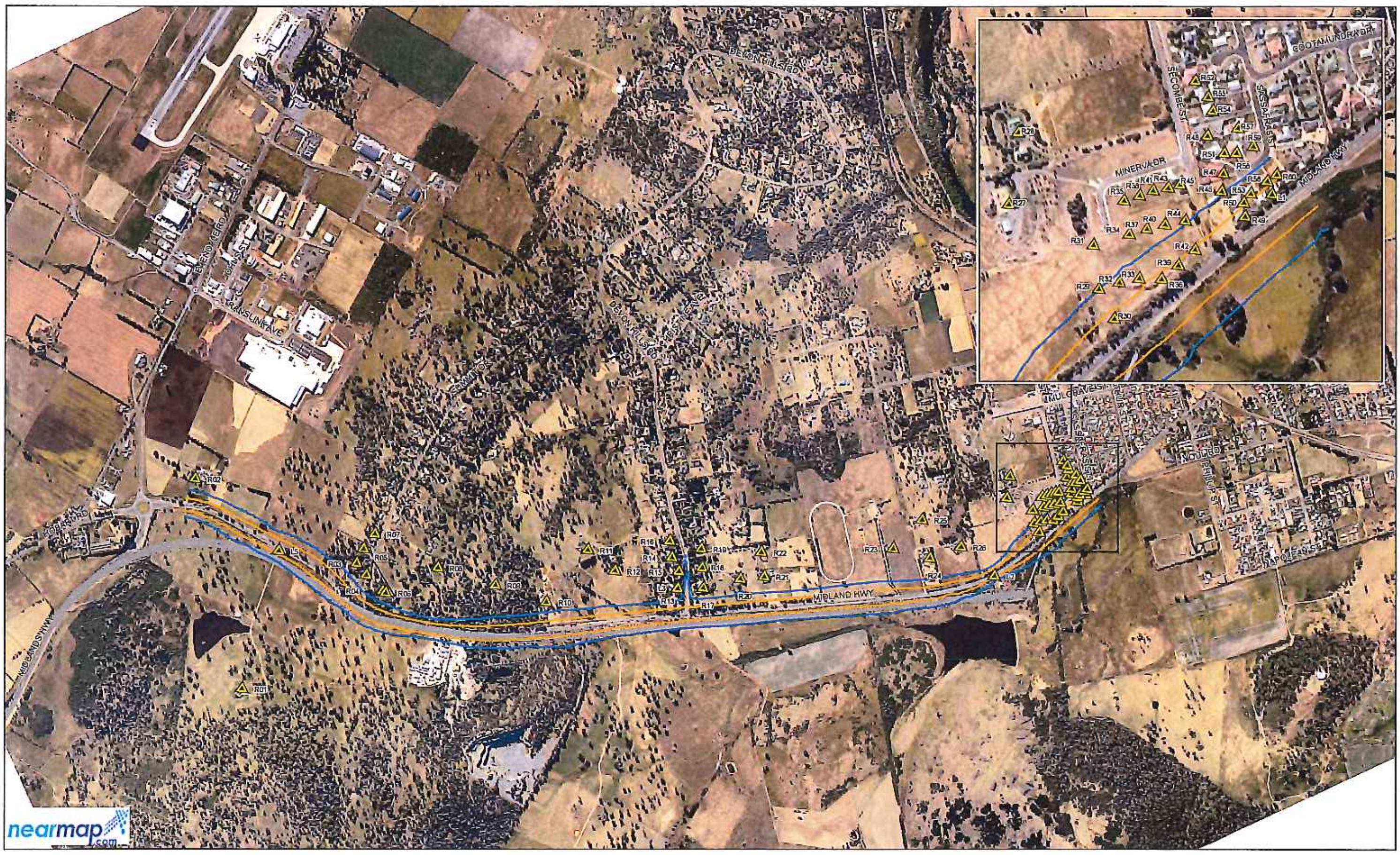
Note 2: Existing domestic fences have not been included in the noise model for the purposes of this assessment as their condition and acoustic performance is unknown.

An analysis of the predicted results presented in Table 4-5 indicates that the noise levels received at the nearest sensitive receivers in the vicinity of the proposal will exceed the 63 dB (A) $L_{A10\ 18hr}$ target criteria and the upper limit target of 68 dB (A) $L_{A10\ 18hr}$ for existing residences by up to 9 dB and 4 dB respectively. However the modelling results also show that noise levels at these receivers are already at or above the target criteria.

Under the *Tasmanian State Road Traffic Noise Management Guidelines* (2011) an exceedance of the target criterion may trigger the requirement of noise mitigation measures.

The results indicate that noise levels are anticipated to increase over the 10 year period by 0.6 to 0.7 dB due to natural traffic volume growth. This increase in noise would also be expected if the project did not proceed.

The anticipated increase in noise due to the project, not including natural growth, is between 0.2 dB and 3.1 dB. This is mainly attributable to the increase in traffic speeds to 110 km/h and the raised elevation of the proposed alignment relative to the existing road.



Paper Size A3

0 70 140 280 420 560

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

LEGEND
- Design
- 63dB LA10 18hour
- 68dB LA10 18hour
- Receiver

Note:
Noise levels account for building facade and ARRB corrections.

GHD

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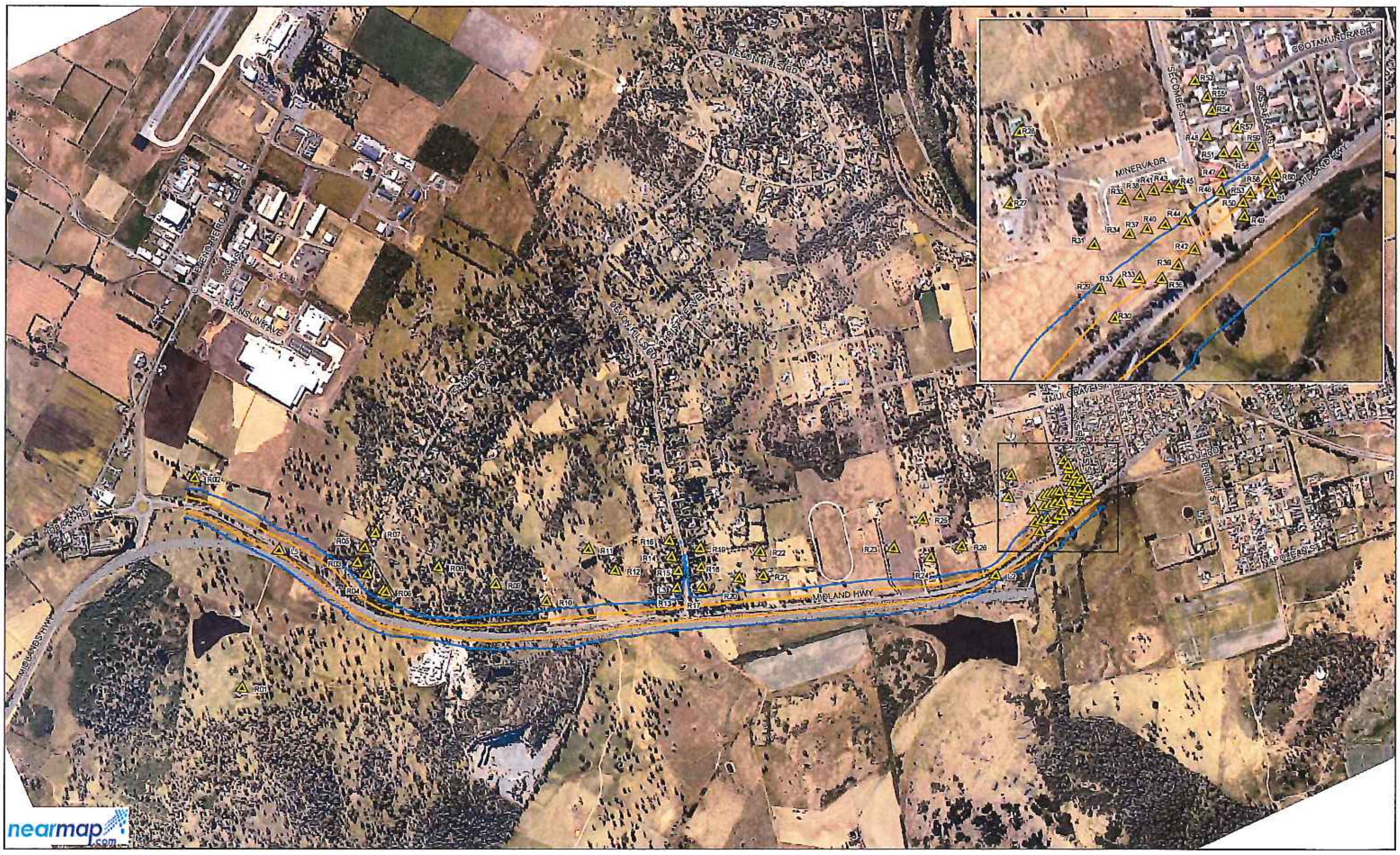
Noise and Vibration Assessment Report

Job Number	32-17526
Revision	0
Date	04 May 2015

Existing 2015

Figure 5.1

Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 T 61 2 4979 9999 F 61 2 4979 9988 E ntlmail@ghd.com W www.ghd.com.au



Paper Size A3

0 70 140 280 420 560

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

LEGEND

- Design
- 63dB LA10 18hour
- 68dB LA10 18hour
- Receiver

Note:
Noise levels account for building facade and ARRB corrections.

GHD

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perth to Breadalbane
Noise and Vibration Assessment Report

Job Number	32-17526
Revision	0
Date	04 May 2015

No Build 2025

Figure 5.2

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Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 T 61 2 4979 9999 F 61 2 4979 9988 E ntlmail@ghd.com W www.ghd.com.au

Paper Size A3

0 70 140 280 420 560

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

LEGEND
Design
63dB LA10 18hour
68dB LA10 18hour
Receiver

Note:
Noise levels account for building facade and ARRB corrections.

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Noise and Vibration Assessment Report

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Date	04 May 2015

Build 2025

Figure 5.3

Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 T 61 2 4979 9999 F 61 2 4979 9988 E ntlmail@ghd.com W www.ghd.com.au

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Data source: Nearmap: Aerial Image, 2015. Created by: lmorton, tmackey

5. Blasting noise and vibration assessment

5.1 Potential blasting impacts

Potential locations requiring blasting during the construction phase of the project were identified by the design team as approximate Chainages 6100 to 6400 and Chainages 9640 to 10100. These locations are indicated in Figure 2-1 and Figure 2-2 as locations B1 and B2 respectively.

Air blast overpressure and ground vibration were estimated at sensitive receptors using a distance relationship calculation, with reference to AS 2187.2 – 2006 *Explosives – Storage and use Part 2: Use of explosives*.

Ground vibration and airblast overpressure estimations have been undertaken with consideration to AS2187-2006 and have been based on available information. Typical site constants have been used in the blasting assessment to reflect geological conditions, however ground conditions, including rock structure and strata type, can vary significantly within and surrounding a particular site and this can affect the propagation of vibration and airblast overpressure. Calculations are based on the distance from the nearest edge of the project boundary, to the sensitive receptors. It should be noted that the calculations are based on typical site constants which should be verified with the blasting contractor prior to blasting.

Site constants and ground constants for air blast overpressure and ground vibration respectively were selected with due consideration to AS 2187.2 – 2006 *Explosives – Storage and use Part 2: Use of explosives*. The standard recommends a site constant in the range of 10 to 100 for the purpose of assessing air blast overpressure – both ends of the range were applied. For ground vibration, the standard recommends a ground constant in the range of 240 to 4,400. A range of 800 to 1600 was considered appropriate for the proposal – both ends of this range were applied. A conservative site exponent, $a = 1.45$, has been used for the assessment.

For the purposes of predicting likely impacts, blasting was considered to occur at the closest of the proposed blast locations to the noise sensitive receivers. As blast size Maximum Instantaneous Charge (MIC) is unknown at this stage, a range of MIC values have been considered in the assessment of potential overpressure and ground vibration impacts. Overpressure predictions are presented in Table 5-1 and ground vibration predictions are presented in Table 5-2.

Table 5-1 Predicted blast overpressure, dB(Lin)

Receiver	Distance to nearest blast location (m)	Predicted Blast Overpressure dB(Lin)									
		site constant K(air) = 100 MIC (kg)					site constant K(air) = 10 MIC (kg)				
		0.1	0.5	1.0	5.0	10.0	0.1	0.5	1.0	5.0	10.0
R26	202	117	124	127	134	137	97	104	107	114	117
R24	212	117	124	127	133	136	97	104	107	113	116
R30 (Minerva Street Residences)	234	116	122	125	132	135	96	102	105	112	115
R23	360	110	117	120	127	130	90	97	100	107	110
R27	377	110	116	119	126	129	90	96	99	106	109
R49 (Sassafras Street Residences)	405	109	115	118	125	128	89	95	98	105	108
Evendale Road Receivers (Business)	231	116	123	125	132	135	96	103	105	112	115
Evendale Road Receivers (Residences)	235	116	122	125	132	135	96	102	105	112	115
R02	241	115	122	125	132	135	95	102	105	112	115
R01 (House)	591	104	111	114	120	123	84	91	94	100	103

- Figures highlighted in orange indicate a predicted exceedance of the blasting overpressure criteria of 115 dB (lin) Peak.

Table 5-2 Predicted blast ground vibration PPV, mm/s

Receiver	Distance to nearest blast location (m)	Predicted Blast Ground Vibration PPV (mm/s)									
		site constant K(ground) = 800 MIC (kg)					site constant K(ground) = 1600 MIC (kg)				
		0.1	0.5	1.0	5.0	10.0	0.1	0.5	1.0	5.0	10.0
R26	202	0.0	0.1	0.2	0.6	1.0	0.1	0.2	0.3	1.2	2.1
R24	212	0.0	0.1	0.2	0.5	1.0	0.0	0.2	0.3	1.1	1.9
R30 (Minerva Street Residences)	234	0.0	0.1	0.1	0.5	0.8	0.0	0.1	0.3	0.9	1.6
R23	360	0.0	0.0	0.1	0.2	0.4	0.0	0.1	0.1	0.5	0.8
R27	377	0.0	0.0	0.1	0.2	0.4	0.0	0.1	0.1	0.4	0.8
R49 (Sassafras Street Residences)	405	0.0	0.0	0.1	0.2	0.3	0.0	0.1	0.1	0.4	0.7
Evendale Road Receivers (Business)	231	0.0	0.1	0.1	0.5	0.8	0.0	0.2	0.3	1.0	1.7
Evendale Road Receivers (Residences)	235	0.0	0.1	0.1	0.5	0.8	0.0	0.1	0.3	0.9	1.6
R02	241	0.0	0.1	0.1	0.4	0.8	0.0	0.1	0.2	0.9	1.6
R01 (House)	591	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.1	0.2	0.4

- No exceedances of the 5mm/s ground vibration criteria are predicted for MIC up to 10kg using the range of site constants considered.

The predictions summarised in Table 5-1 indicate that for MIC size of as little as 0.1 kg for both proposed blast locations have the potential to exceed the overpressure criteria of 115dB(Lin) if a conservative blast constant is used in the calculations. These predictions are based on a range of assumed site constants and therefore provide a guide only.

The ground vibration predictions presented in Table 5-2 show that even for MIC sizes up to 10 kg, ground vibration levels at nearby residences are not predicted to exceed the 5 mm/s building damage criteria, however are likely to be perceptible. These predictions are based on a range of assumed site constants and therefore provide a guide only. Site constants are able to be refined for the site using a small test blast, away from sensitive receivers. Following this, the overpressure and vibration predictions would then be refined to allow appropriate blast design to be developed by the blasting contractor.

Due to the potential for exceedance of overpressure blasting criteria, the blasting specific mitigation measures presented in Table 6-5 are recommended to minimise impacts.

The blasting design would be carried out by a licensed blasting contractor.

6. Mitigation measures

6.1 Road traffic noise mitigation

The TNMG presents a step by step process for identification of buildings that are eligible for noise mitigation treatments, *Table B: Identification of eligible buildings*, which is reproduced below as Table 6-1.

Table 6-1 TNMG, Table B Identification of eligible buildings

Step	
1	Identify all sensitive use buildings within the traffic noise assessment area, being an area out to a nominal distance of 300 m either side of the road.
2	Where there is an existing approved but undeveloped residential subdivision within the noise assessment area, assume a reasonable location for future sensitive use building and adopt those locations as presumed sensitive use buildings.
3	Exclude from further assessment all new buildings or extensions to existing buildings or new sensitive uses in existing buildings, if those buildings or extensions are less than 50 m away from an existing or planned category 1, 2 or 3 road.
4	Measure existing $L_{A10(18\ hour)}$ traffic noise and traffic counts at representative locations(s) along the road or, in the case of a greenfield situation, measure $L_{Aeq(16\ hour)}$ ambient noise at representative locations along the proposed road alignment.
5	Determine (by measurement or modeling) existing $L_{A10(18\ hour)}$ traffic noise at assessment building facades (allowing for the 2.5 dB(A) façade effect).
6	Predict $L_{A10(18\ hour)}$ noise at assessment building facades (allowing for the 2.5 dB(A) façade effect) for 10 years in the future for existing roads or 10 years after the completion of the road works for future roads.
7	Identify all 63-plus buildings, being assessment buildings where the 10 year future $L_{A10(18\ hour)}$ traffic noise at the building façade will be greater than 63 dB(A).
8	Exclude from further assessment all 63-plus buildings at which the existing $L_{A10(18\ hour)}$ traffic noise is already greater than 63 dB(A) but at which the 10 year future $L_{A10(18\ hour)}$ traffic noise will be less than 68 dB(A).
9	Identify all 68-plus buildings, being assessment buildings where the existing $L_{A10(18\ hour)}$ traffic noise is already greater than 63 dB(A) and at which the 10 year future $L_{A10(18\ hour)}$ traffic noise will be greater than 68 dB(A).
10*	For a greenfield situation, identify all 15-delta buildings, being assessment buildings where the 10 year future $L_{A10(18\ hour)}$ traffic noise will be more than 15 dB(A) greater than the existing $L_{Aeq(16\ hour)}$ ambient noise.
11*	Identify any 45-heavy buildings where a permanent increase in the proportion of heavy vehicles as a result of a DIER decision will take night time heavy vehicle traffic noise on a category 1, 2 or 3 road above $L_{Aeq(8\ hour)}$ 45 dB(A).
12	Carry all non-excluded 63-plus, 68-plus, 15-delta and 45-heavy buildings forward as eligible buildings and apply Table C to develop mitigation solutions

*Note *: steps 10 and 11 are not relevant for this assessment as they apply to a greenfield situation only.*

Using the TNMG 'Table B' method, the receivers following on from 'step 7' where 10 year future noise levels are predicted to be greater than 63 dB $L_{A10(18\ hour)}$ are presented in Table 6-2 along with subsequent eligibility check steps 8, 9 and 12 which are applicable to this assessment. Following the eligibility check process, a total of 6 assessed receiver locations are identified as being eligible for noise mitigation. The corresponding noise mitigation target levels have also been presented and are based on whether the predicted future level at a receiver is greater than 63 dB $L_{10,18\ hour}$ or 68 dB $L_{10,18\ hour}$ as per Table C of the TNMG.

Table 6-2 Receiver mitigation eligibility, dB(A)

Name	Criterion $L_{10,18\ hour}$	No Build (Existing) – Year 2015[2] $L_{10,18\ hour}$	No Build – Year 2025 $L_{10,18\ hour}$	Build – Year 2015 $L_{10,18\ hour}$	Build – Year 2025 $L_{10,18\ hour}$	*'Step 7'* Build Future >63 $L_{10,18\ hour}$	*'Step 8'* Exclude if Existing >63 and Future <68	*'Step 9'* Identify if Existing >63 and future >68	*'Step 12'* All non-excluded buildings	*TNMG Table C Target Level*
R30	63	70	71	64	64	Yes	Exclude			
R33	63	66	67	63	64	Yes	Exclude			
R36	63	70	71	66	66	Yes	Exclude			
R39	63	69	70	66	66	Yes	Exclude			
R42	63	68	69	66	67	Yes	Exclude			
R46	63	62	63	64	64	Yes	→	→	Eligible	63
R49	63	71	72	72	72	Yes	→	Yes →	Eligible	68
R50	63	67	68	68	69	Yes	→	Yes →	Eligible	68
R53	63	66	67	68	68	Yes	→	→	Eligible	63
R58	63	67	67	69	69	Yes	→	Yes →	Eligible	68
R60	63	67	67	69	69	Yes	→	Yes →	Eligible	68

[2] Existing noise levels presented in the table are modelled levels.

The TNMG also presents '*Table C Development of mitigation solutions for eligible buildings'.* A step by step process to aid in development of noise mitigation solutions for receiver buildings that have been identified as being eligible from the *Table B* process. Table C of the TNMG is reproduced below in Table 6-3.

Table 6-3 TNMG, Table C Development of mitigation solutions for eligible buildings

Step	
1	For 63-plus buildings, determine the external noise mitigation requirements (speed changes, road seal type, noise barriers, noise mounds etc) that would be required to reduce the external 10 year future road traffic noise at the most exposed sensitive use building façade to $L_{A10(18\ hour)}$ 63 dB(A) or less
2	For 68-plus buildings, determine the external noise mitigation requirements (speed changes, road seal type, noise barriers, noise mounds etc) that would be required to reduce the external 10 year future road traffic noise at the most exposed sensitive use building façade to $L_{A10(18\ hour)}$ 68 dB(A) or less.
3	For 15-delta buildings, determine the external noise mitigation requirements (speed changes, road seal type, noise barriers, noise mounds etc) that would be required to reduce the external 10 year future road traffic noise increase at the most exposed sensitive use building façade to $L_{A10(18\ hour)}$ 15 dB(A) or less.
4	Assess the reasonableness and practicality of the required noise mitigation to determine whether the relevant noise criterion can be achieved within the budget.
5	Where the external noise targets at the most exposed façade of a 63-plus, 68-plus or 15-delta building cannot be achieved, determine the reasonableness, practicality and desirability of achieving the alternative external noise criterion of $L_{A10(18\ hour)}$ 52 dB(A) in any existing outdoor living area located on the opposite side of the sensitive use building to the façade most exposed to road traffic noise.
6	Where external noise criteria can reasonably and practicably be achieved for a 63-plus, 68-plus or 15-delta building, proceed with the road design on that basis.
7	Where external noise criteria cannot reasonably and practicably be achieved for a 63-plus, 68-plus or 15-delta building, develop any reasonable and practicable acoustic treatment solutions calculated to achieve a nominal daytime internal traffic noise design criterion of $L_{Aeq(16\ hour)}$ 35 dB(A)).
8	For any 45-heavy buildings, develop any reasonable and practicable acoustic treatment solutions calculated to achieve a nominal internal night time traffic noise design criterion of $L_{Aeq(8\ hour)}$ 30 dB(A)).
9	For any building where acoustic treatment is proposed, offer that treatment to the sensitive use building owner and, if the offer is accepted, enter into a corresponding agreement.
10	Proceed with the project, incorporating all reasonable and practicable external noise mitigations and agreed acoustic treatments.

Steps relating to 63-plus and 68-plus buildings have been followed in developing possible mitigation measures in relation to the proposal. The eligible receivers have been identified as:

63-plus: R46, R53

68-plus: R49, R50, R58, R60

6.1.1 Description of mitigation options considered

Low noise pavements

Low noise pavements such as open graded asphalt (OGA) have the potential for a noise reduction when new of between 2 and 4dB when compared to typical dense graded asphalt (DGA), however performance typically reduces over time to the point where no additional noise reduction is realised.

In the context of the proposal, the possible future southern extension to the highway has the potential to alter the road alignment for most traffic near to the eligible receivers which would potentially reduce traffic noise at these receivers to below the 63 dB $L_{A10(18\ hour)}$ or 68 dB(A) $L_{A10(18\ hour)}$ target levels. Therefore low noise surface treatments are a potential interim noise mitigation option which may be revisited at the effective acoustic life of the pavement or once future road alignments are known.

Speed reduction

A small reduction in traffic speed of 10 to 20% has the potential to reduce noise levels by 1 to 2 dB while a larger reduction of 50% may provide a 5 to 6 dB reduction in noise levels. However, one of the aims of a road proposal would generally be to improve traffic flow and reduce travel times; therefore speed reductions are usually not favoured.

In the case of this proposal, the eligible receivers are at the end of the proposal, not far from reduced speeds through the township of Perth and noise reductions of only 1 to 4 dB are required. Therefore minor reductions in traffic speed in the vicinity of the eligible receivers may be explored further as a potential noise mitigation measure.

Noise barriers / mounds

Noise barriers or mounds are usually the most cost effective where road noise targets are exceeded for groups of houses close together as multiple residences and their outdoor areas are able to benefit from the single barrier. All eligible 63-plus and 68-plus receivers identified in this assessment are within the same area, or adjacent to each other such that a barrier has the potential to provide a cost effective solution.

To ensure noise barrier effectiveness is not diminished, barriers are to consist of materials with surface density of at least 15 kg/m^2 and be free of holes or discontinuities. Longevity and maintenance issues should be considered when deciding on noise barrier constructions and material with the aim to avoid premature deterioration of the barrier over time which may adversely impact the attenuation performance

Receiver building treatments

Where noise targets cannot be reasonably and practically achieved, for 63-plus and 68-plus eligible receivers, the TNMG states:

> *"develop any reasonable and practicable acoustic treatment solutions calculated to achieve a nominal daytime internal traffic noise design criterion of $L_{Aeq(16\ hour)}$ 35 dB(A))."*

Building treatments would be offered to the owner of the eligible building by the proponent and if accepted, an agreement would then be negotiated.

6.1.2 Mitigated road traffic noise levels

To investigate the effectiveness of mitigation for the eligible receivers, four additional modelling scenarios based on the 'Build 2025' noise model have been undertaken.

Barrier Mitigated: this scenario includes a noise barrier on the roadside boundary of the eligible properties of sufficient height to satisfy the adopted criteria. The proposed barrier consists of a 3.0 metre high noise wall in the location as indicated on Figure 6-1 and is approximately 150 metres in total length.

Pavement Mitigated: low noise pavement has been assumed for the proposal in the vicinity of the eligible receivers. The length of low noise pavement required would extend from the intersection with the old highway to the southern end of the works.

Reduced Speed Mitigated: A speed reduction from 110 to 90 km/h and 90 to 70 km/h was applied in the noise model.

Pavement and Reduced Speed: Both low noise pavement and reduced speeds were applied in the noise model.

Table 6-4 presents a comparison between the predicted model results for the scenarios of 2025 'build' (no mitigation), 2025 'no build', and the mitigated scenarios for 2025 'build'. The results have been summarised and limited to eligible receivers.

Table 6-4 Predicted noise levels, dB(A)

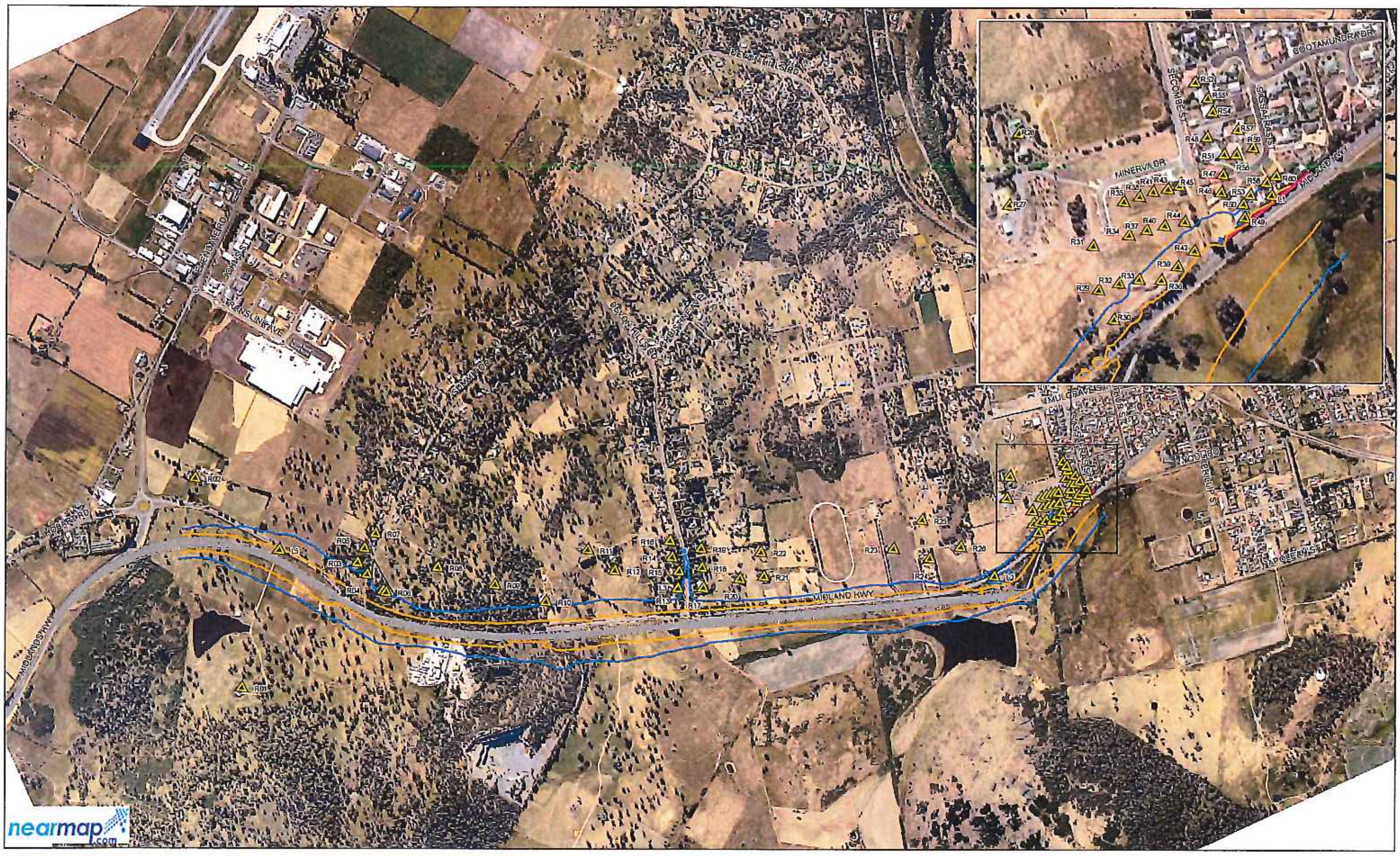
Receiver identified for mitigation	Target level $L_{10,18\ hour}$	Build – Year 2025 $L_{10,18\ hour}$	Barrier Mitigated Build – Year 2025 $L_{10,18\ hour}$	Pavement Mitigated – Year 2025 $L_{10,18\ hour}$	Reduced Speed Mitigated – Year 2025 $L_{10,18\ hour}$	Pavement and Reduced Speed Mitigated – Year 2025 $L_{10,18\ hour}$
R46	63	**64**	62	63	63	61
R49	68	**72**	63	**71**	**71**	**69**
R50	68	**69**	63	67	67	66
R53	63	**68**	63	**67**	**67**	**65**
R58	68	**69**	63	68	68	66
R60	68	**69**	63	67	68	66

Note: Values highlighted and in **bold** indicates an exceedance of the target criteria of 63 dB $L_{A10\ 18hr}$

The results of additional mitigation modelling indicate that a 3 metre high barrier at the receiver boundary provides compliance with the adopted criteria at all receivers. Modelling scenarios for reduced speeds, quiet pavements and combined speed/pavement mitigation indicate that target levels are achievable at R46, R50, R58 and R60, however R49 and R53 remained above target levels. No additional receivers were reduced to within the target levels by combining the speed/pavement mitigations.

In deciding the final noise mitigation to be applied, consideration should be given to the practicality and reasonableness of the mitigation options. Where residual impacts are predicted, building treatments would typically be offered to these receivers. Alternatively building treatments may be considered the preferred option for all receivers in which case the procedure outlined in TNMG *Chapter 8.12 Building* Treatments would typically be applied.

It is understood that the proposed road upgrade may be extended to the south of the site in the future; in which case the noise levels in the vicinity of the receivers identified for noise mitigation is anticipated to decrease when compared to the future 'build' noise levels presented in this assessment. Therefore it is recommended that future operating conditions are considered when deciding on the final mitigation measures for this proposal.



Paper Size A3

0 70 140 280 420 560

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

LEGEND
- Design
- 63dB LA10 18hour
- 68dB LA10 18hour
- Receiver
- Barrier

Note:
Noise levels account for building facade and ARRB corrections.

GHD

Department of State Growth
perth to Breadalbane
Noise and Vibration Assessment Report

Job Number	32-17526
Revision	0
Date	04 May 2015

Build 2025 - Mitigated

Figure 6.1

G:\32\17526\GIS\Maps\Deliverables\Noise\3217526_N004_NoiseModelling_Build_2025Mitigated.mxd

Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 T 61 2 4979 9999 F 61 2 4979 9988 E ntlmail@ghd.com W www.ghd.com.au

Data source: Nearmap: Aerial Image, 2015. Created by: tmorton, fmackey

6.2 Blasting overpressure and vibration mitigation

In practice, every practical and reasonable measure should be implemented to minimise the noise impacts of blasting on local residences and sensitive land uses.

It is recommended that the mitigation measures presented in Table 6-5 are considered to reduce the impact on the surrounding noise sensitive receivers.

Table 6-5 Construction noise and vibration mitigation measures

Blasting mitigation measures
• A full blasting design is be produced for all locations with consideration to the location of residences and the blasting overpressure and ground vibration criteria. This design would ensure that in these areas, less charge (shot) is released for any one instantaneous moment. This would assist in minimising noise and vibration impacts from blasting.
• Apply a minimum face burden. A face burden is the distance from a blasthole to the free face in front of it, and controls the movement of material and control overpressure.
• Apply a minimum design stemming height. Stemming is the aggregate placed in the blasthole on top of the explosive product to confine the energy and optimize blast performance while reducing environmental impact. This measure would control overpressure and flyrock.
• Cover any presplit blasts with a blanket of heavy clay to control flyrock and overpressure.
• Delay any presplit holes to be fired in groups of holes rather than instantaneously to reduce overpressure.
• Monitor overpressure and vibration at the nearest residences.
• Notify neighbours of blasting events and providing the opportunity for feedback.
• Minimise the number of blasting events.

7. Conclusion

A baseline noise monitoring and modelling assessment has been undertaken on behalf of the Department of State Growth for the Midland Highway duplication project (the project).This assessment has led to the following conclusions, which are subject to the limitations outlined in Section 1.3:

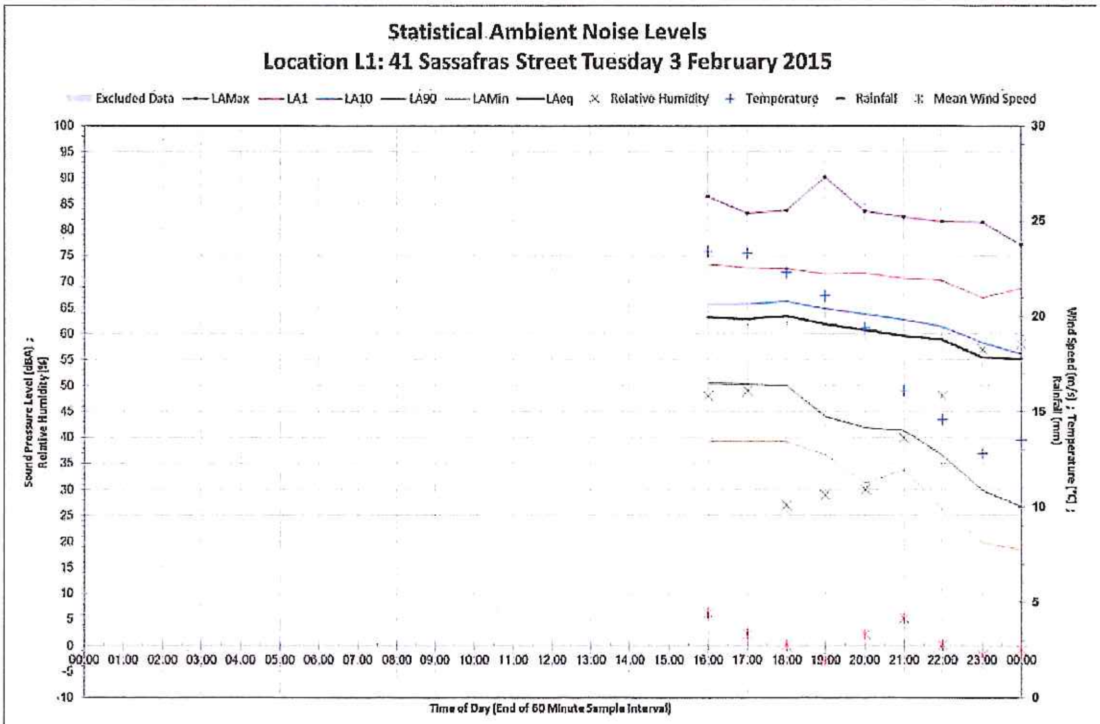
- Baseline noise monitoring was conducted at a number of locations within the study area. The unattended noise logging locations were selected due to their proximity to the proposal and were considered representative of the acoustic environment for the nearest sensitive receivers. The background noise monitoring results are presented in Section 2.3 and Appendix A.
- Operational noise criteria and blasting noise and vibration criteria are provided in Section 3.
- Noise modelling indicates that the noise levels received at the nearest sensitive receivers in the vicinity of the proposal will exceed the 63 dB (A) $L_{A10\ 18hr}$ target criteria and the upper limit target of 68 dB (A) $L_{A10\ 18hr}$ for existing residences by up to 9 dB and 4 dB respectively. However the modelling results also show that noise levels at these receivers are already at or above the target criteria. Under the Tasmanian State Road Traffic Noise Management Guidelines (DIER 2011) an exceedance of the target criterion may trigger the requirement of noise mitigation measures. Potential options for noise mitigation are discussed in the report.
- An assessment of potential ground vibration and overpressure due to blasting at the proposed locations indicates that for MIC size of as little as 0.1 kg has the potential to exceed the overpressure criteria of 115dB(Lin) if a conservative blast constant is used in the calculations. These predictions are based on a range of assumed site constants and therefore provide a guide only. Due to the potential for adverse impacts, it is recommended that a full blasting design be produced for all locations with consideration to the location of residences and the blasting overpressure and ground vibration criteria. This design would ensure that in these areas, less charge (shot) is released for any one instantaneous moment. This would assist in minimising noise and vibration impacts from blasting.

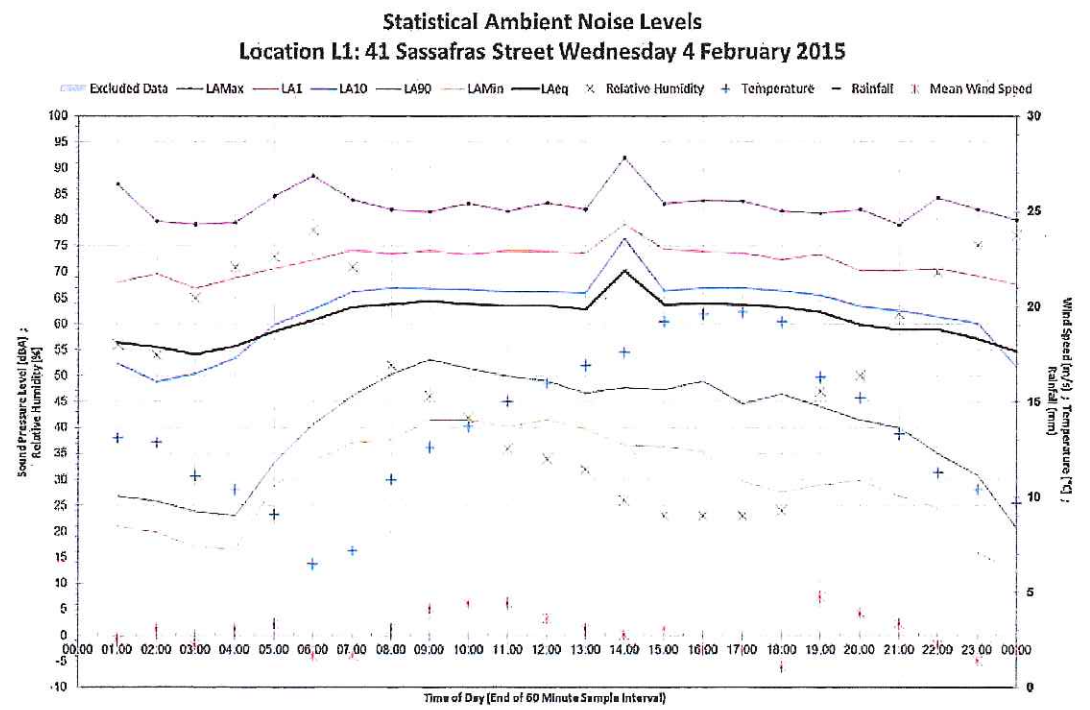
8. References

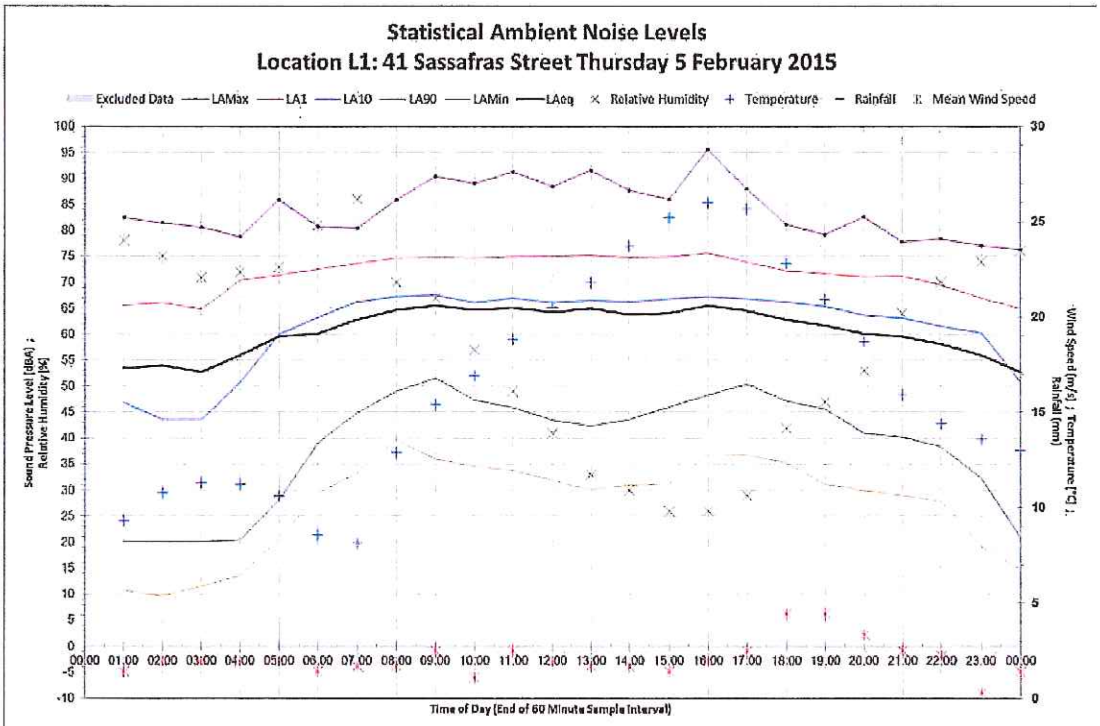
- Department of Environment, Parks, Heritage and the Arts 2009 *Environment Protection Policy* (Noise)
- Department of Environment, Parks, Heritage and the Arts 2008 *Noise Measurement Procedure Manual*, Second Edition
- Department of Infrastructure, Energy and Resources 2011 *State Noise Strategy*
- Department of Infrastructure, Energy and Resources 2011 *Tasmanian State Road Traffic Noise Management Guidelines*

Appendices

Appendix A – Noise logger charts



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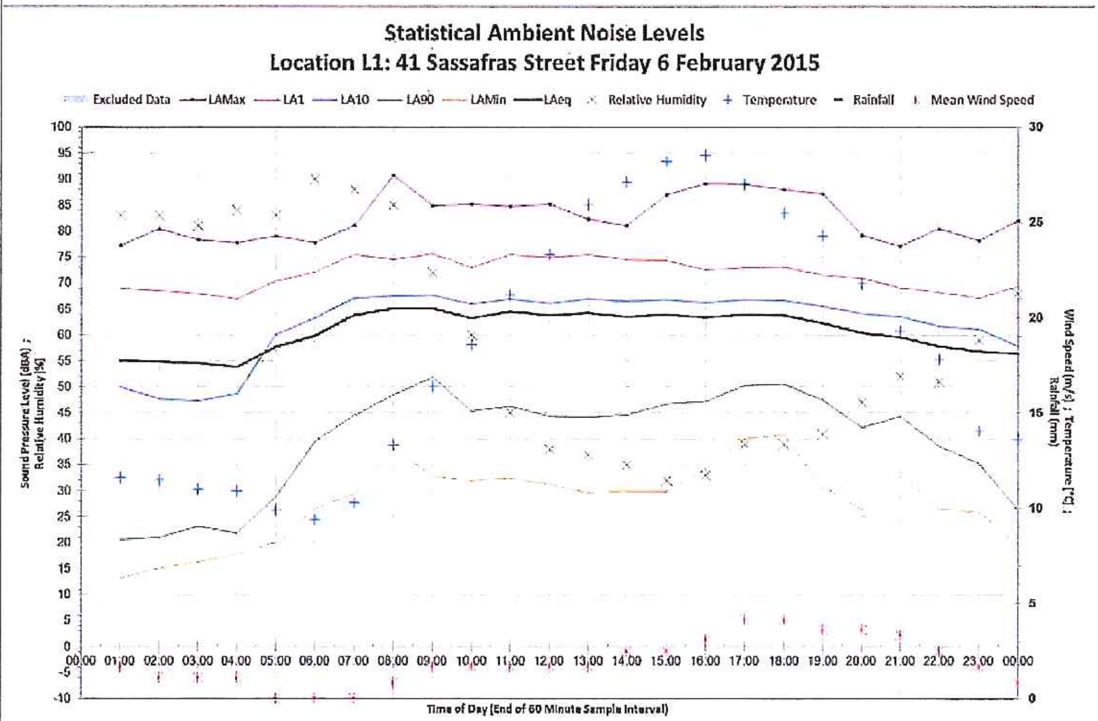
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)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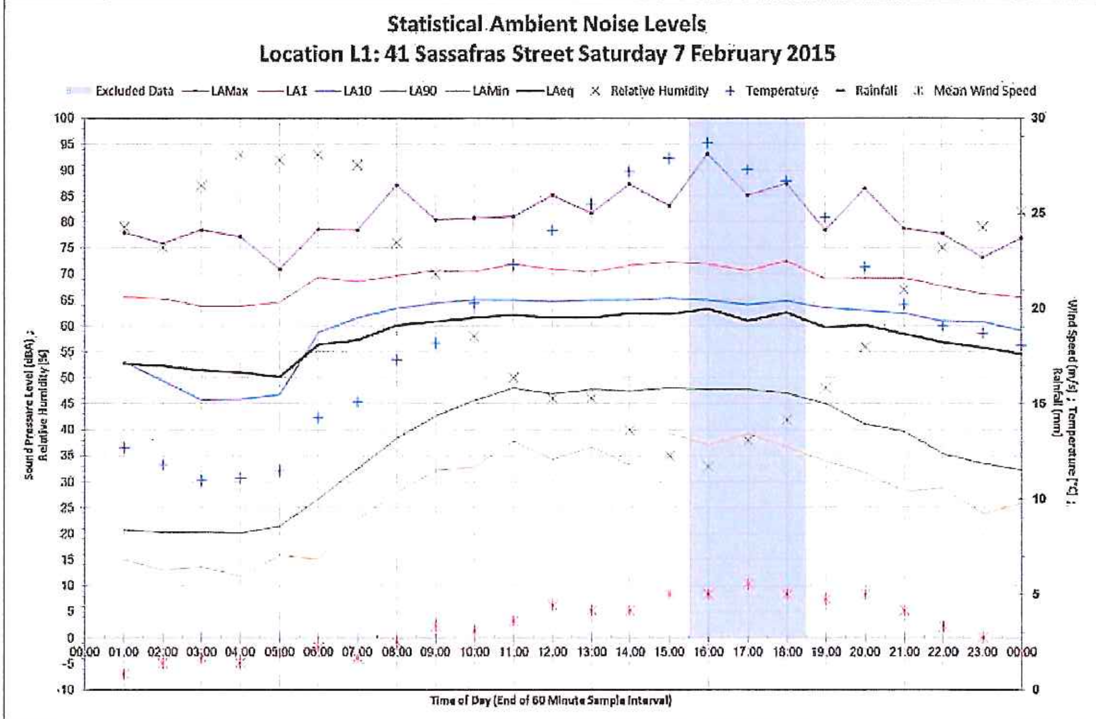
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LA90
LAMin
LAeq
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Temperature
Rainfall
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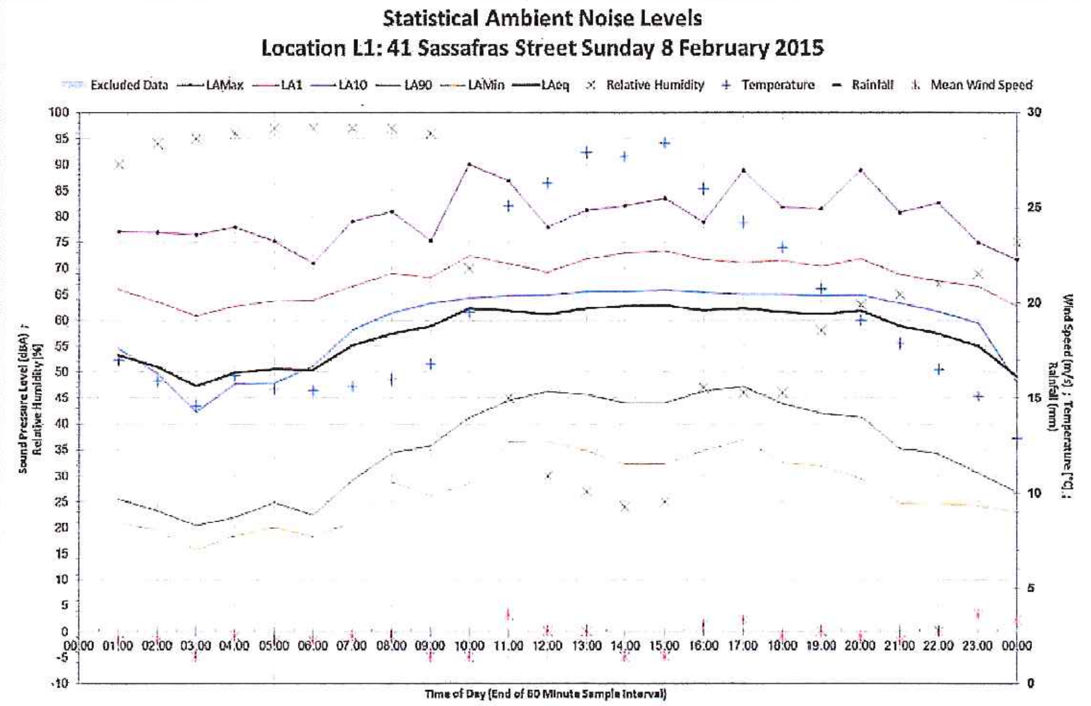
Time of Day (End of 60 Minute Sample Interval)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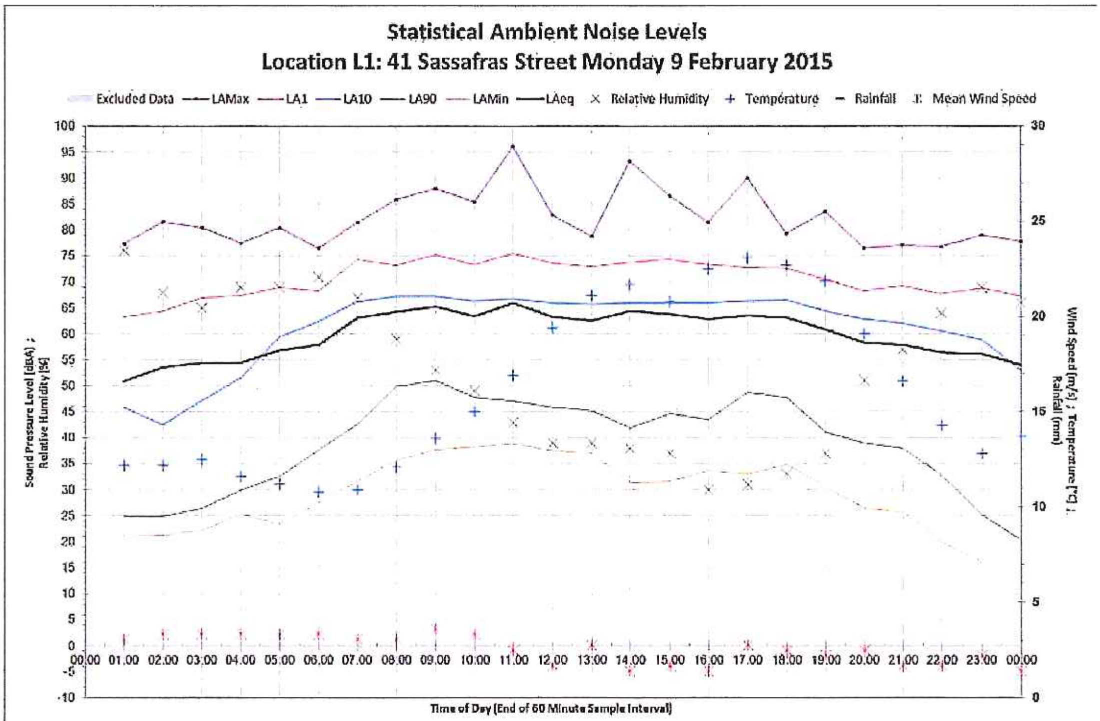
Time of Day (End of 60 Minute Sample Interval)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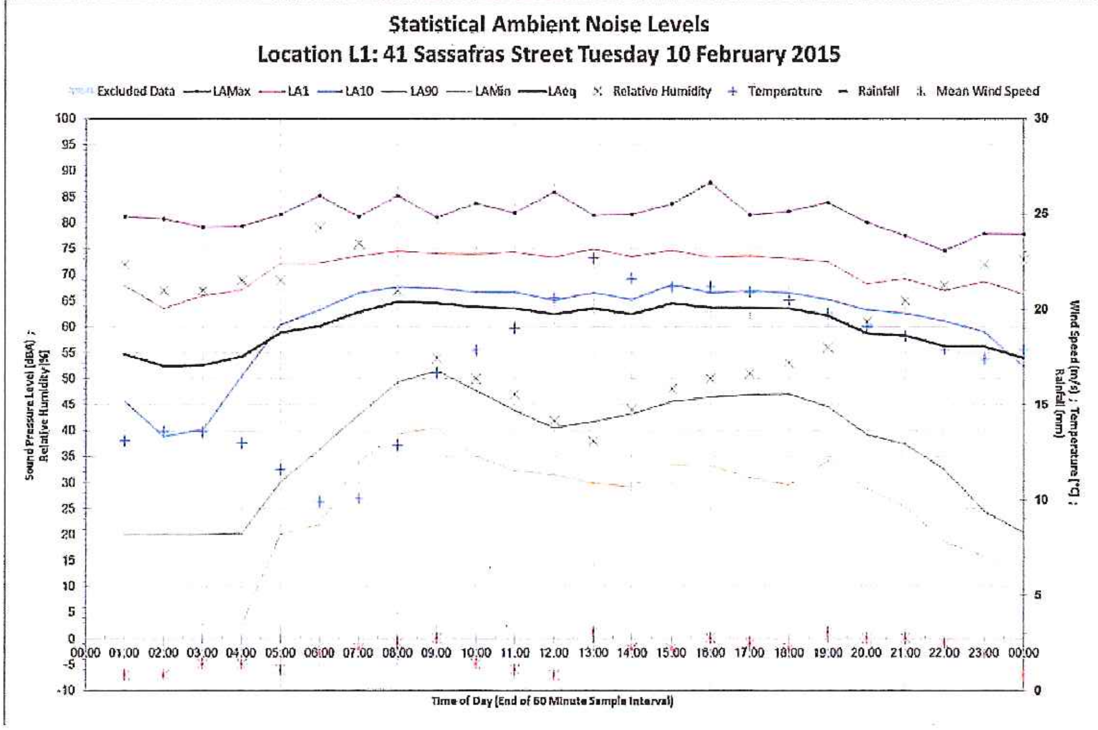
Time of Day (End of 60 Minute Sample Interval)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Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)

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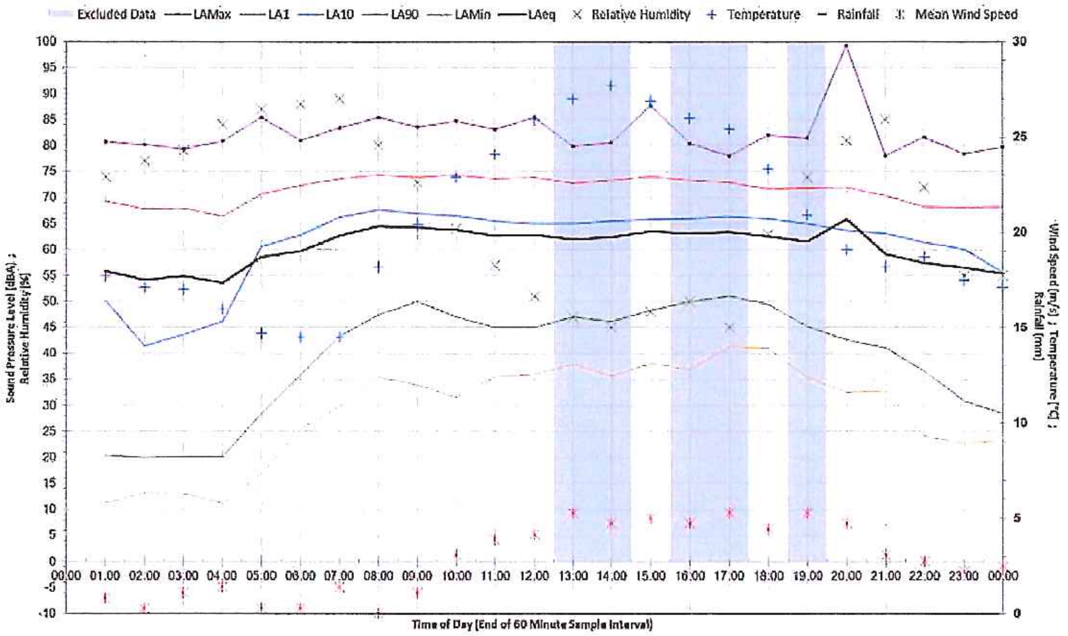

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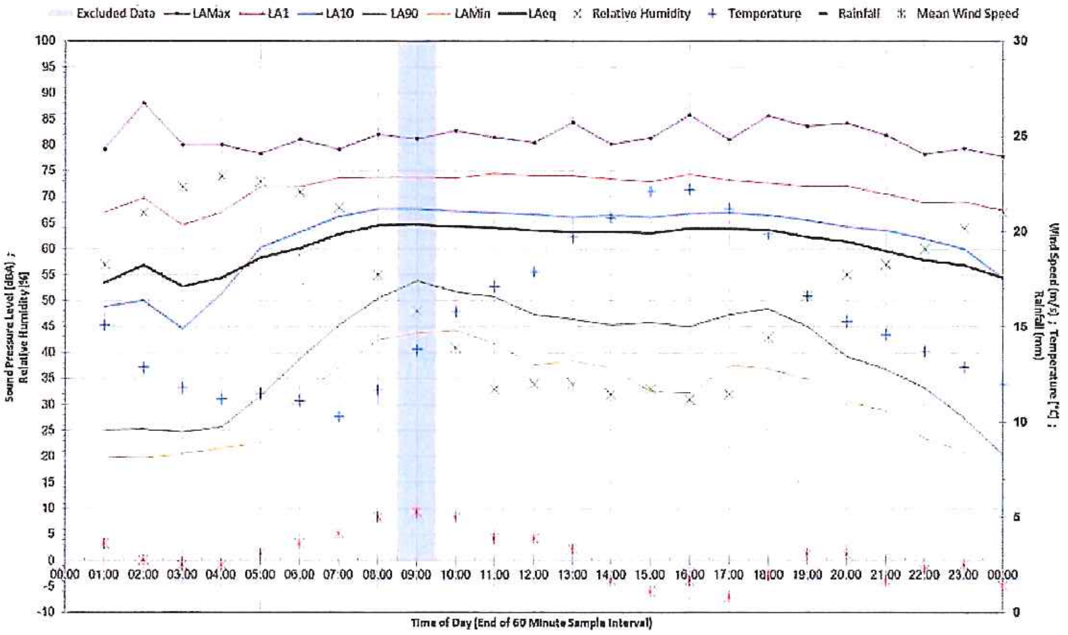

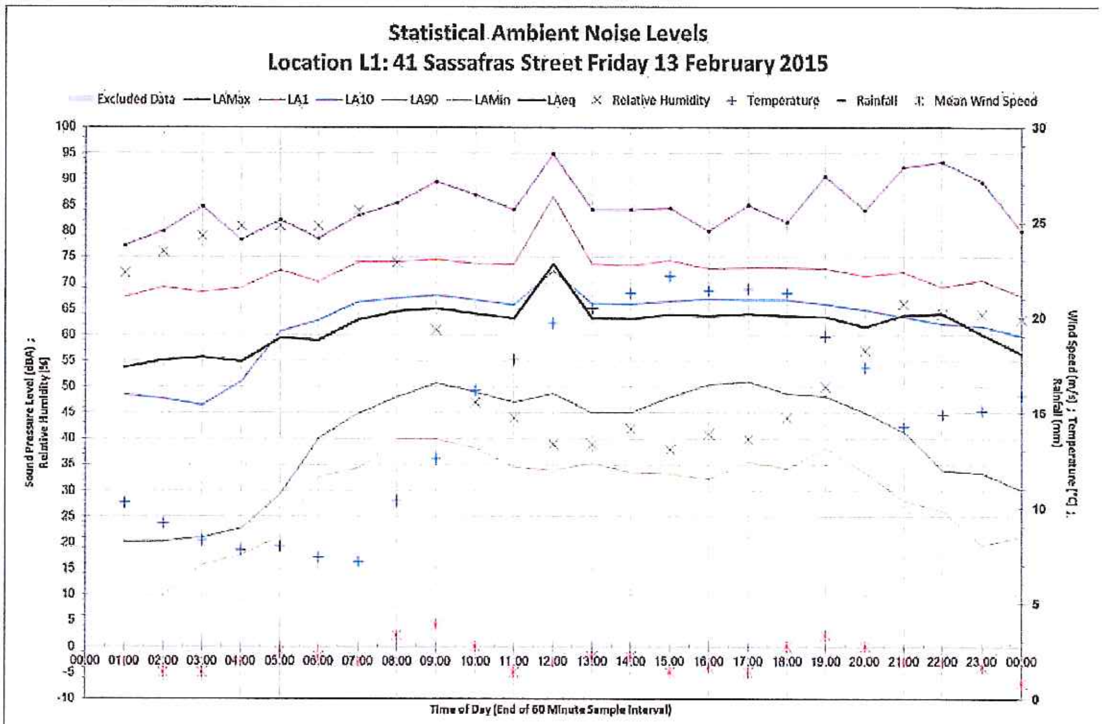
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Temperature
Rainfall
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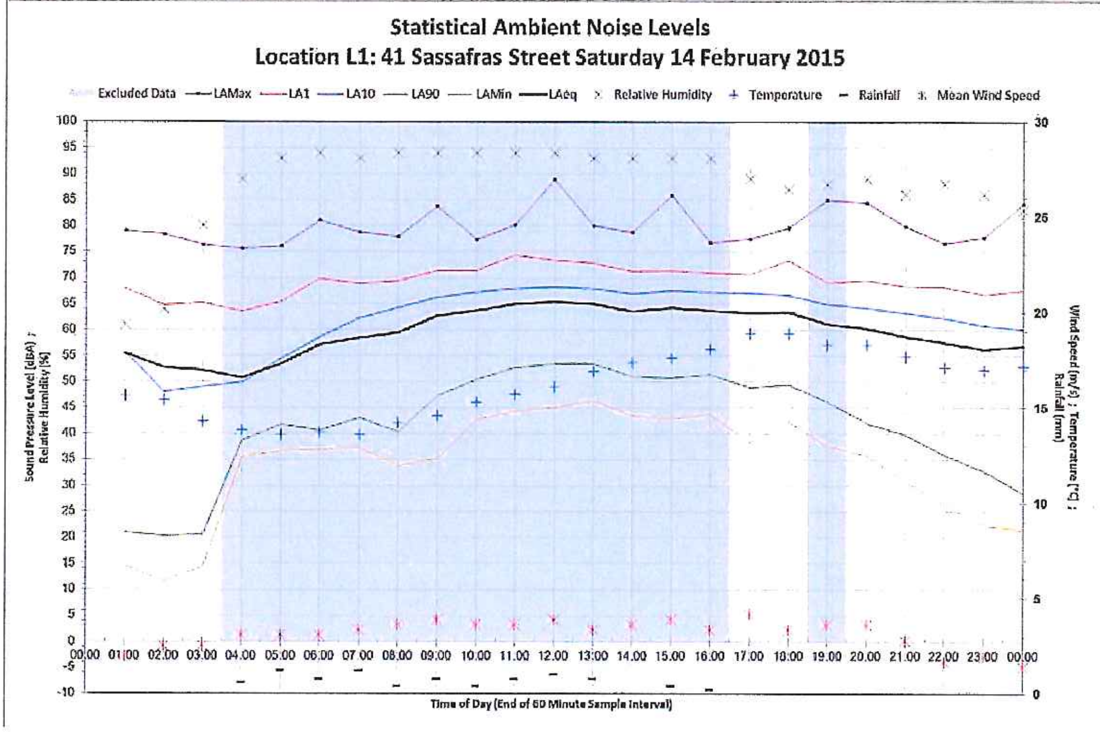
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)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Temperature
Rainfall
Mean Wind Speed
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Time of Day (End of 60 Minute Sample Interval)

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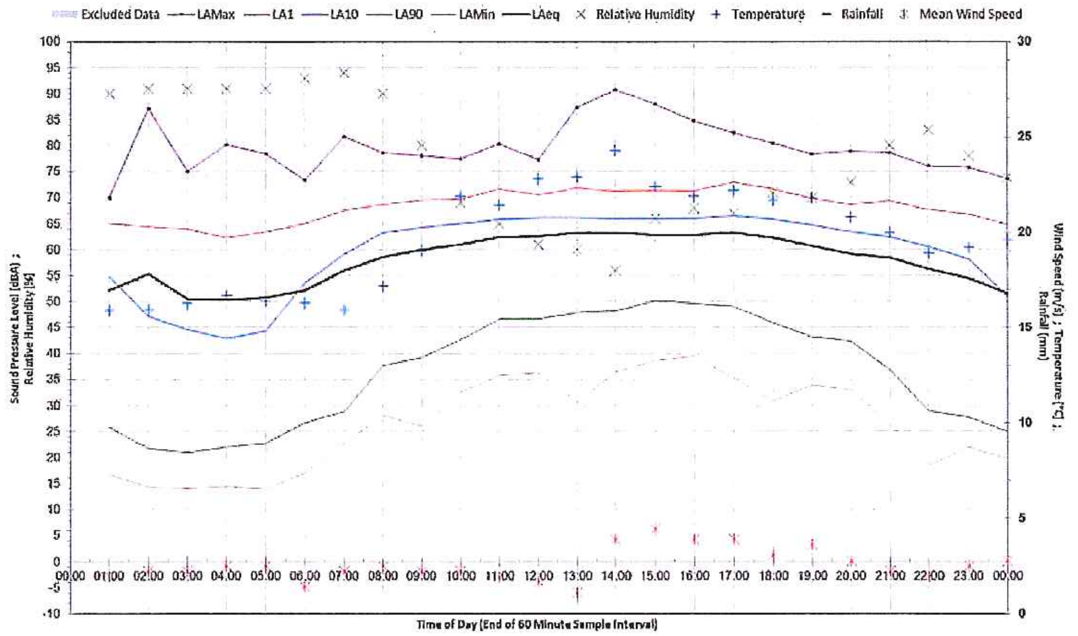

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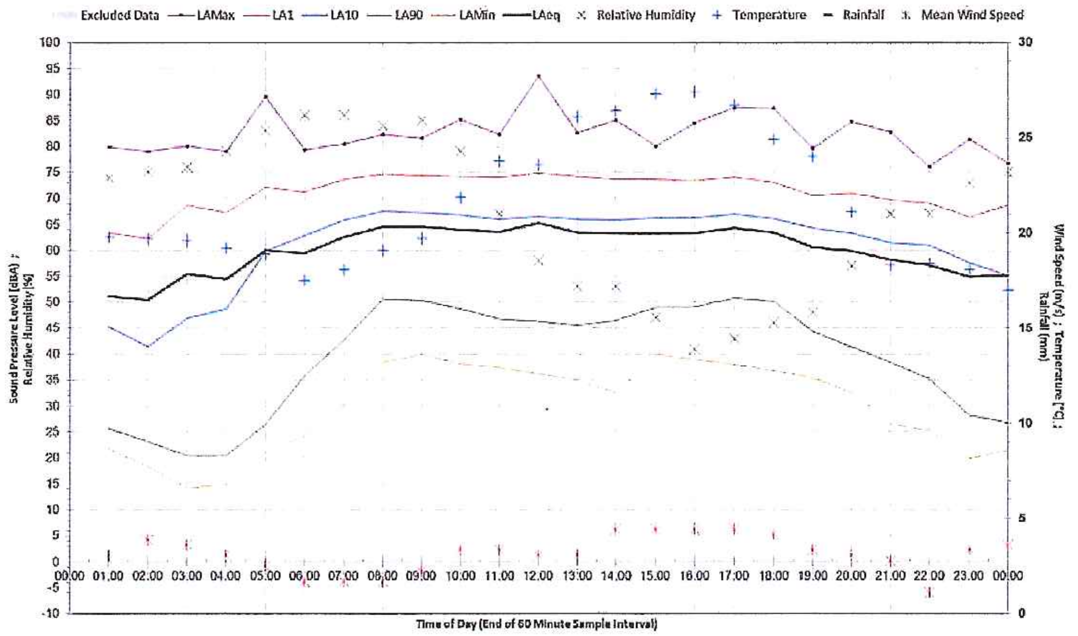

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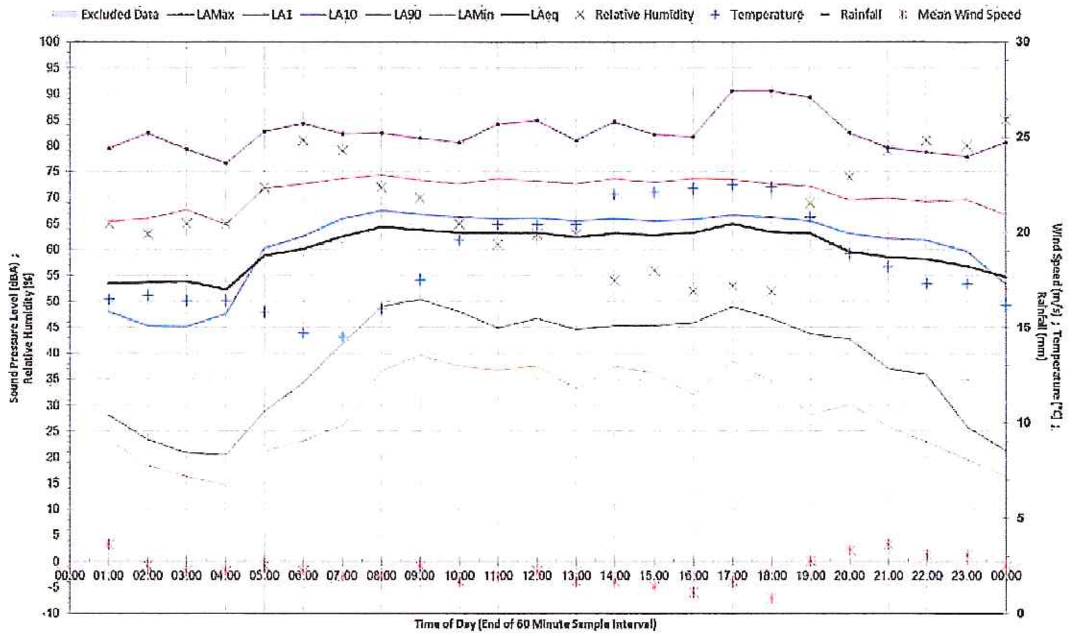

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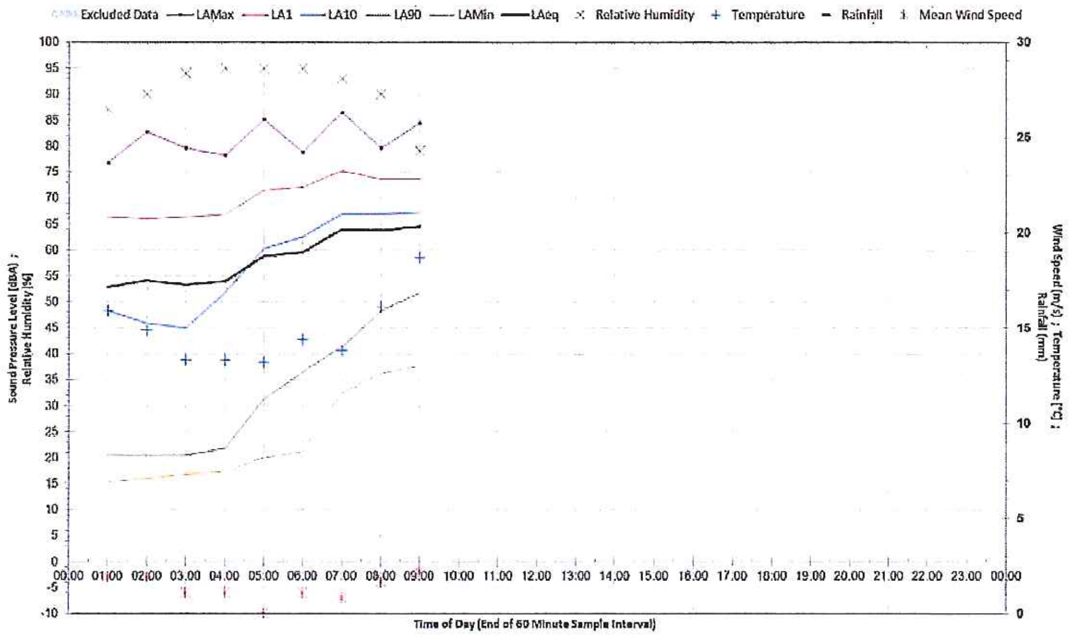

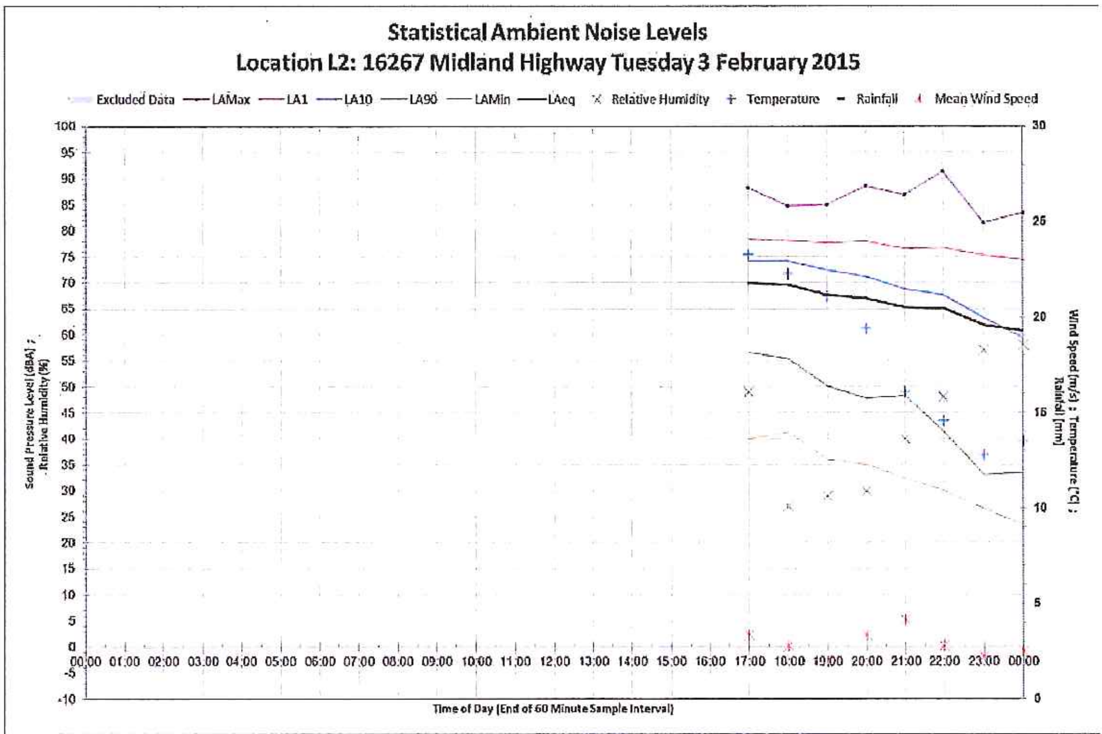
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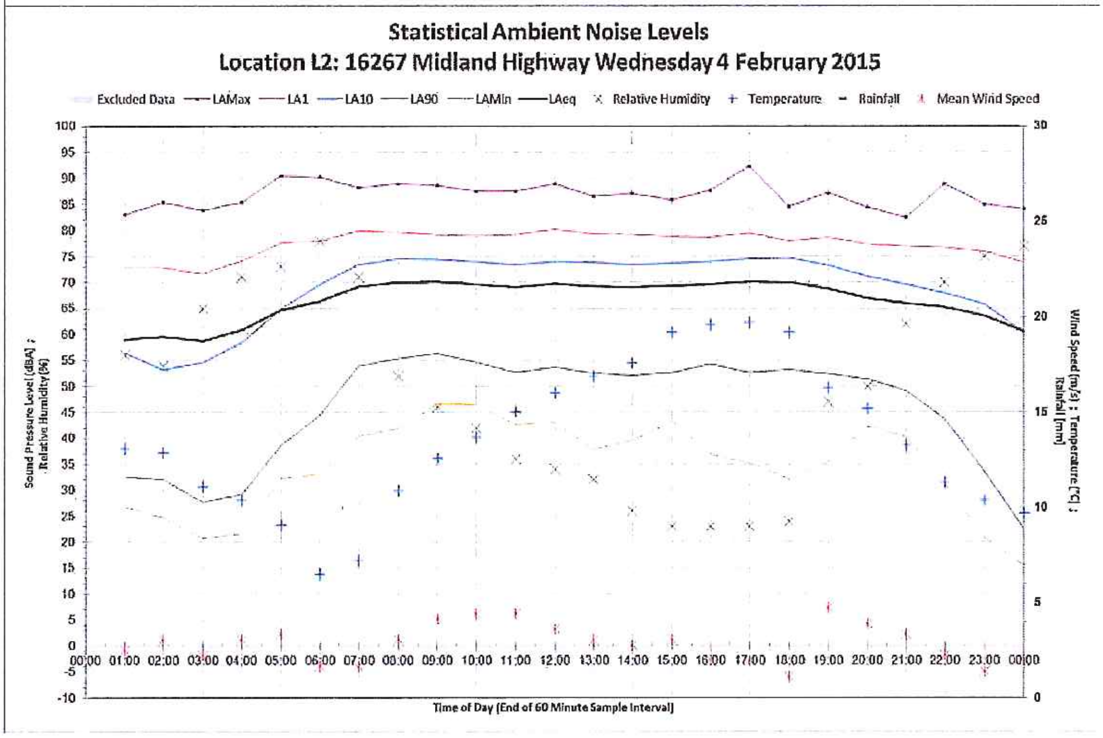
Time of Day [End of 60 Minute Sample Interval]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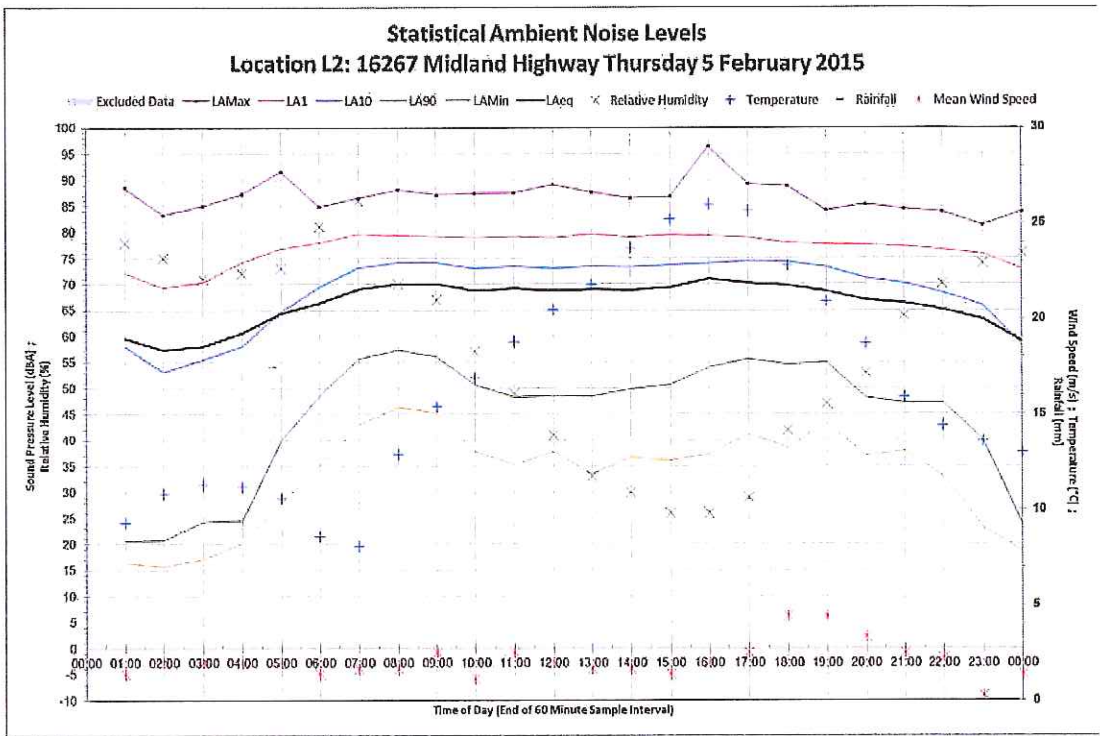
Time of Day [End of 60 Minute Sample Interval]



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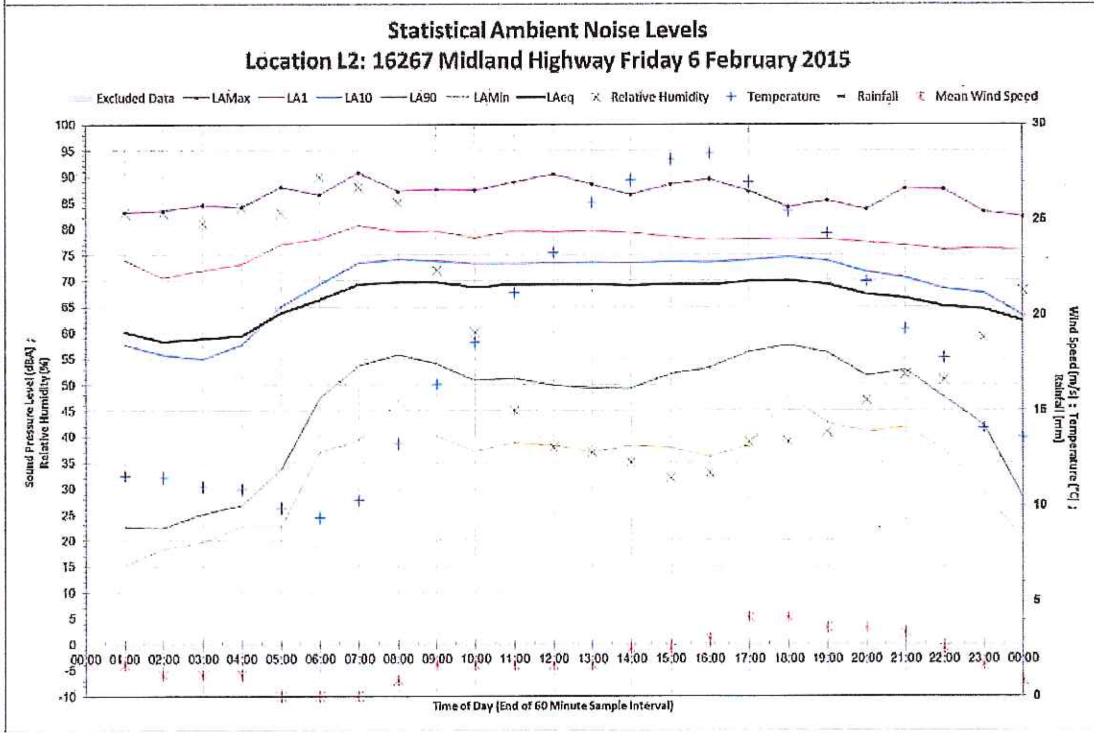
Time of Day (End of 60 Minute Sample Interval)



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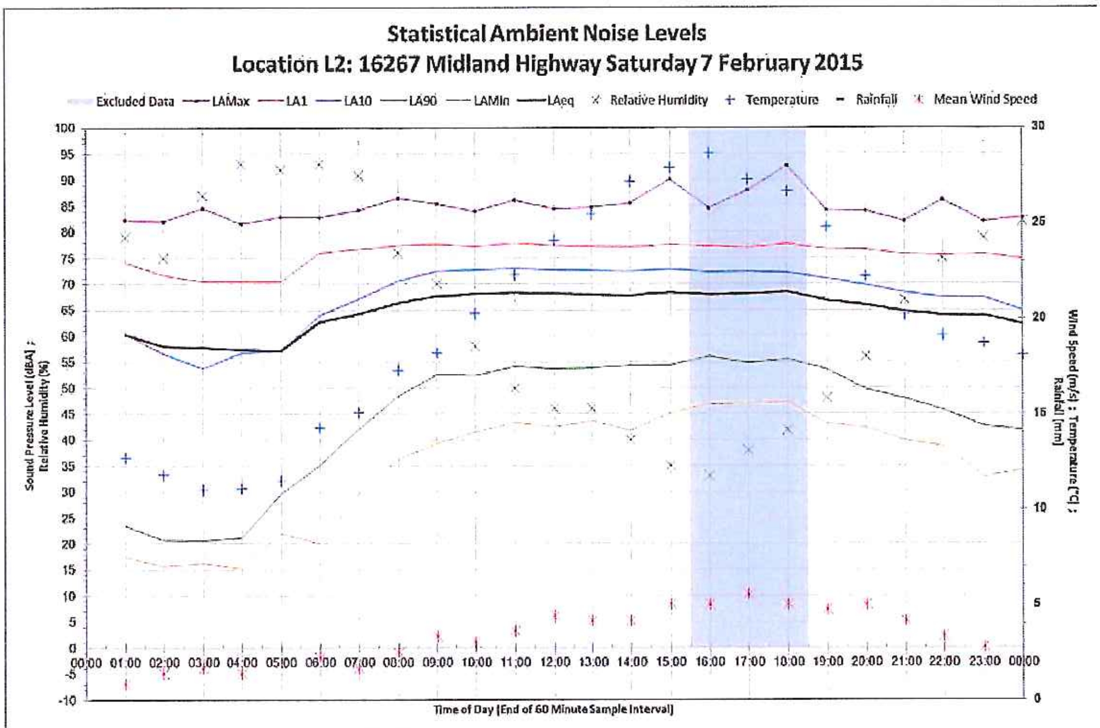
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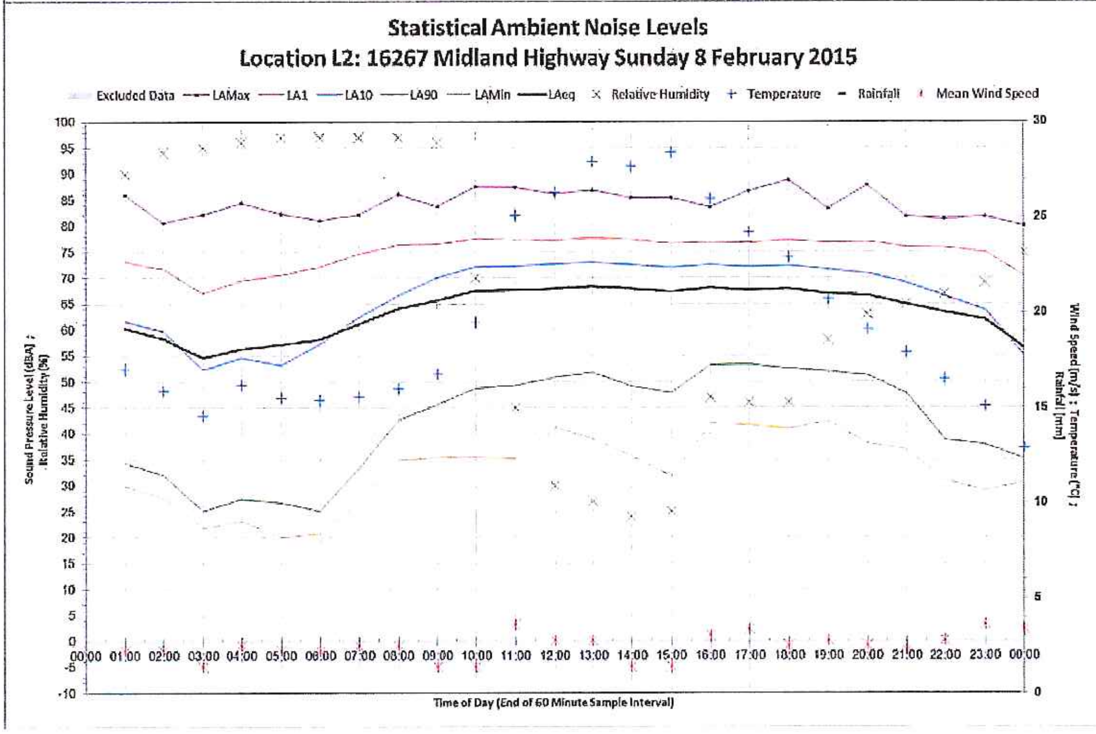
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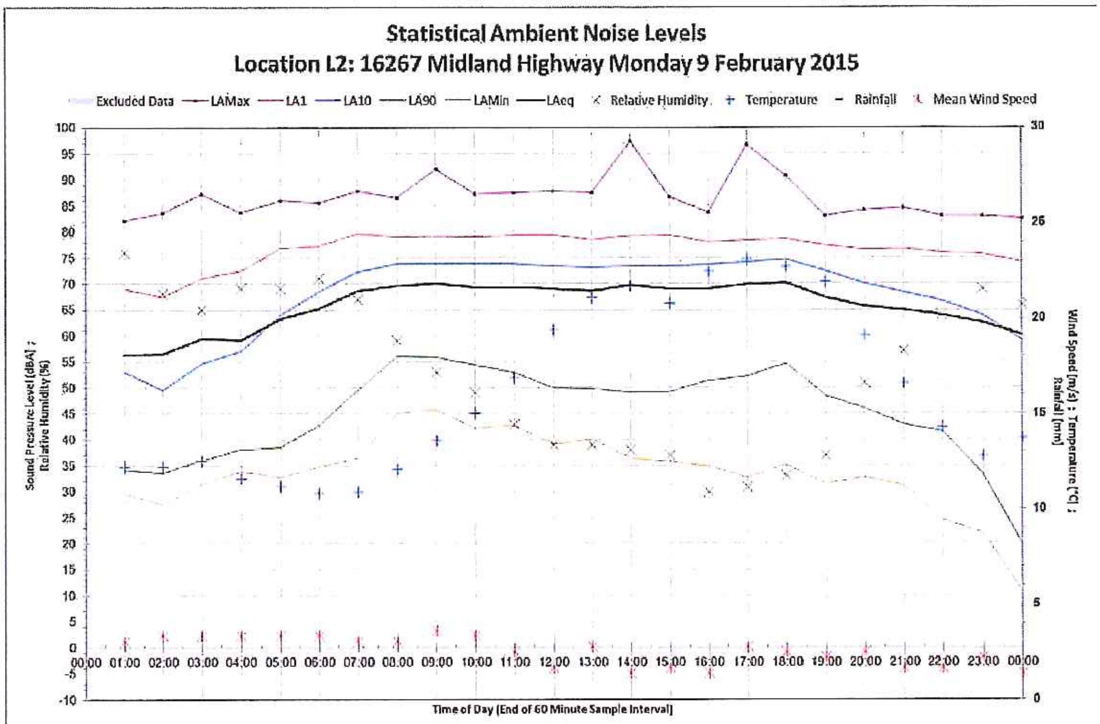
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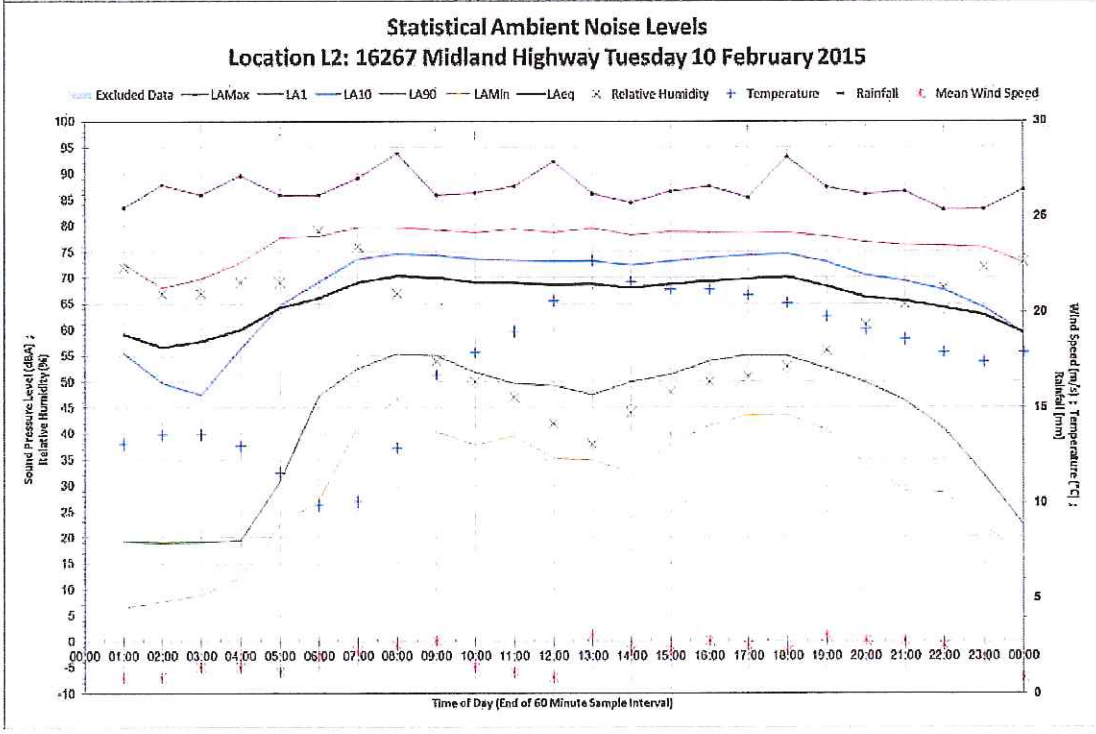
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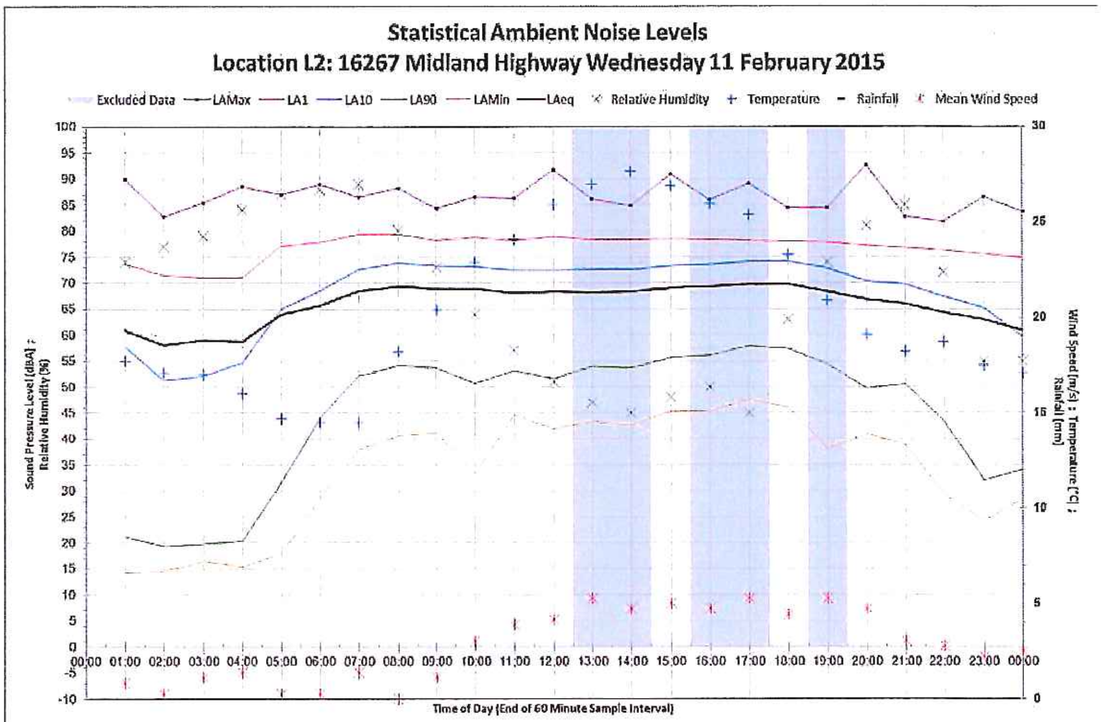
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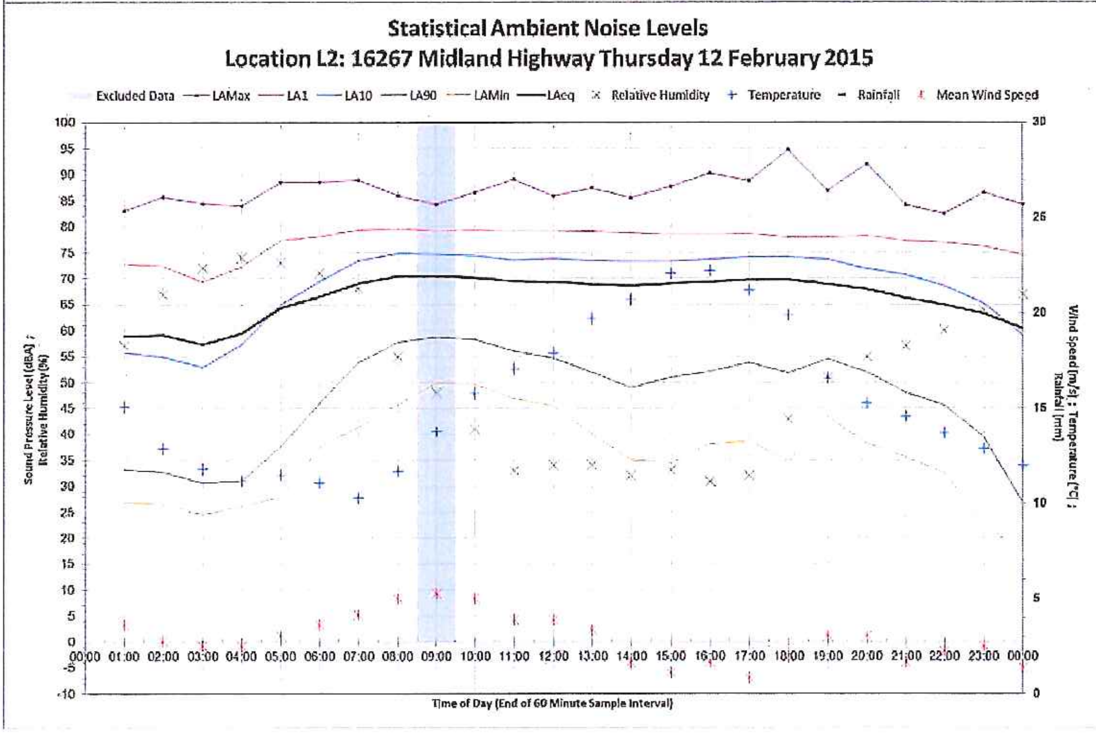
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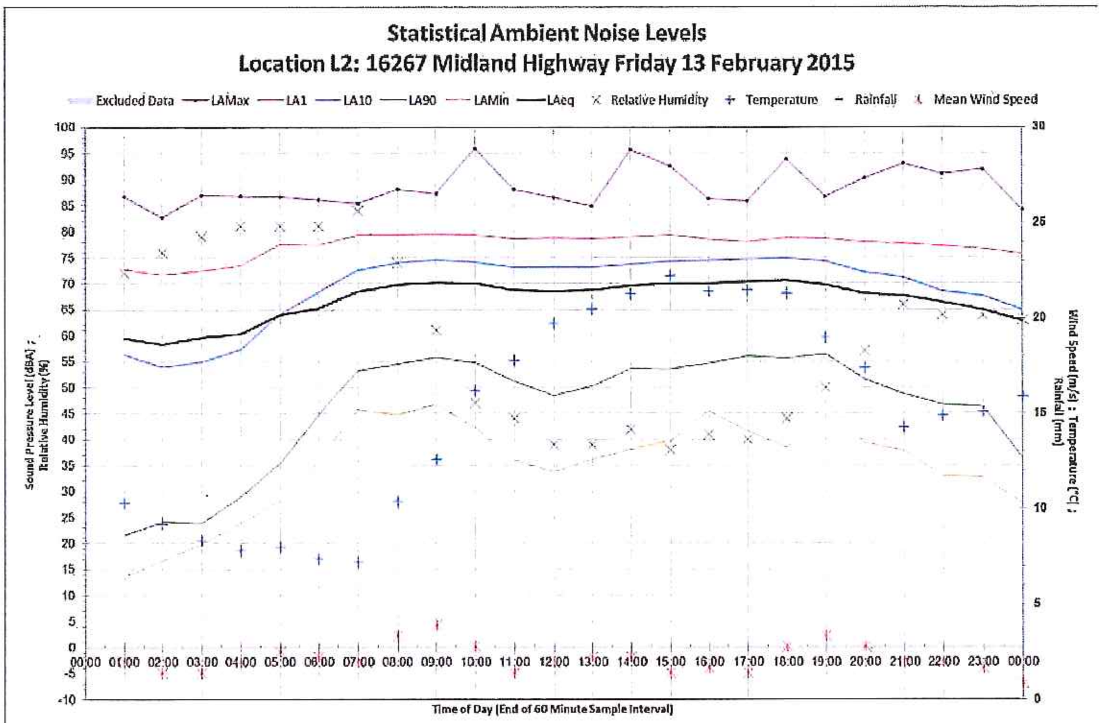
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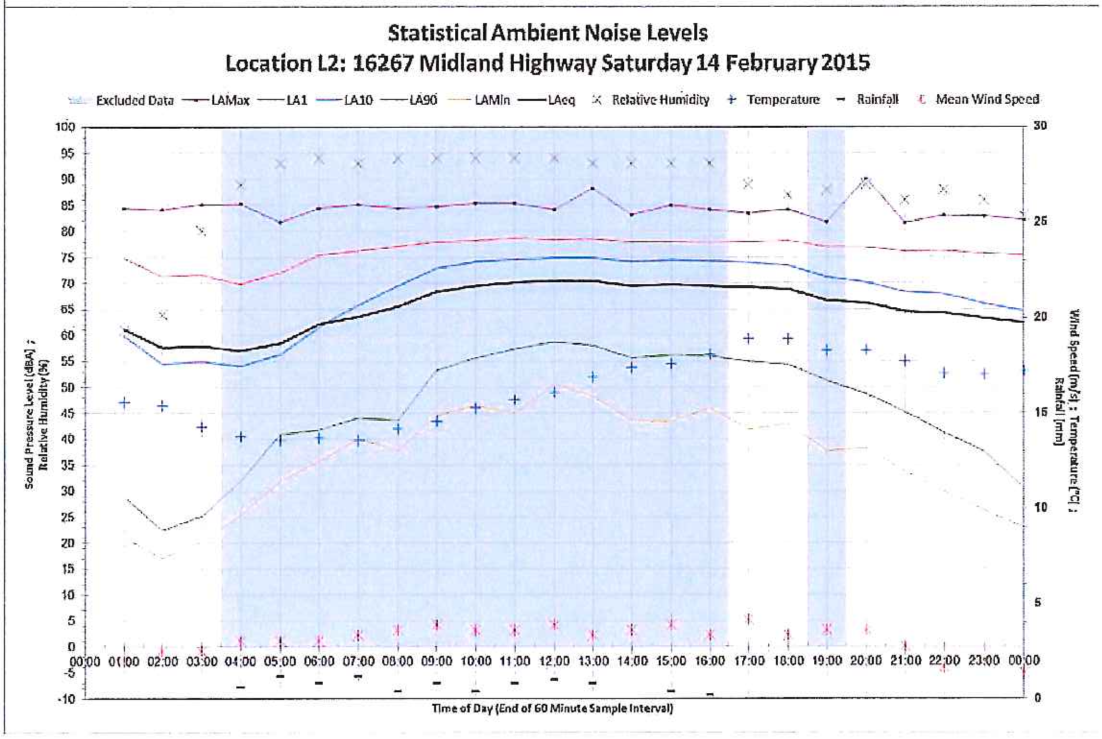
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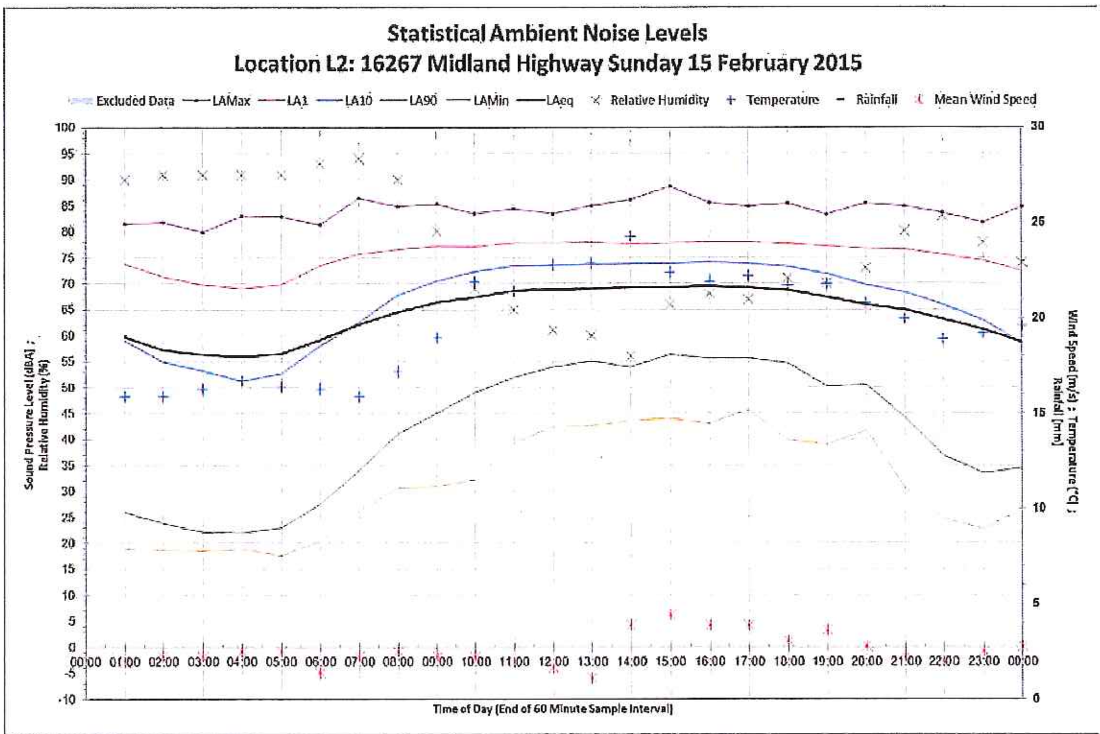
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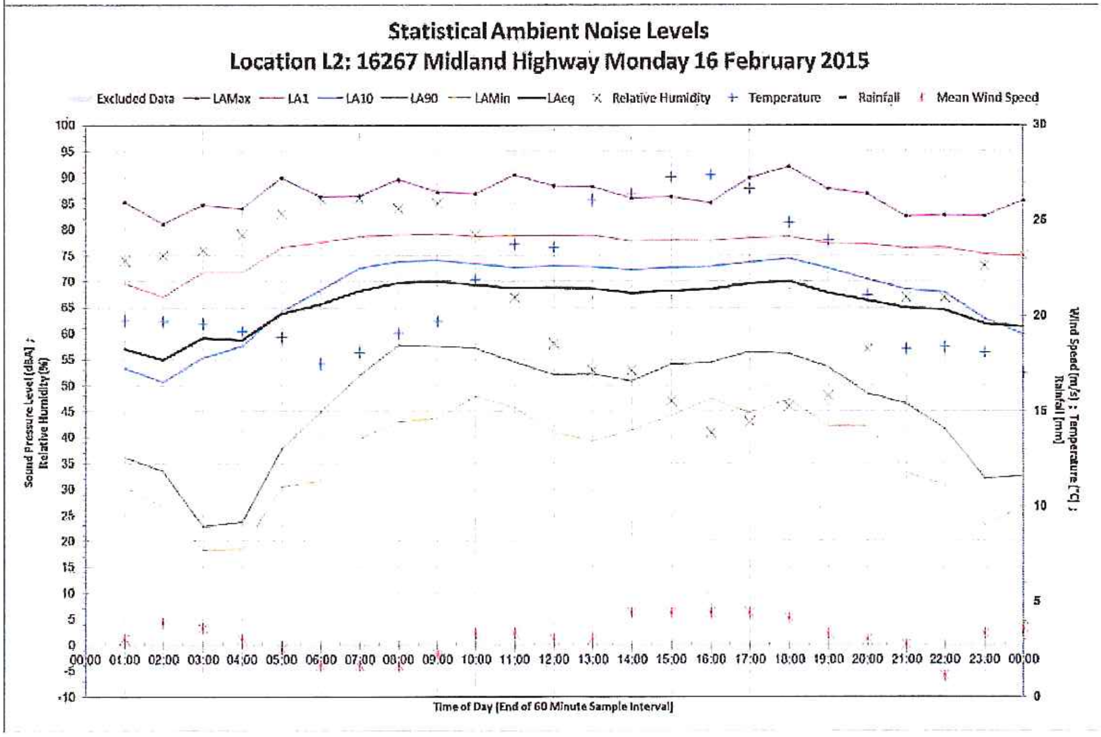
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)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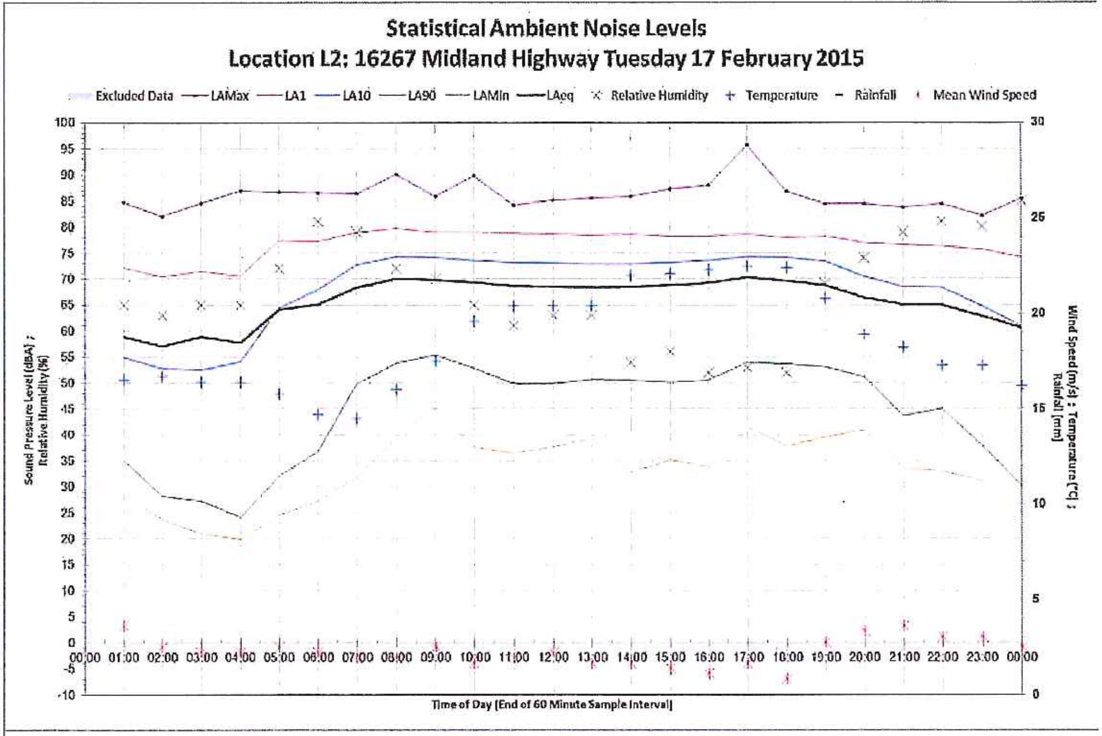
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)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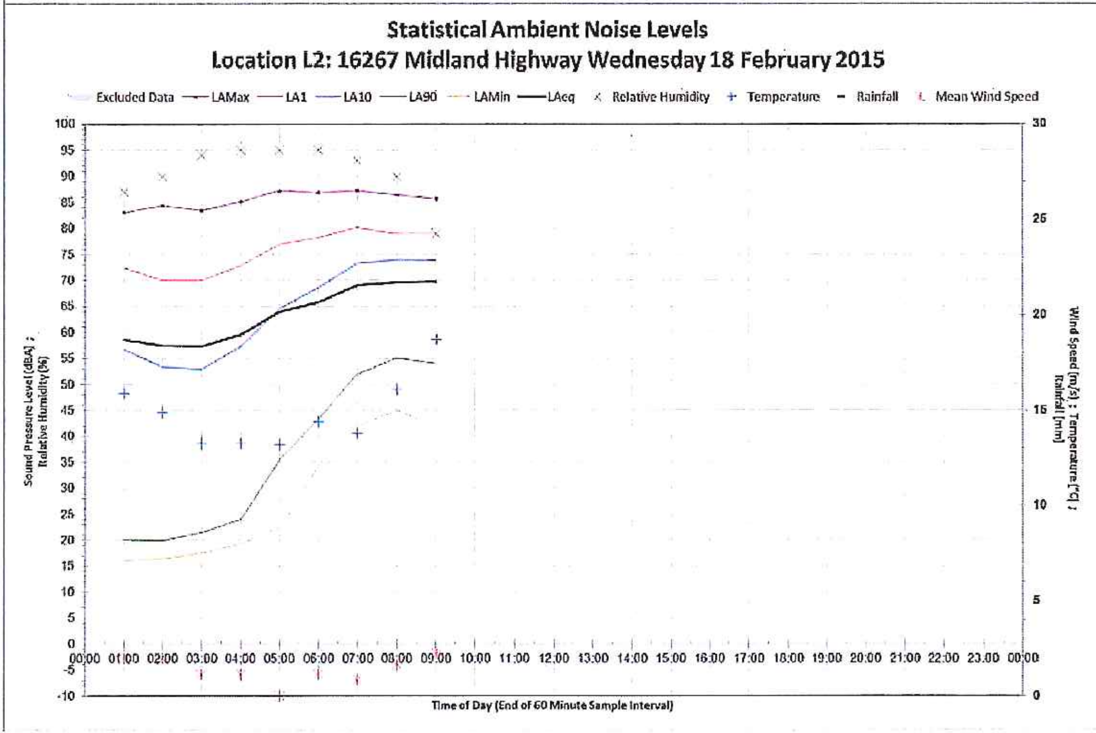
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Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)

Statistical Ambient Noise Levels
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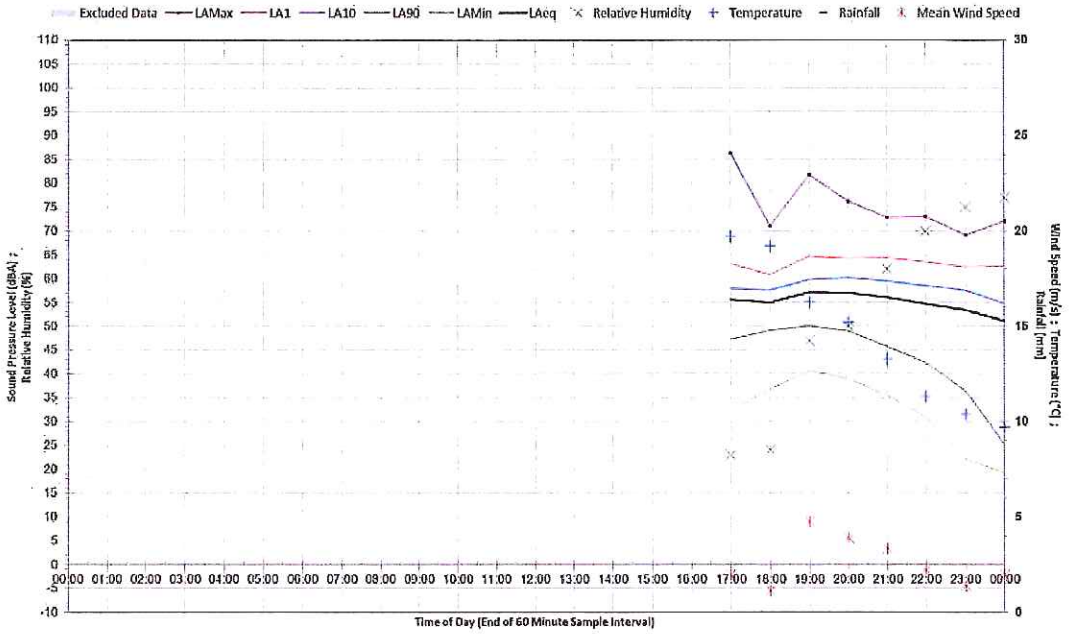
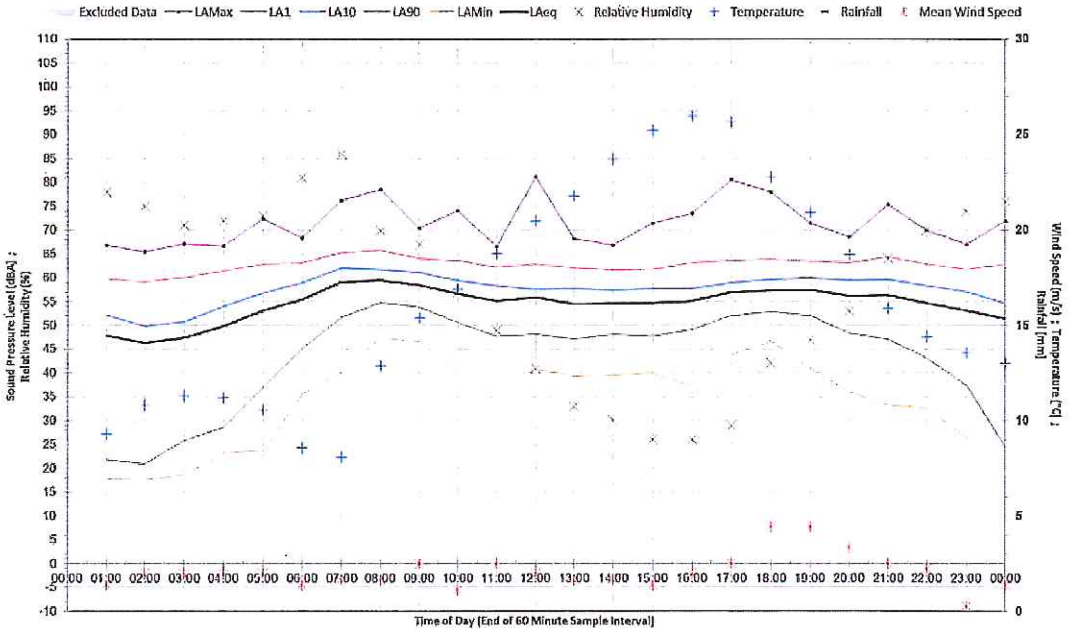
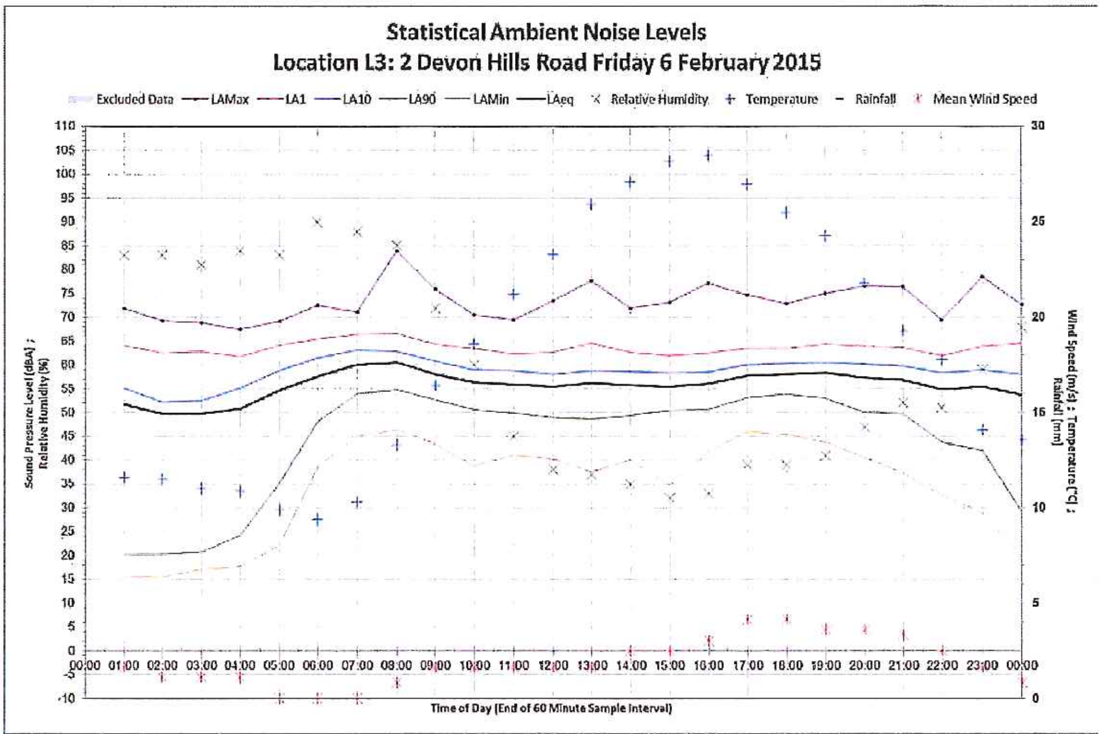
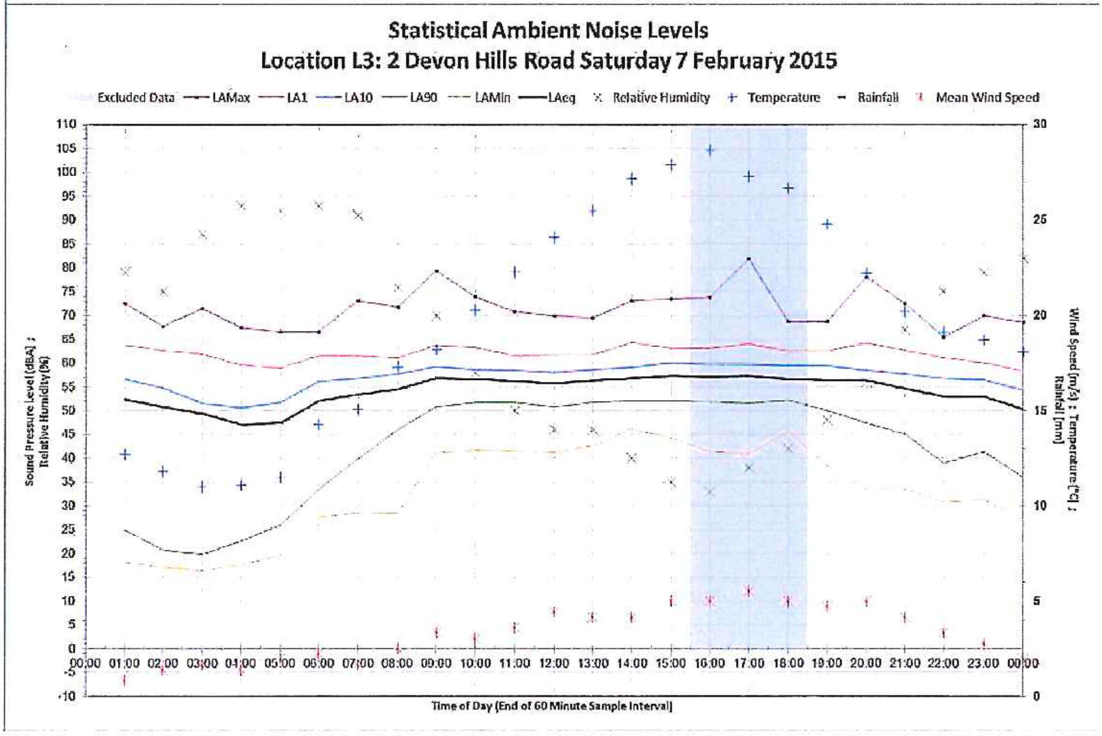
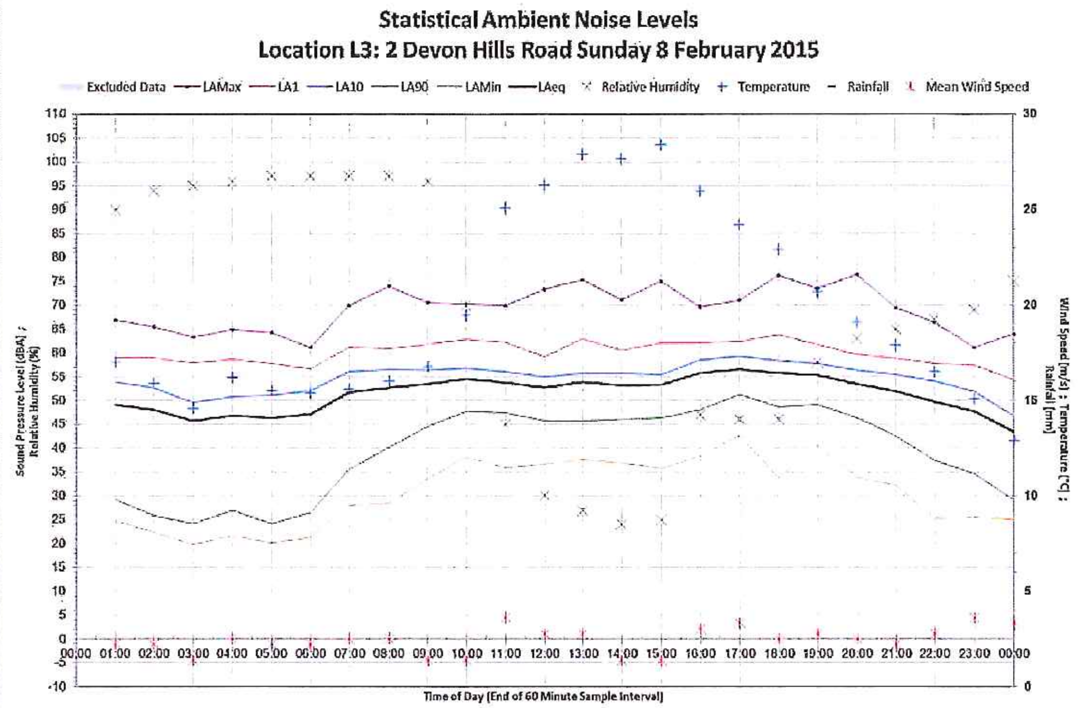


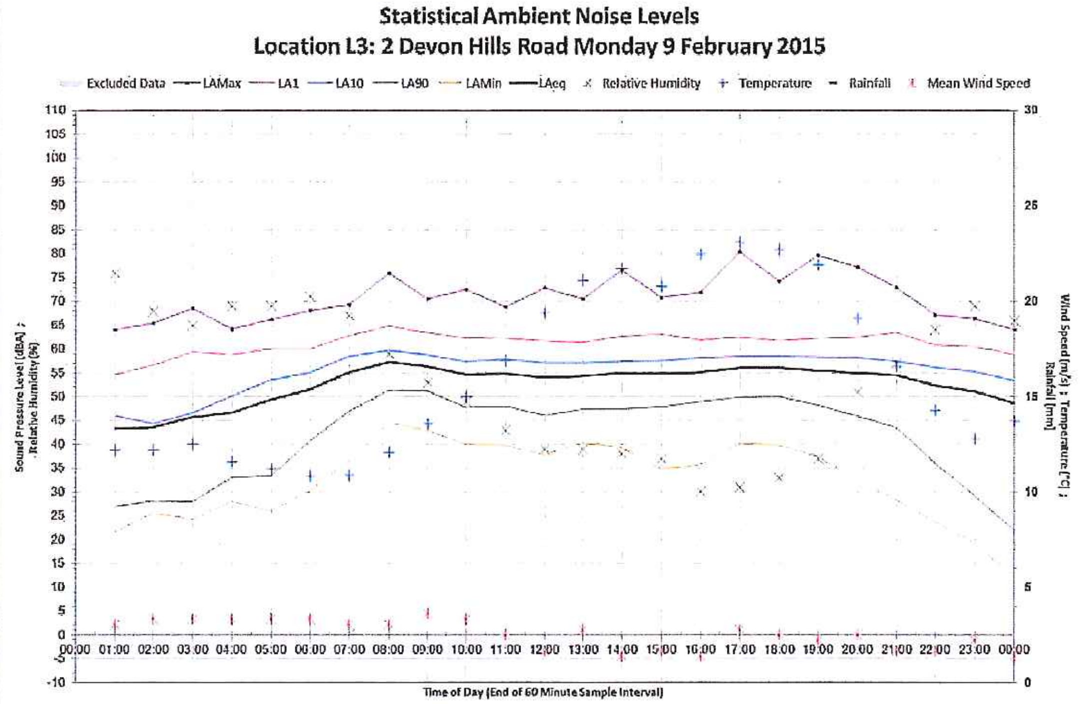
Statistical Ambient Noise Levels
Location L3: 2 Devon Hills Road Thursday 5 February 2015

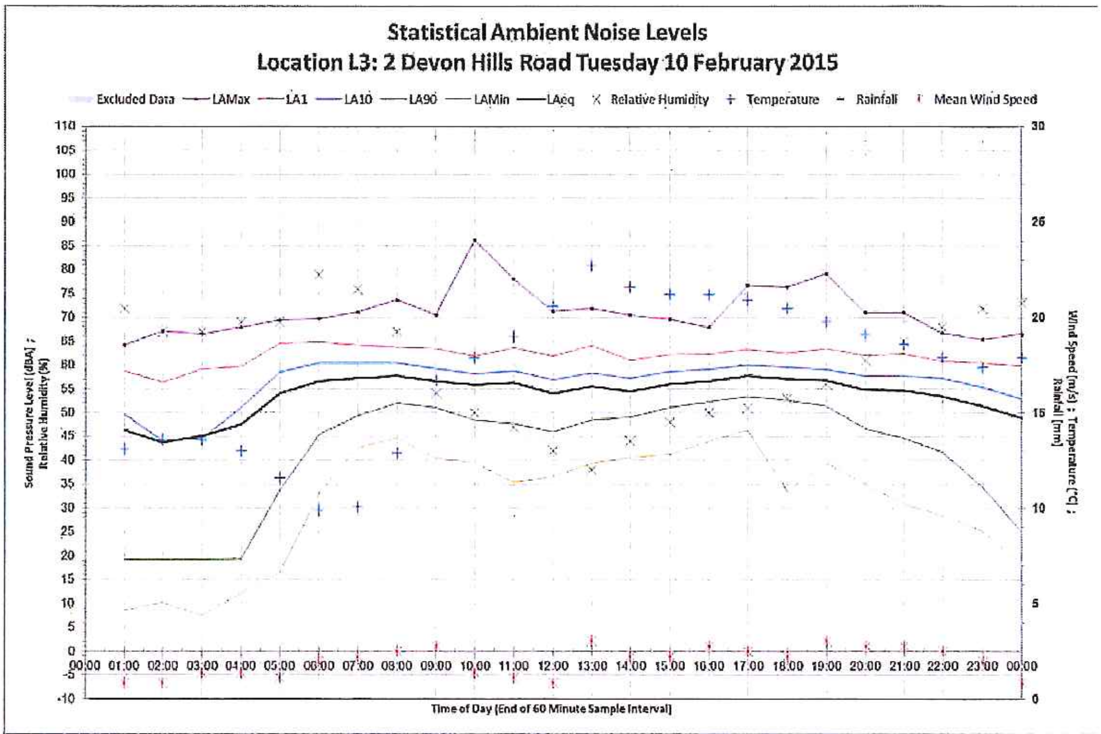


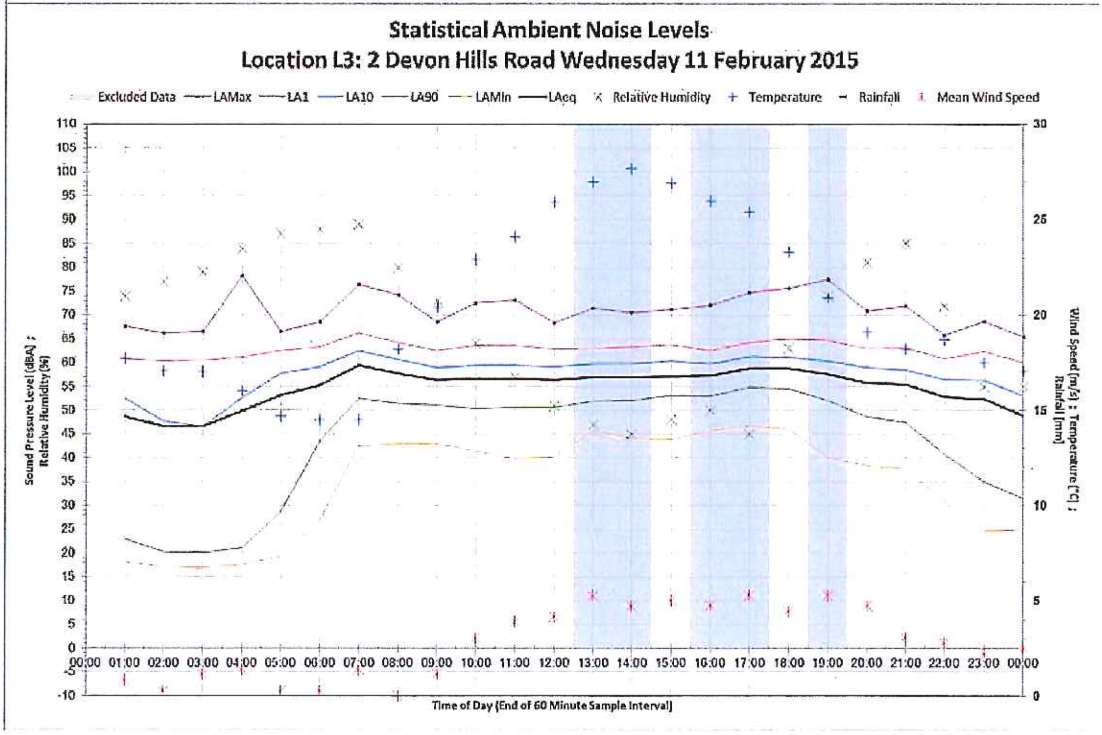

Statistical Ambient Noise Levels
Location L3: 2 Devon Hills Road Friday 6 February 2015
Excluded Data
LAMax
LA1
LA10
LA90
LAMin
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)

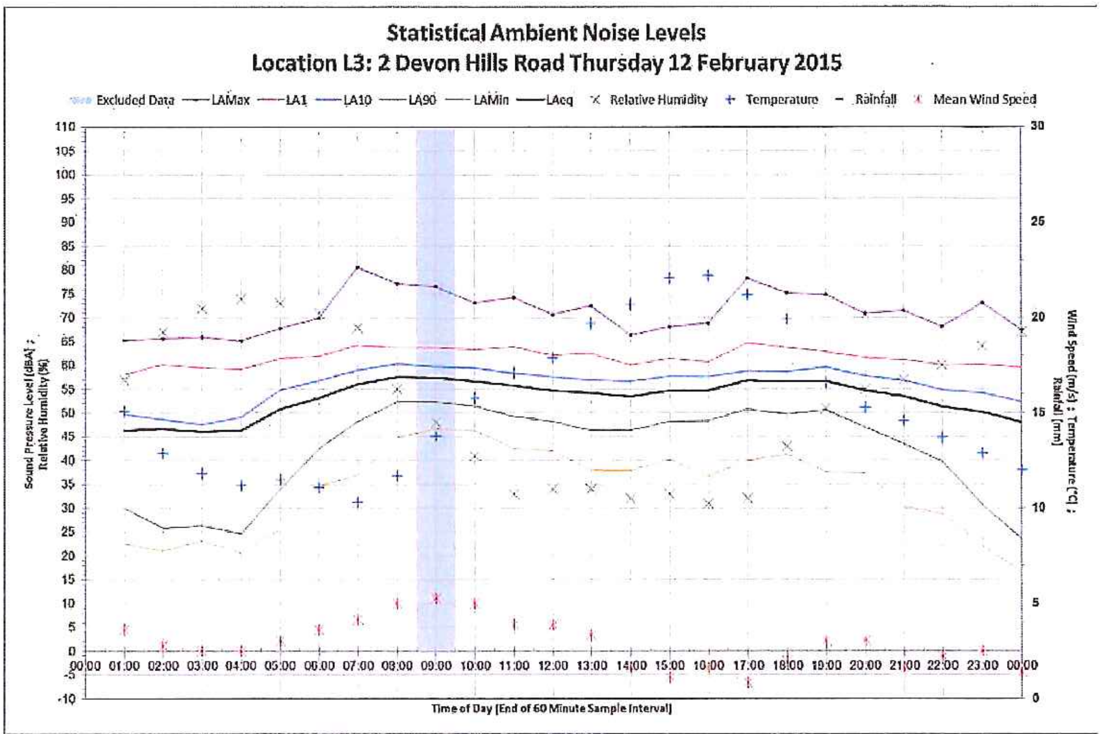

Statistical Ambient Noise Levels
Location L3: 2 Devon Hills Road Saturday 7 February 2015
Excluded Data
LAMax
LA1
LA10
LA90
LAMin
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)


Statistical Ambient Noise Levels
Location L3: 2 Devon Hills Road Sunday 8 February 2015
Excluded Data
LAMax
LA1
LA10
LA90
LAMin
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)

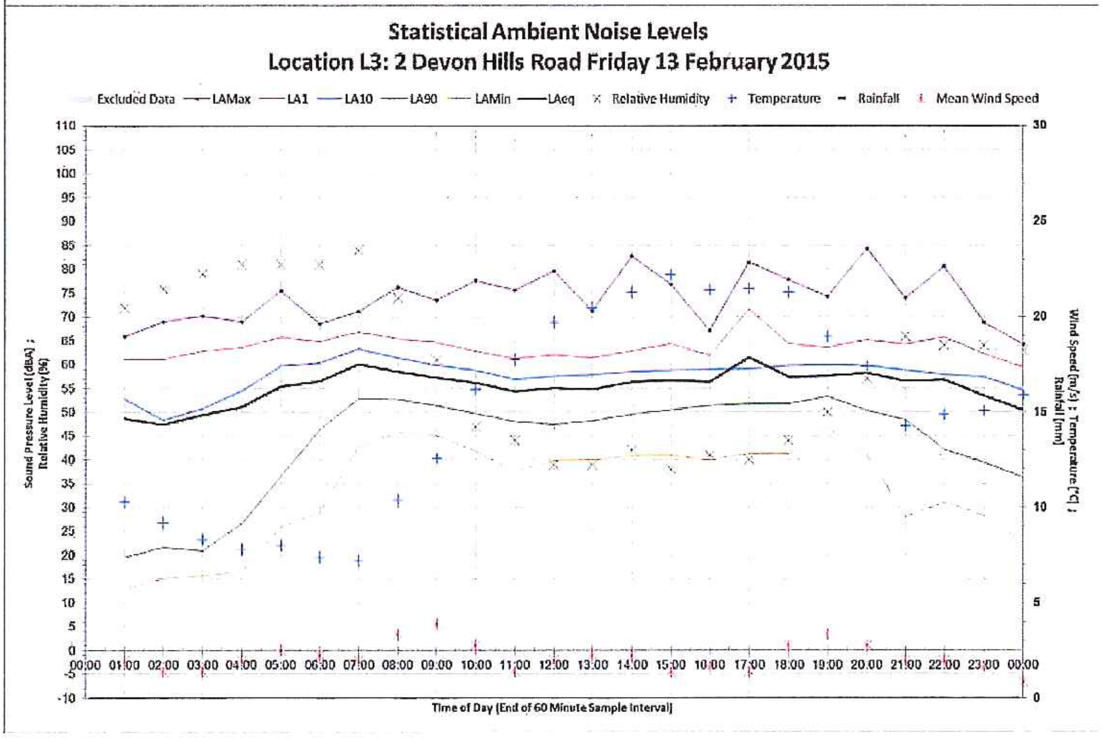

Statistical Ambient Noise Levels
Location L3: 2 Devon Hills Road Monday 9 February 2015
Excluded Data
LAMax
LA1
LA10
LA90
LAMin
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)


Statistical Ambient Noise Levels
Location L3: 2 Devon Hills Road Tuesday 10 February 2015
Excluded Data LAMax LA1 LA10 LA90 LAMin LAeq Relative Humidity Temperature Rainfall Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
00:00 01:00 02:00 03:00 04:00 05:00 06:00 07:00 08:00 09:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 00:00
Time of Day (End of 60 Minute Sample Interval)

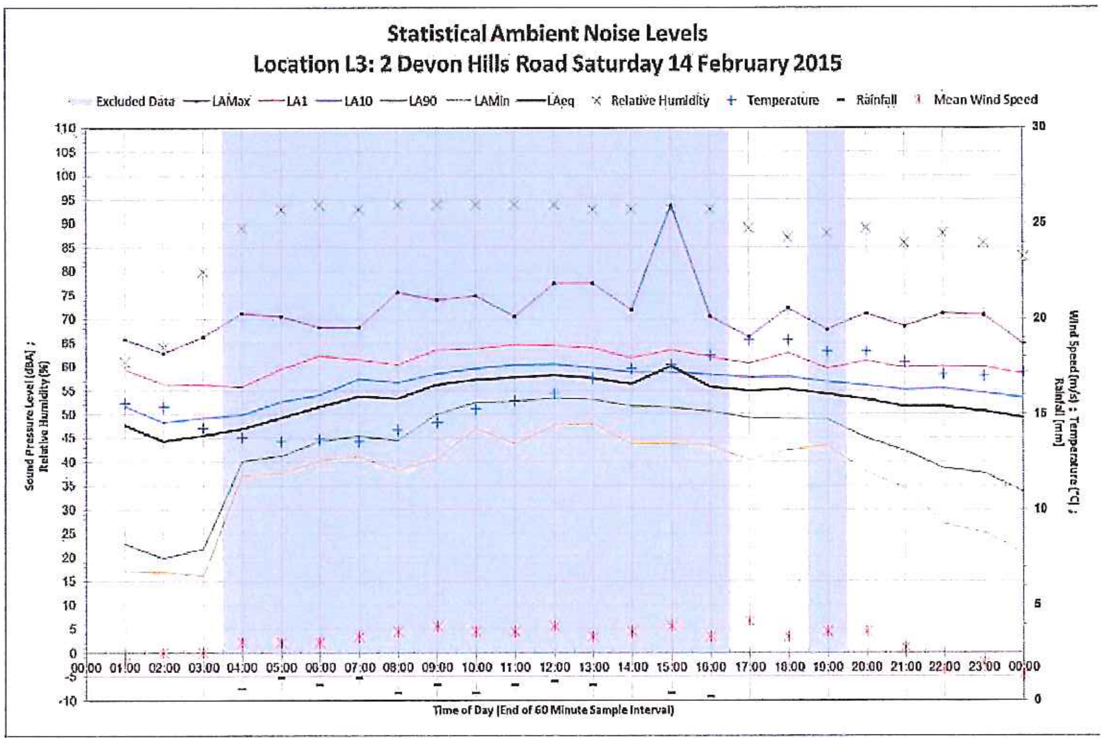

Statistical Ambient Noise Levels
Location L3: 2 Devon Hills Road Wednesday 11 February 2015
Excluded Data LAMax LA1 LA10 LA90 LAMin LAeq Relative Humidity Temperature Rainfall Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
00:00 01:00 02:00 03:00 04:00 05:00 06:00 07:00 08:00 09:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 00:00
Time of Day (End of 60 Minute Sample Interval)

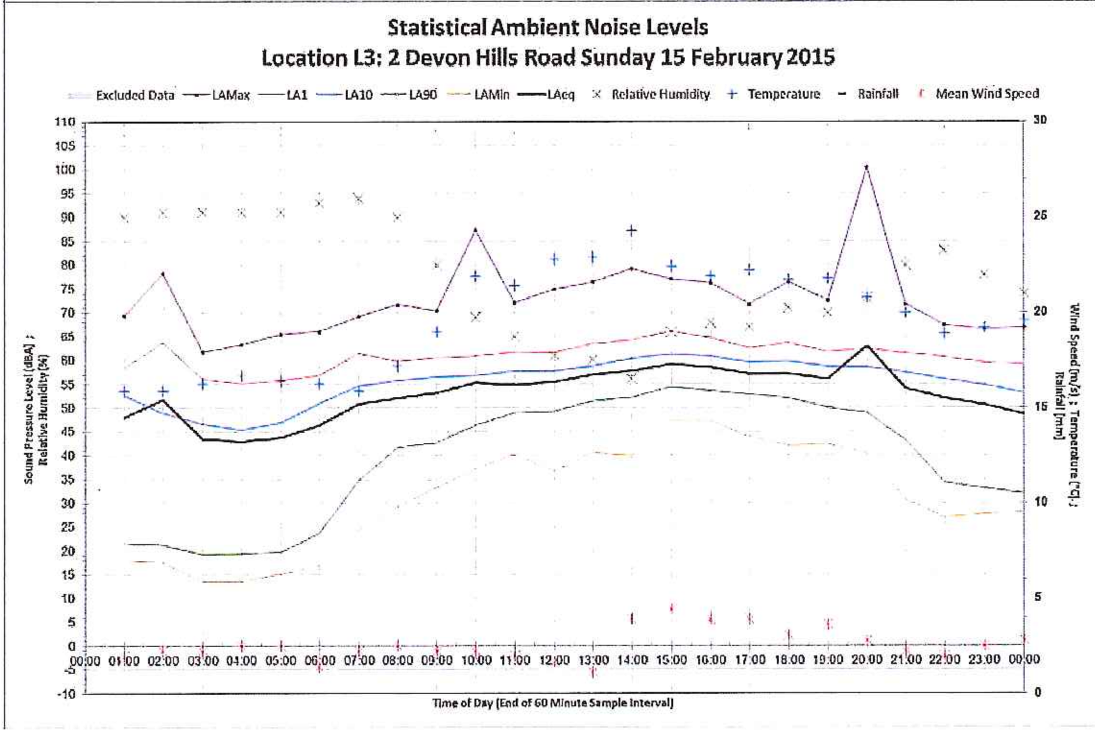


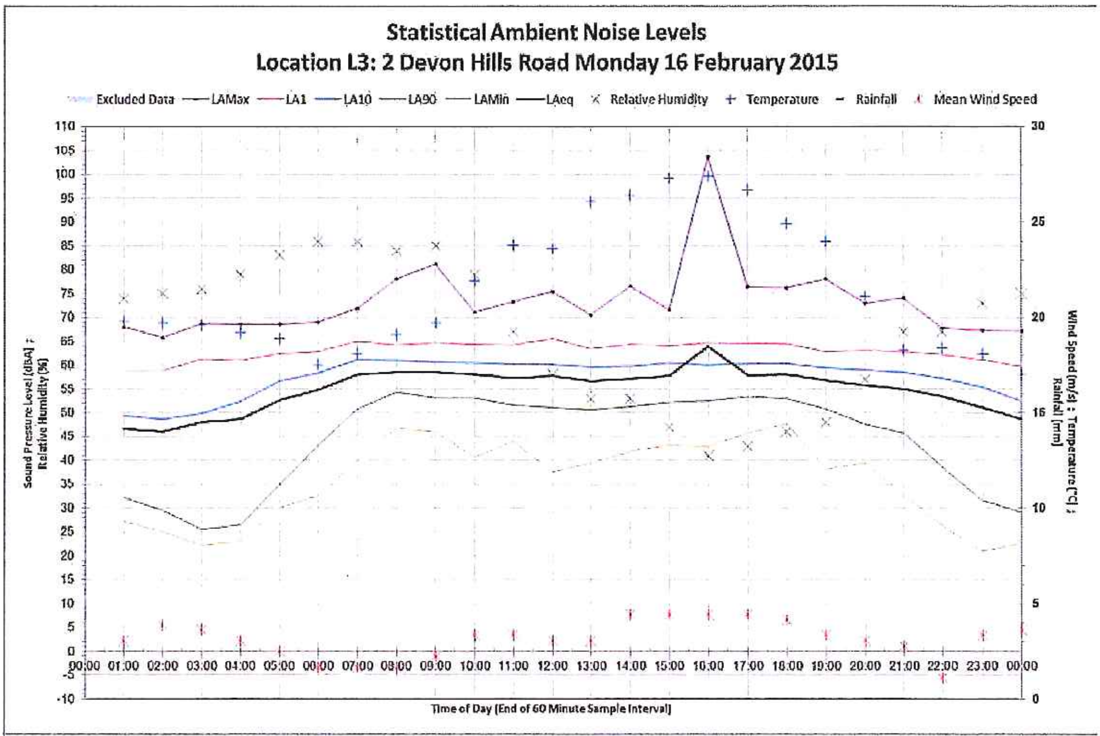
Statistical Ambient Noise Levels
Location L3: 2 Devon Hills Road Thursday 12 February 2015
Excluded Data
LAMax
LA1
LA10
LA90
LAMin
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)

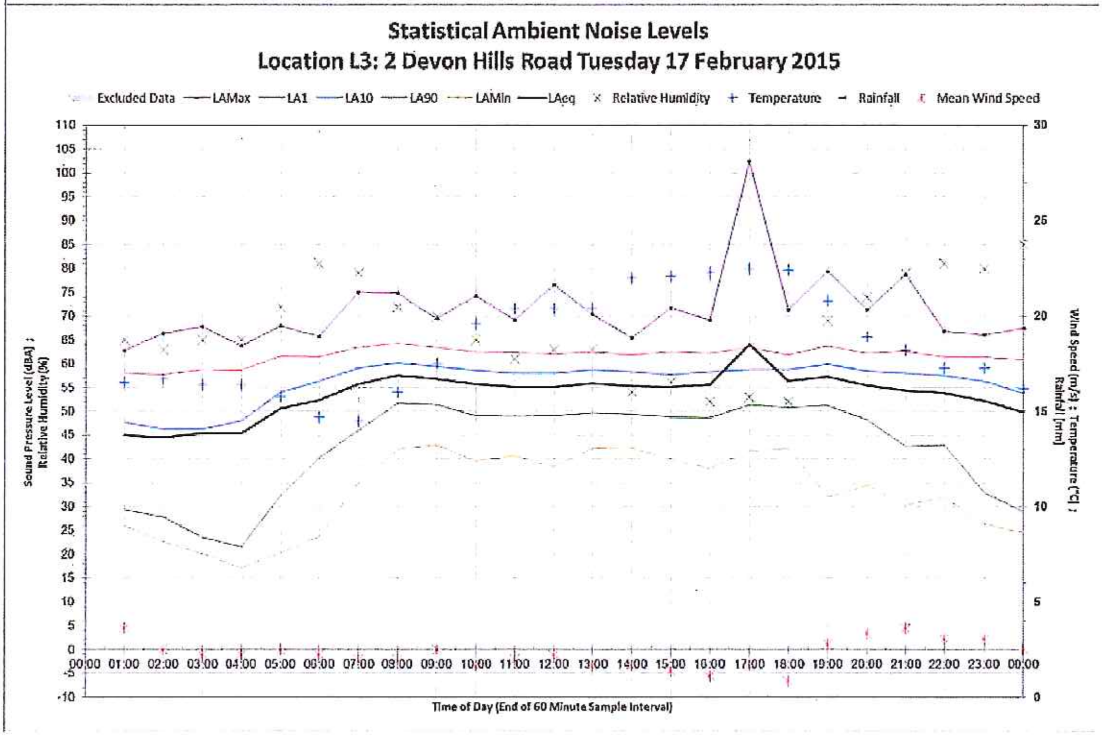


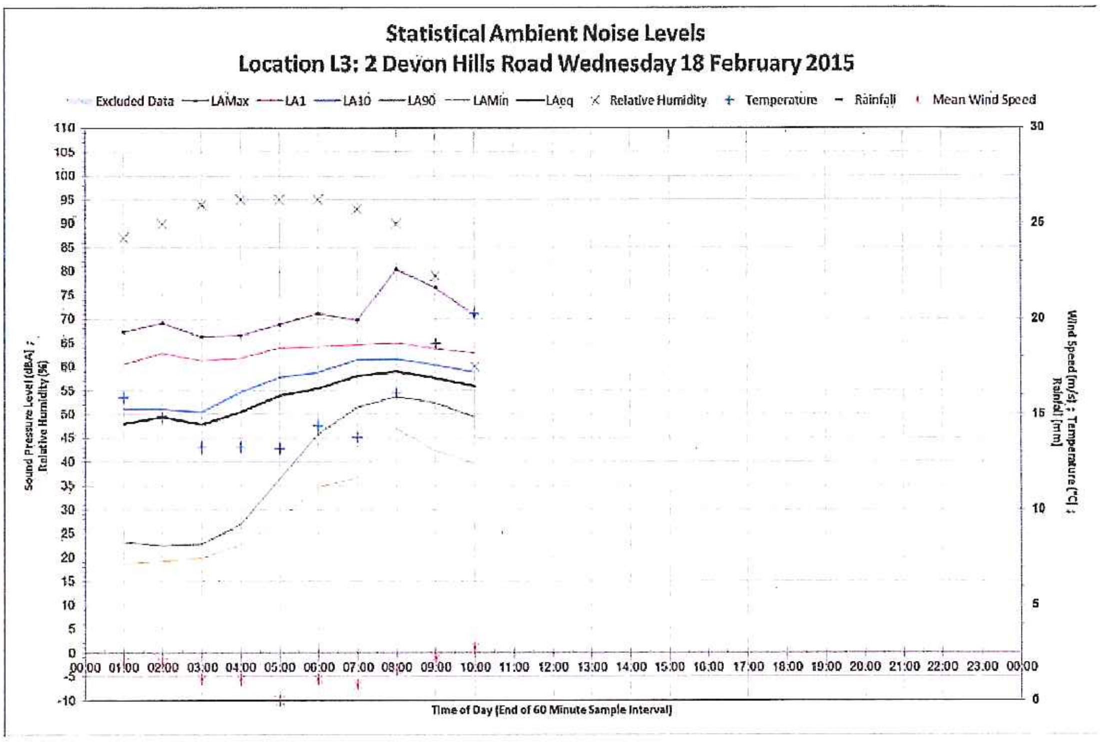
Statistical Ambient Noise Levels
Location L3: 2 Devon Hills Road Friday 13 February 2015
Excluded Data
LAMax
LA1
LA10
LA90
LAMin
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)

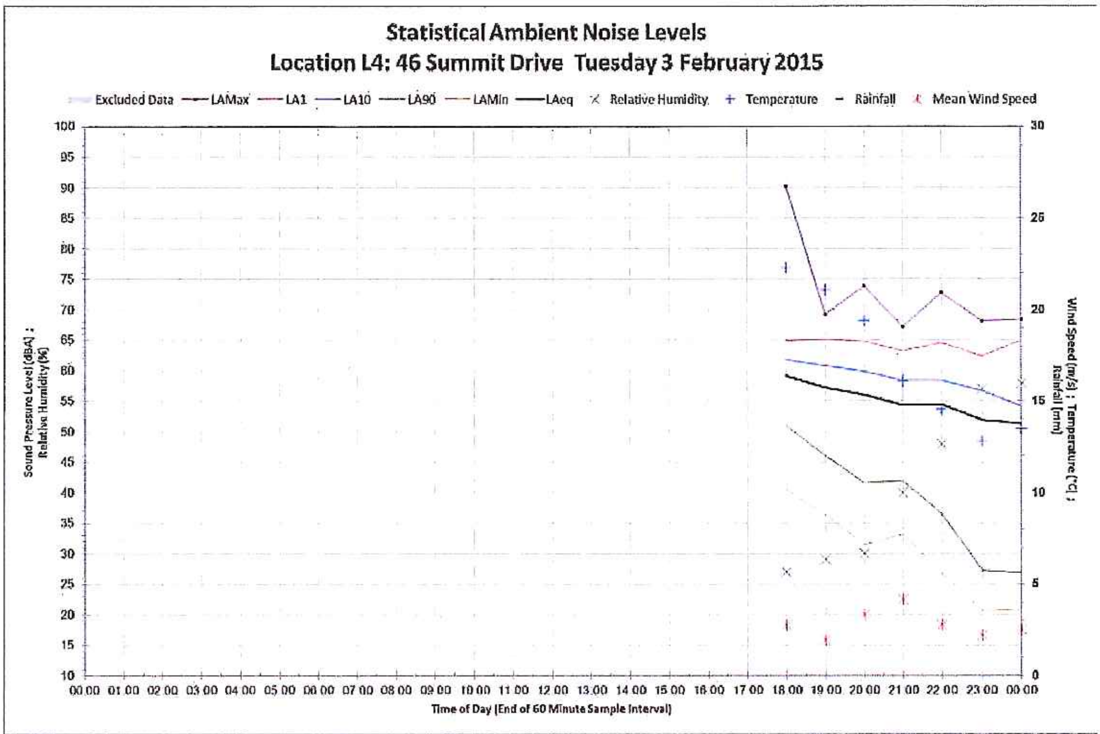

Statistical Ambient Noise Levels
Location L3: 2 Devon Hills Road Saturday 14 February 2015
Excluded Data
LAMax
LA1
LA10
LA90
LAMin
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level [dBA] ; Relative Humidity [%]
Wind Speed [m/s] ; Temperature [°C] ; Rainfall [mm]
Time of Day [End of 60 Minute Sample Interval]

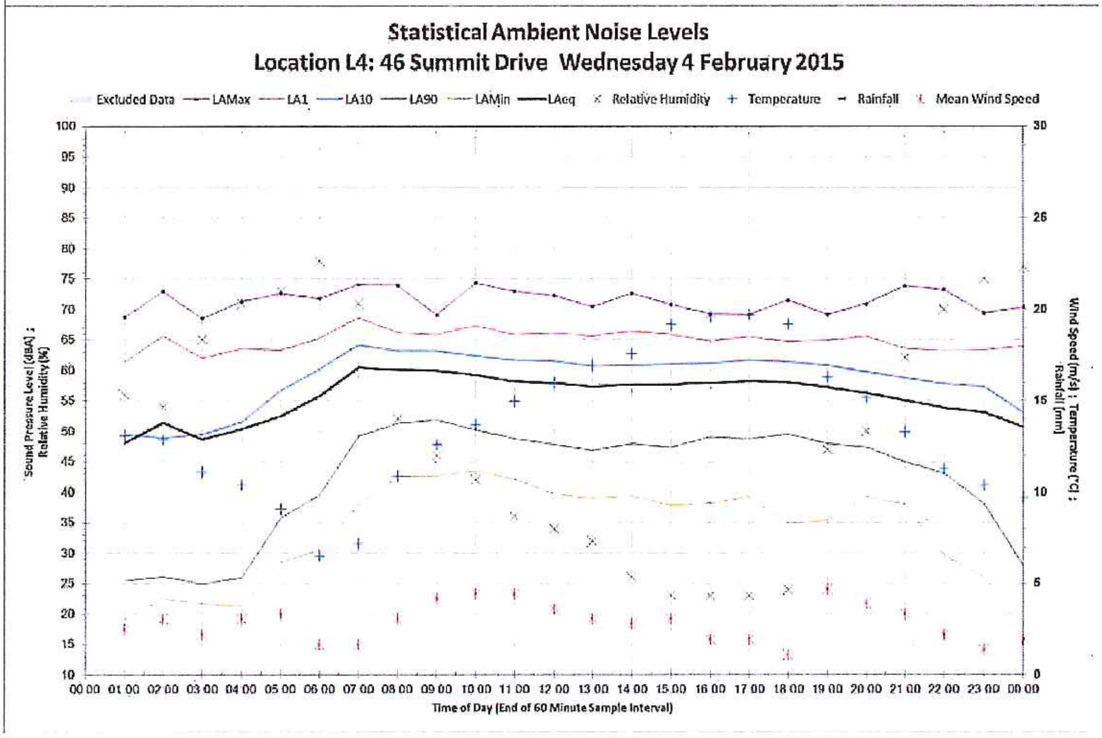

Statistical Ambient Noise Levels
Location L3: 2 Devon Hills Road Sunday 15 February 2015
Excluded Data
LAMax
LA1
LA10
LA90
LAMin
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level [dBA] ; Relative Humidity [%]
Wind Speed [m/s] ; Temperature [°C] ; Rainfall [mm]
Time of Day [End of 60 Minute Sample Interval]


Statistical Ambient Noise Levels
Location L3: 2 Devon Hills Road Monday 16 February 2015
Excluded Data
LAMax
LA1
LA10
LA90
LAMin
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)

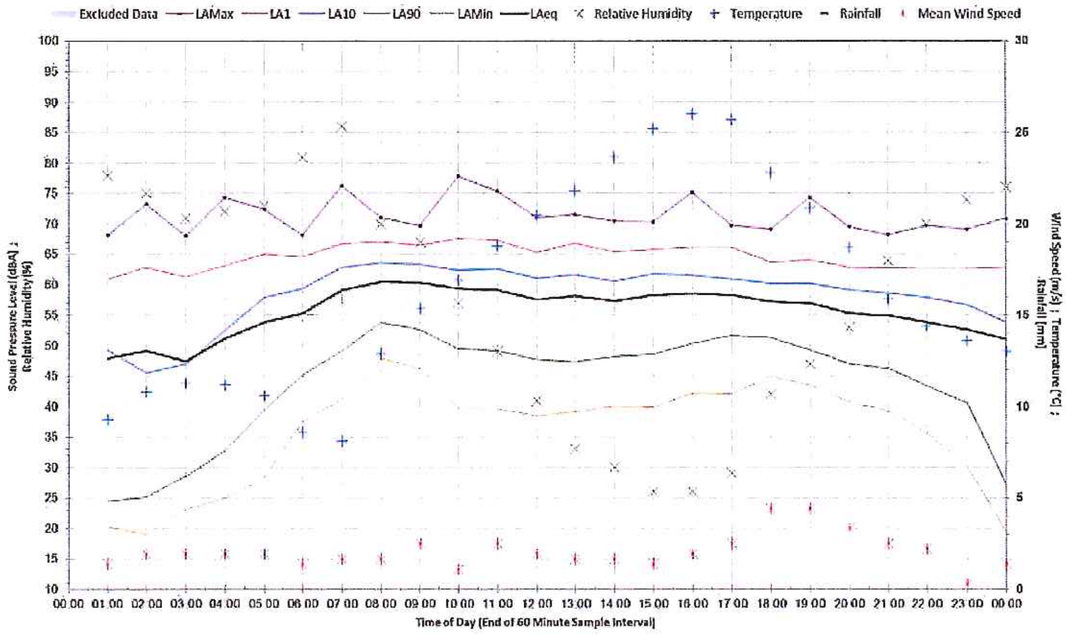

Statistical Ambient Noise Levels
Location L3: 2 Devon Hills Road Tuesday 17 February 2015
Excluded Data
LAMax
LA1
LA10
LA90
LAMin
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)


Statistical Ambient Noise Levels
Location L3: 2 Devon Hills Road Wednesday 18 February 2015
Excluded Data
LAMax
LA1
LA10
LA90
LAMin
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level [dBA] ; Relative Humidity [%]
Wind Speed [m/s] ; Temperature [°C] ; Rainfall [mm]
Time of Day (End of 60 Minute Sample Interval)

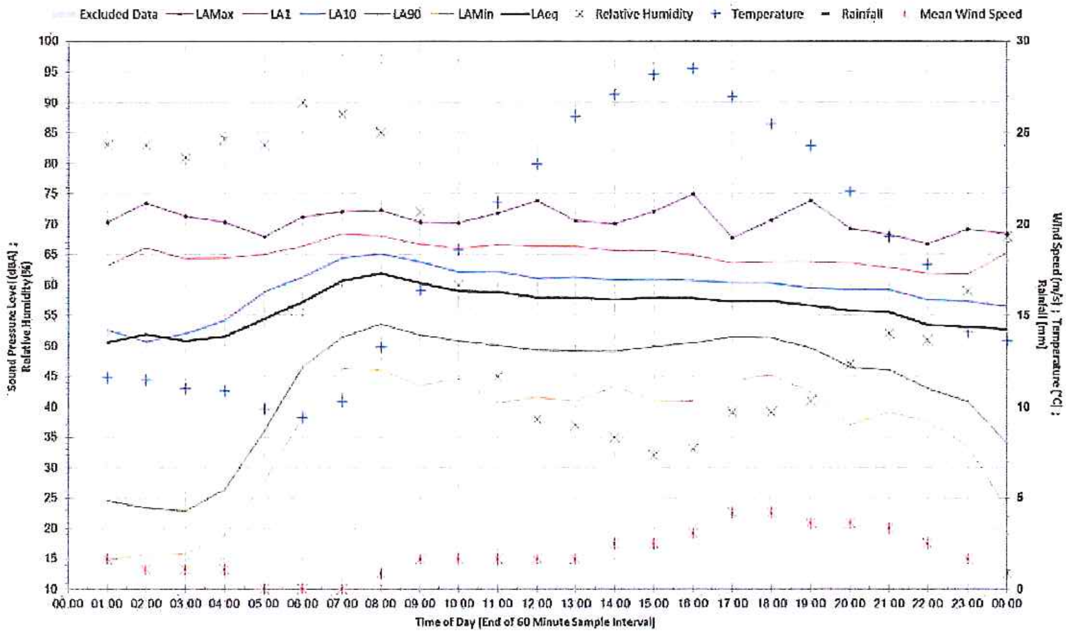

Statistical Ambient Noise Levels
Location L4: 46 Summit Drive Tuesday 3 February 2015
Excluded Data
LAMax
LA1
LA10
LA90
LAMin
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)

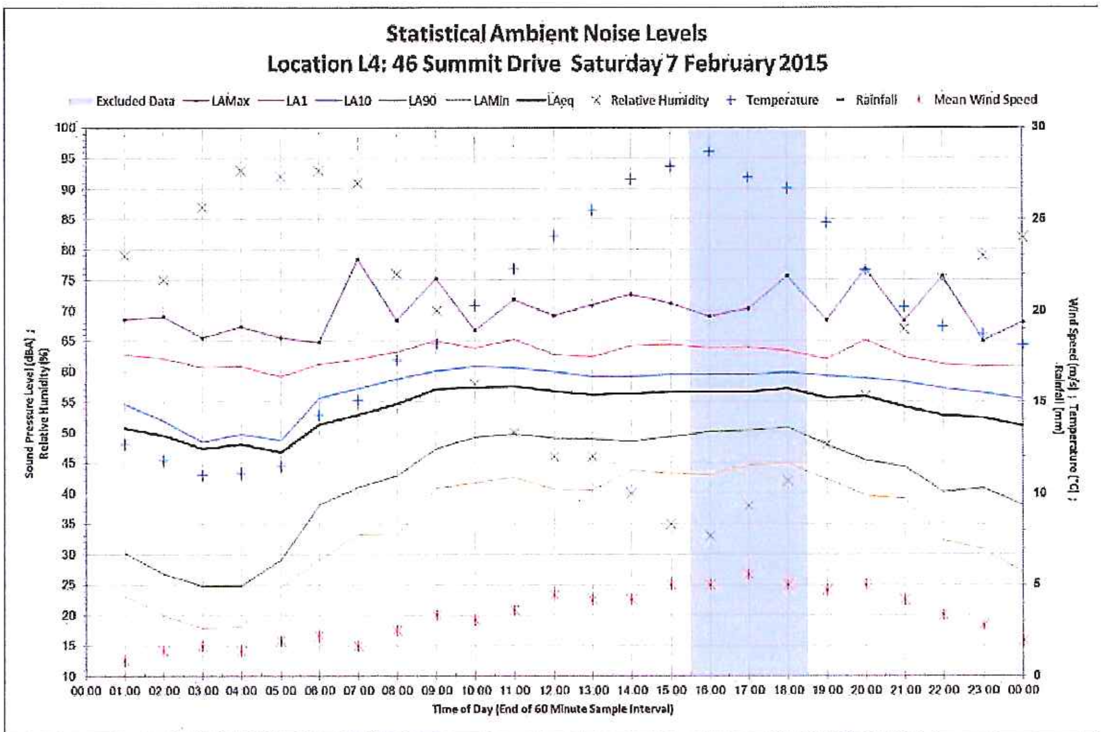

Statistical Ambient Noise Levels
Location L4: 46 Summit Drive Wednesday 4 February 2015
Excluded Data
LAMax
LA1
LA10
LA90
LAMin
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)

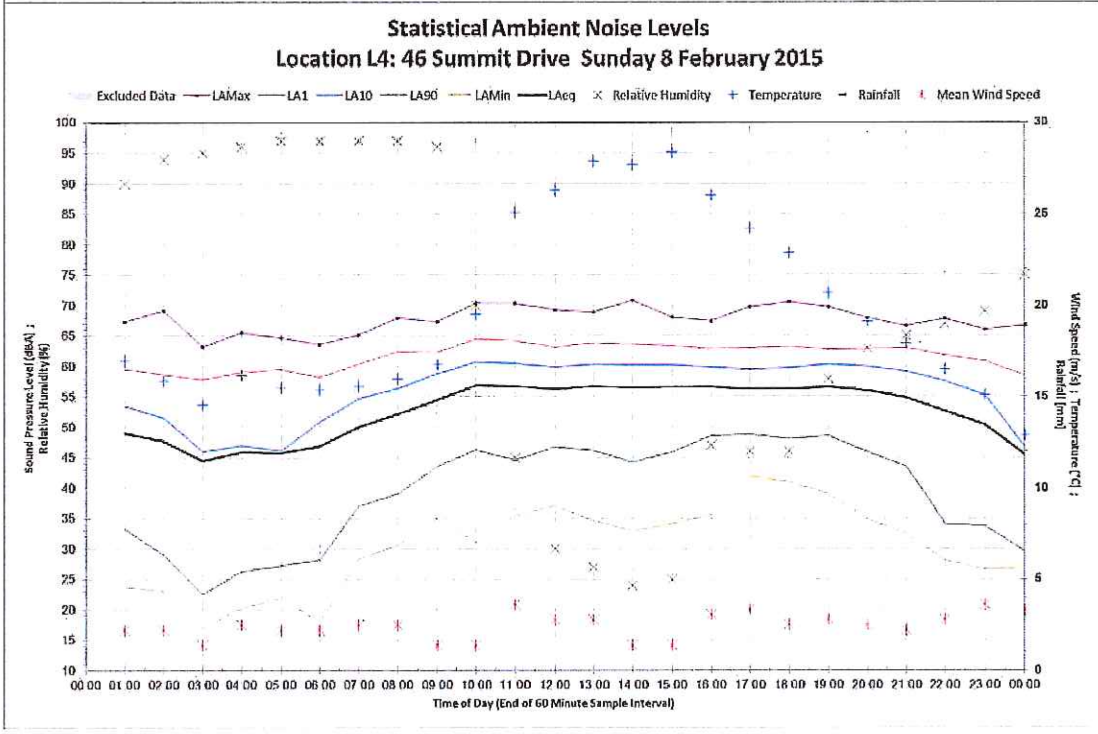
Statistical Ambient Noise Levels
Location L4: 46 Summit Drive Thursday 5 February 2015



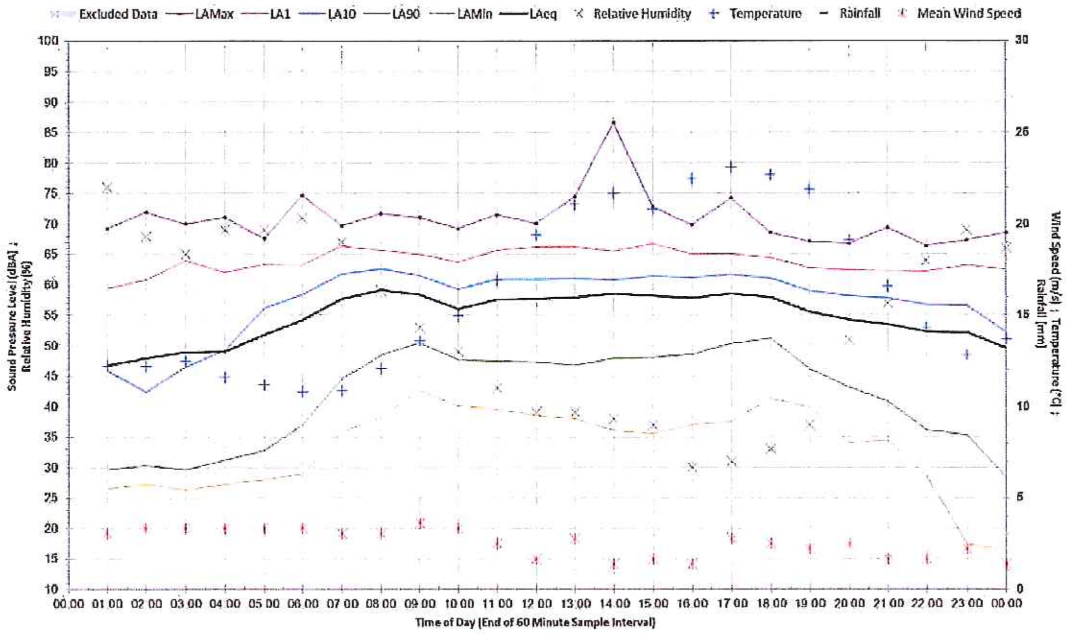
Statistical Ambient Noise Levels
Location L4: 46 Summit Drive Friday 6 February 2015



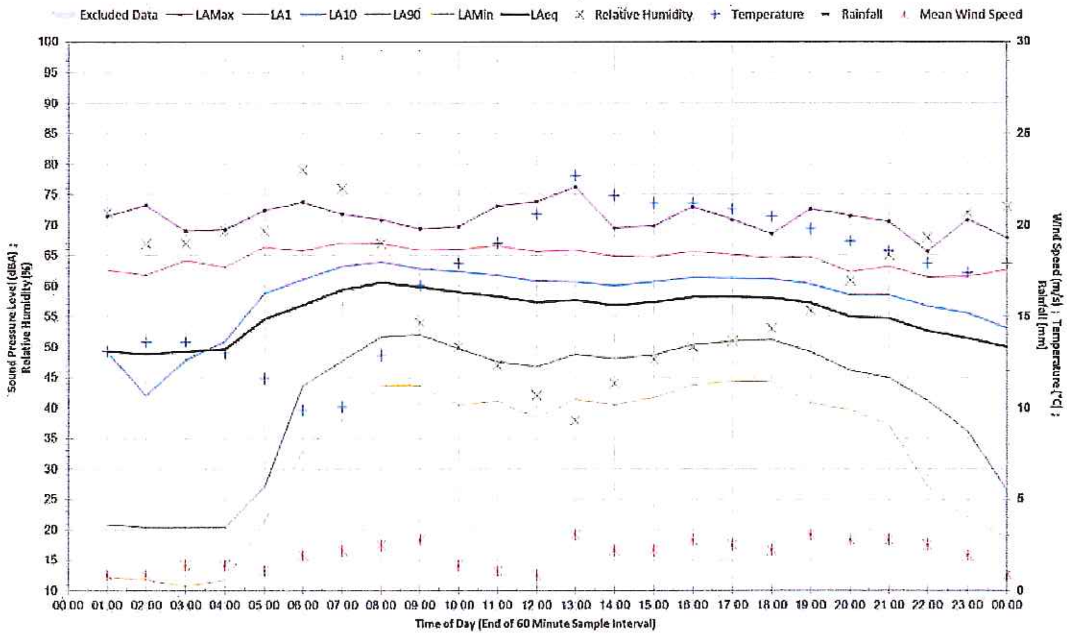

Statistical Ambient Noise Levels
Location L4: 46 Summit Drive Saturday 7 February 2015
Excluded Data
LAMax
LA1
LA10
LA90
LAMin
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)


Statistical Ambient Noise Levels
Location L4: 46 Summit Drive Sunday 8 February 2015
Excluded Data
LAMax
LA1
LA10
LA90
LAMin
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)

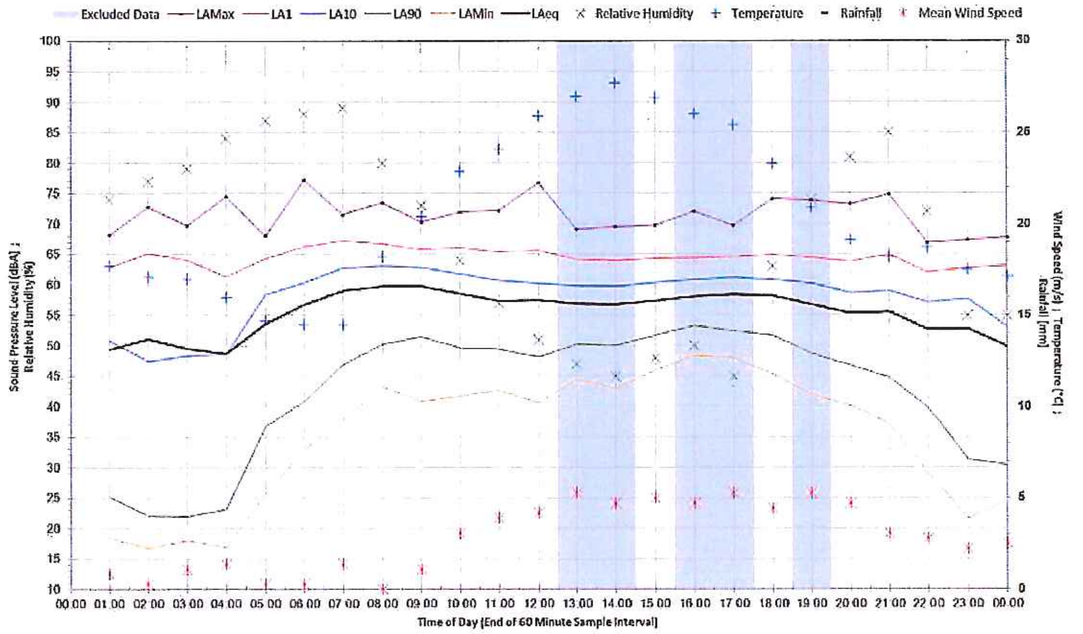
Statistical Ambient Noise Levels
Location L4: 46 Summit Drive Monday 9 February 2015



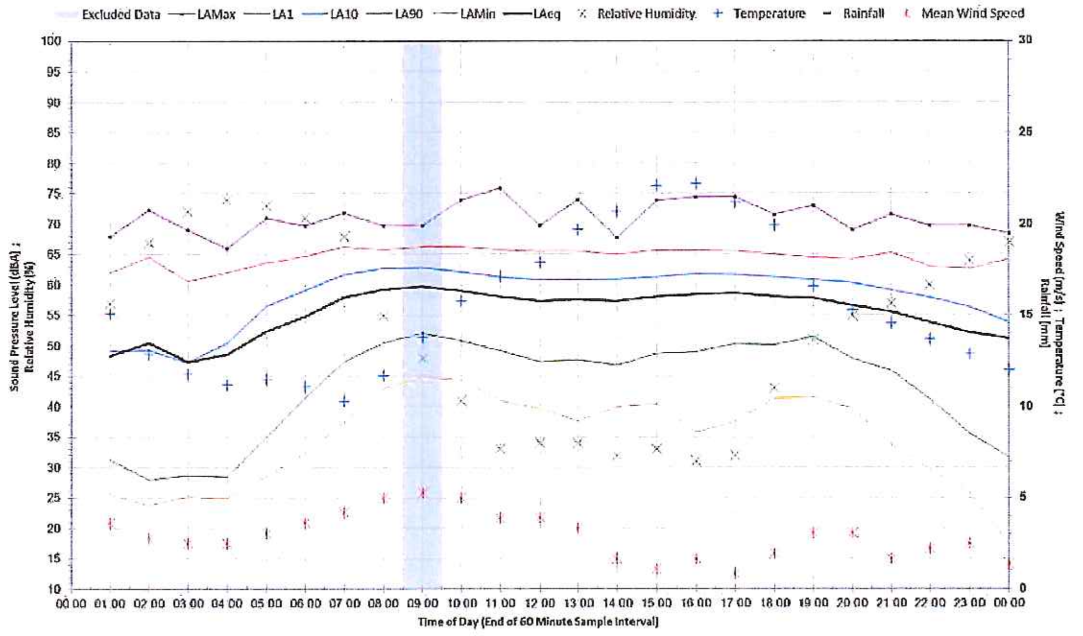
Statistical Ambient Noise Levels
Location L4: 46 Summit Drive Tuesday 10 February 2015

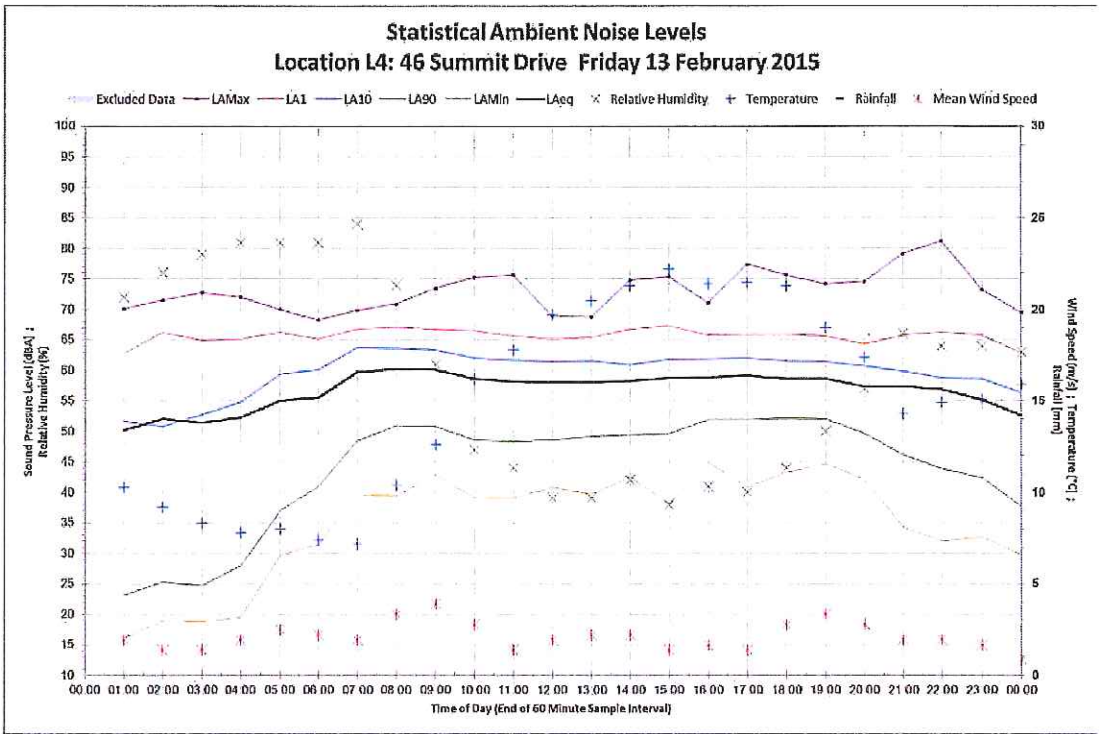


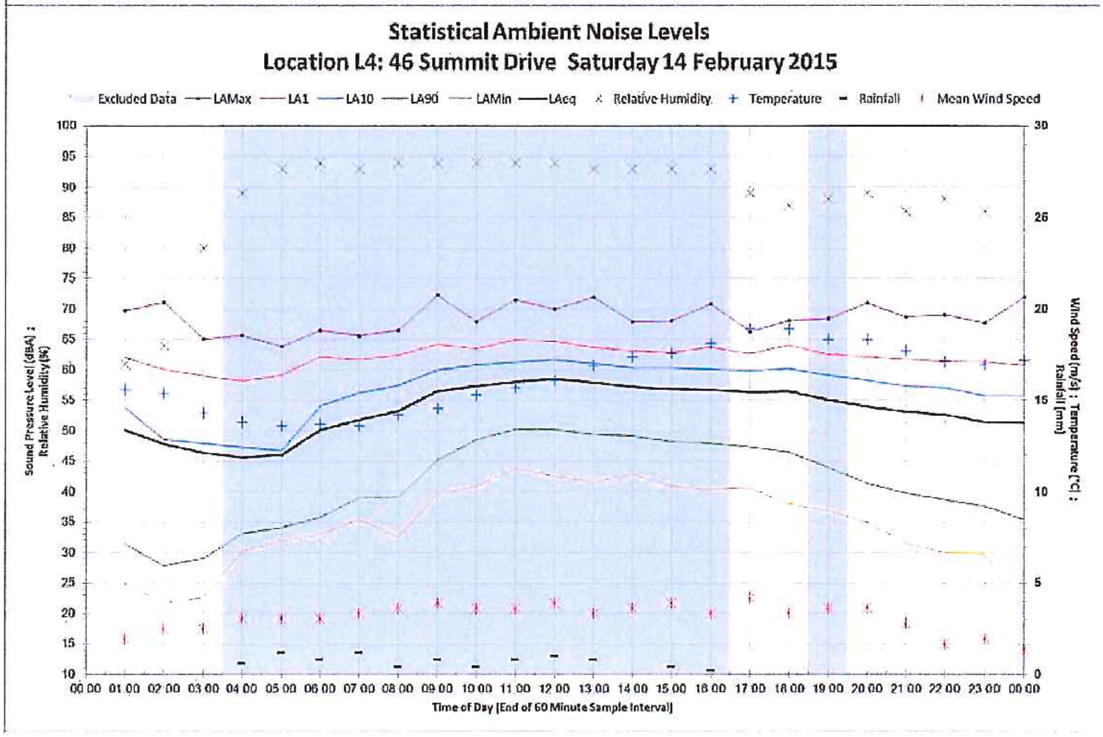
Statistical Ambient Noise Levels
Location L4: 46 Summit Drive Wednesday 11 February 2015

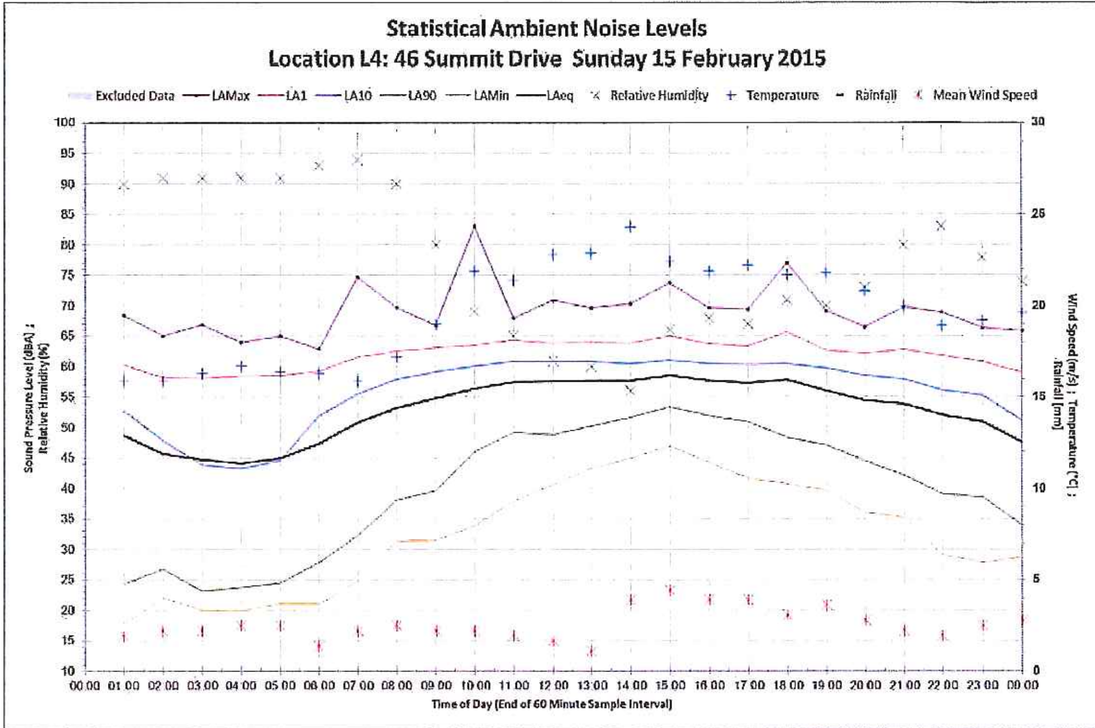


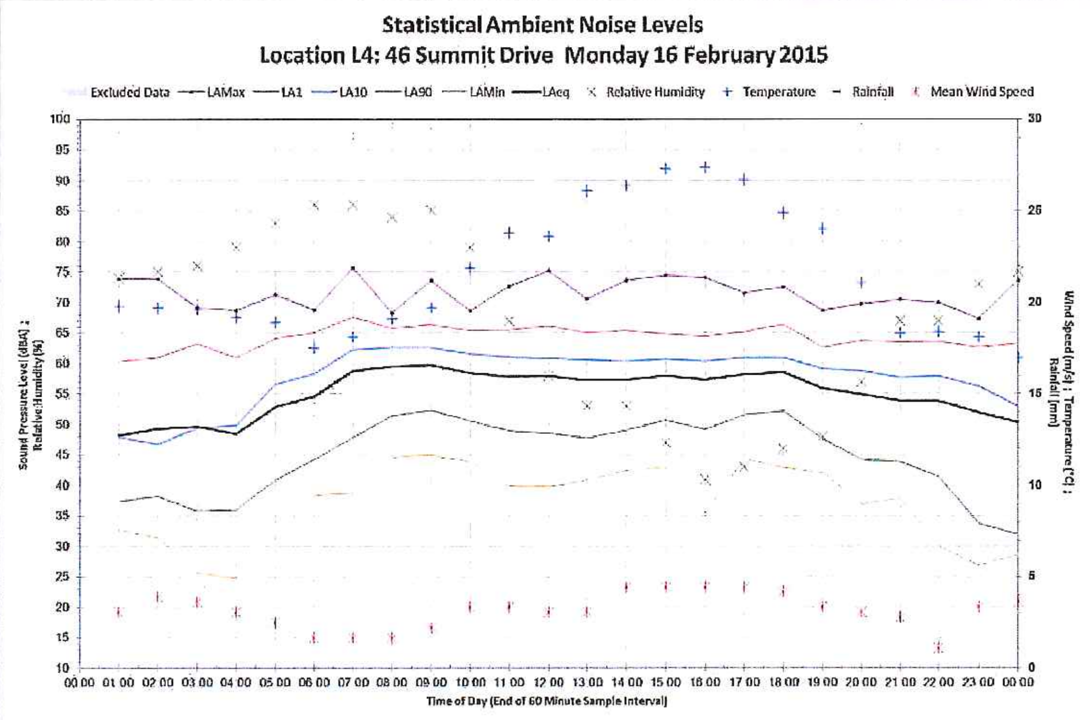
Statistical Ambient Noise Levels
Location L4: 46 Summit Drive Thursday 12 February 2015



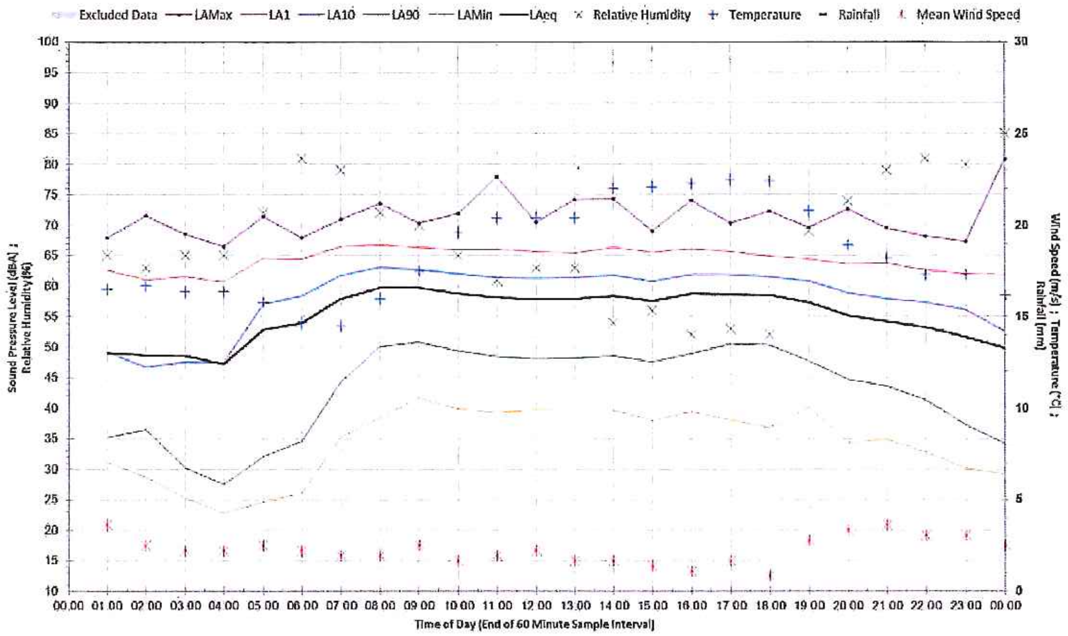

Statistical Ambient Noise Levels
Location L4: 46 Summit Drive Friday 13 February 2015
Excluded Data
LAMax
LA1
LA10
LA90
LAMin
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)


Statistical Ambient Noise Levels
Location L4: 46 Summit Drive Saturday 14 February 2015
Excluded Data
LAMax
LA1
LA10
LA90
LAMin
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)

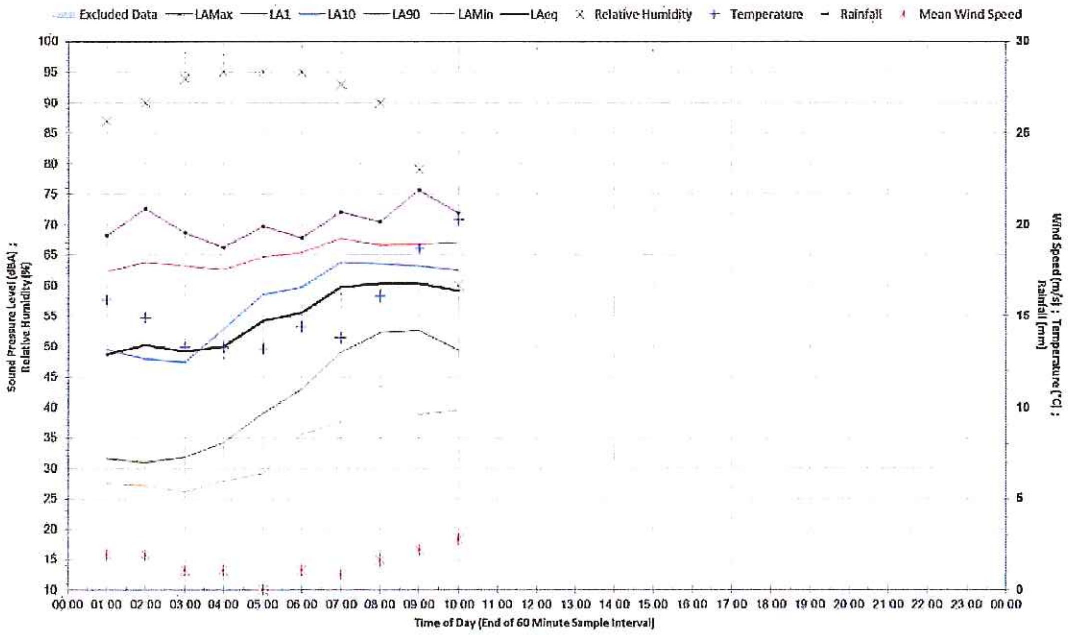

Statistical Ambient Noise Levels
Location L4: 46 Summit Drive Sunday 15 February 2015
Excluded Data
LAMax
LA1
LA10
LA90
LAMin
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)

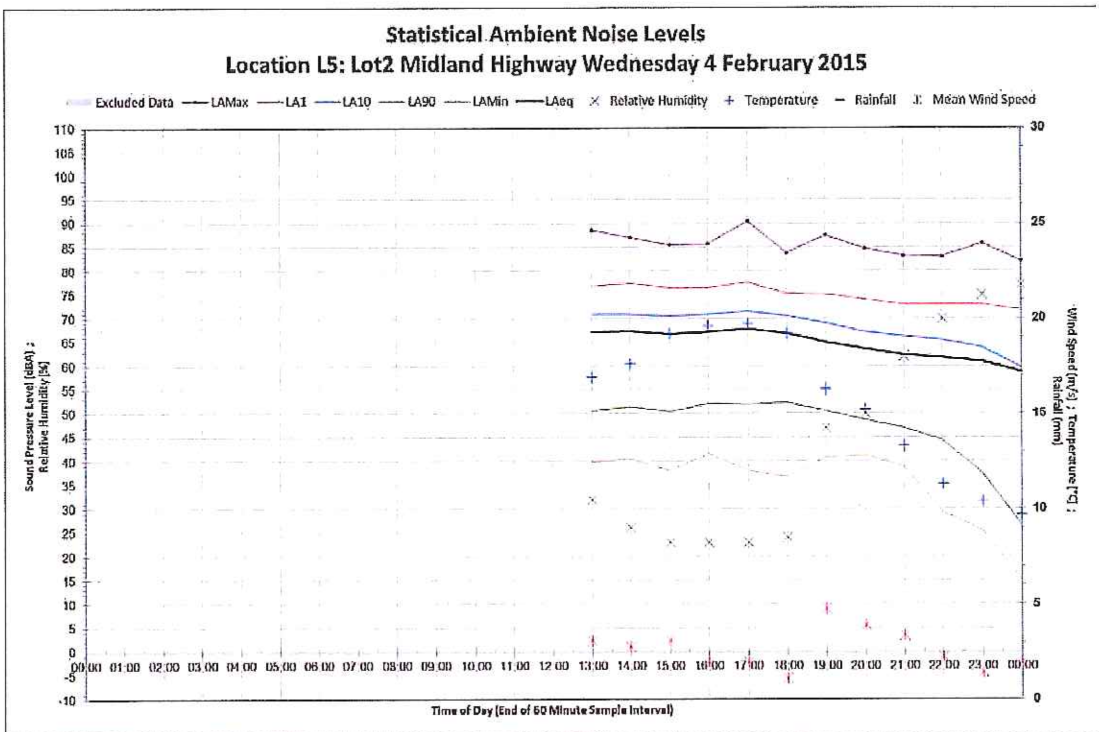

Statistical Ambient Noise Levels
Location L4: 46 Summit Drive Monday 16 February 2015
Excluded Data
LAMax
LA1
LA10
LA90
LAMin
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)

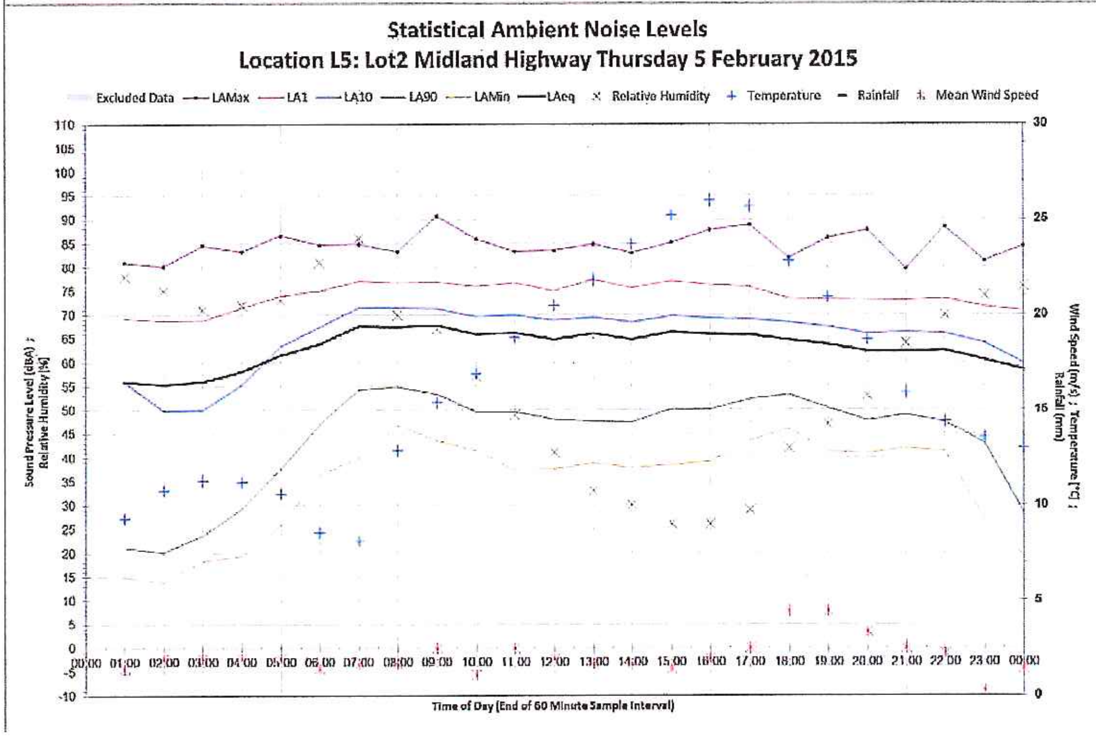
Statistical Ambient Noise Levels
Location L4: 46 Summit Drive Tuesday 17 February 2015

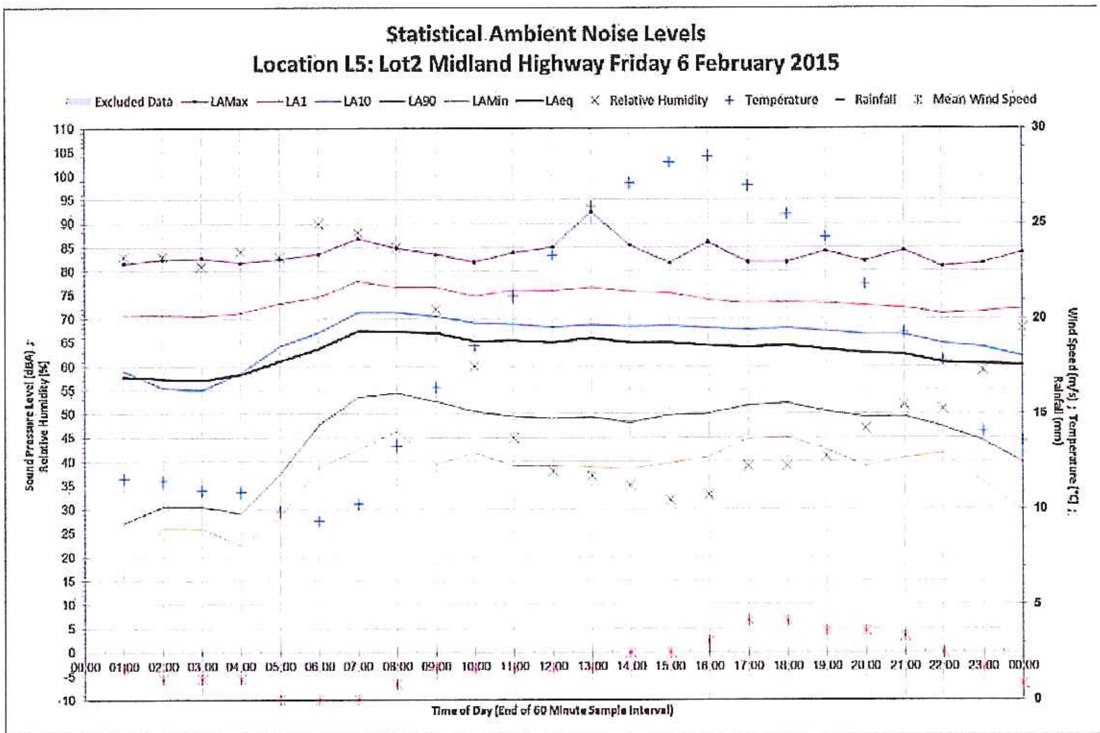


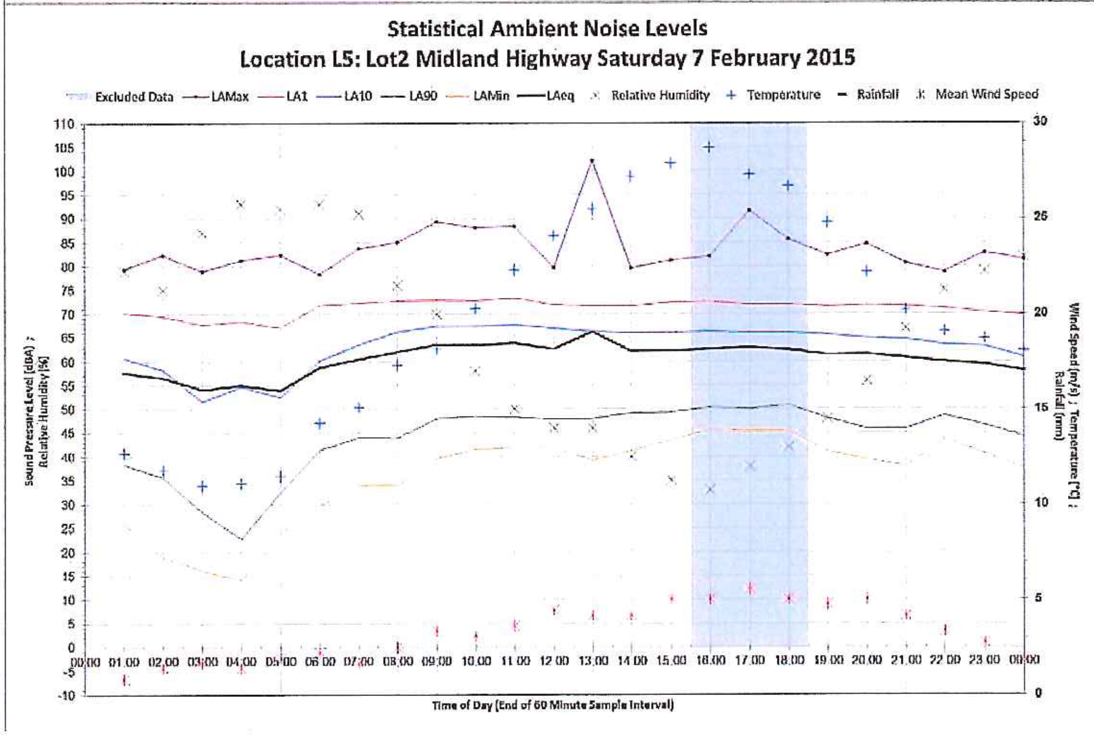
Statistical Ambient Noise Levels
Location L4: 46 Summit Drive Wednesday 18 February 2015

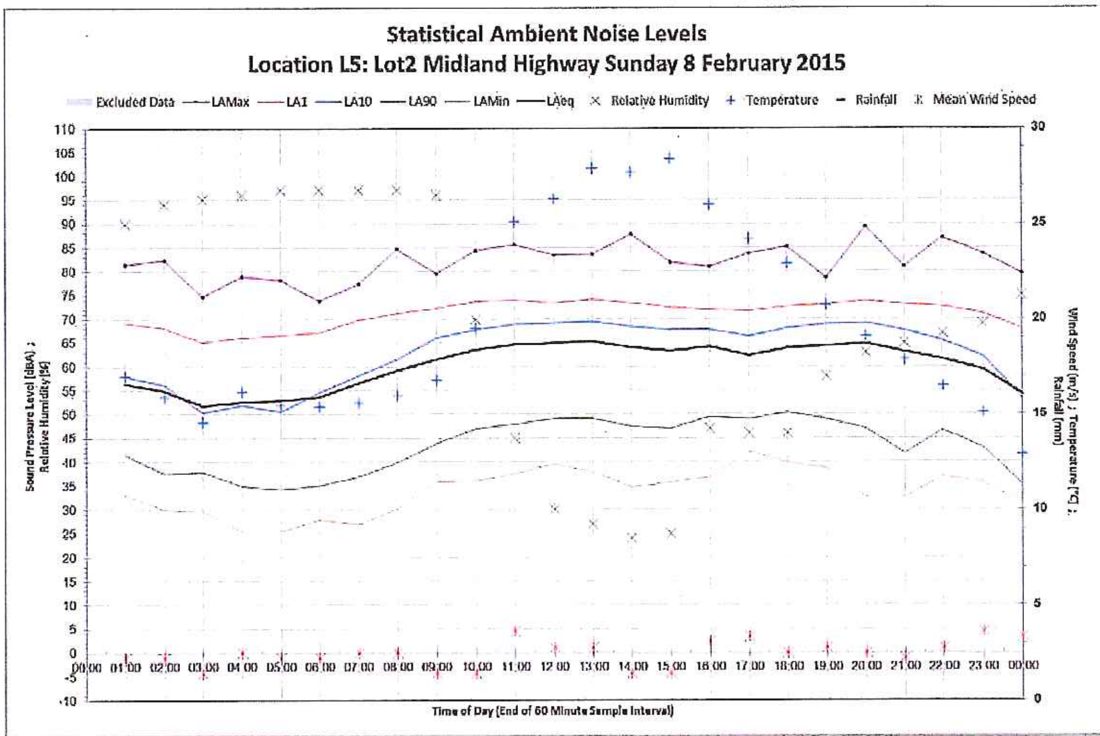


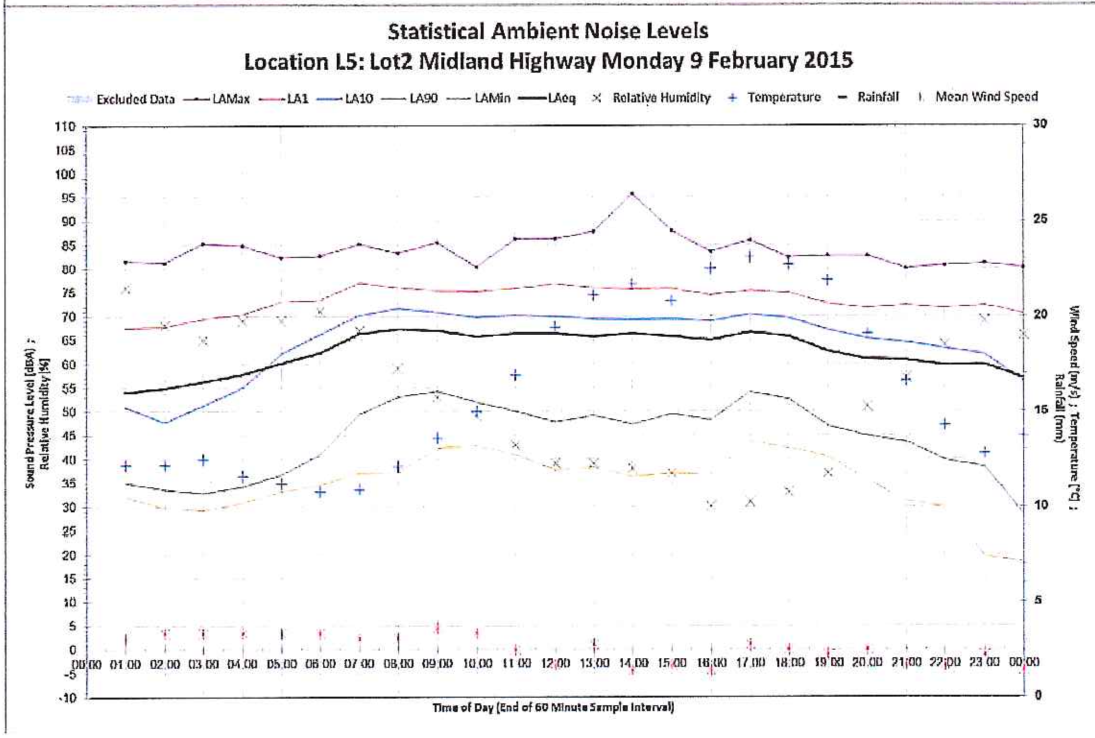

Statistical Ambient Noise Levels
Location L5: Lot2 Midland Highway Wednesday 4 February 2015
Excluded Data
LAMax
LA1
LA10
LA90
LAMin
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity [%]
Wind Speed (m/s) ; Temperature [°C] ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)


Statistical Ambient Noise Levels
Location L5: Lot2 Midland Highway Thursday 5 February 2015
Excluded Data
LAMax
LA1
LA10
LA90
LAMin
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity [%]
Wind Speed (m/s) ; Temperature [°C] ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)

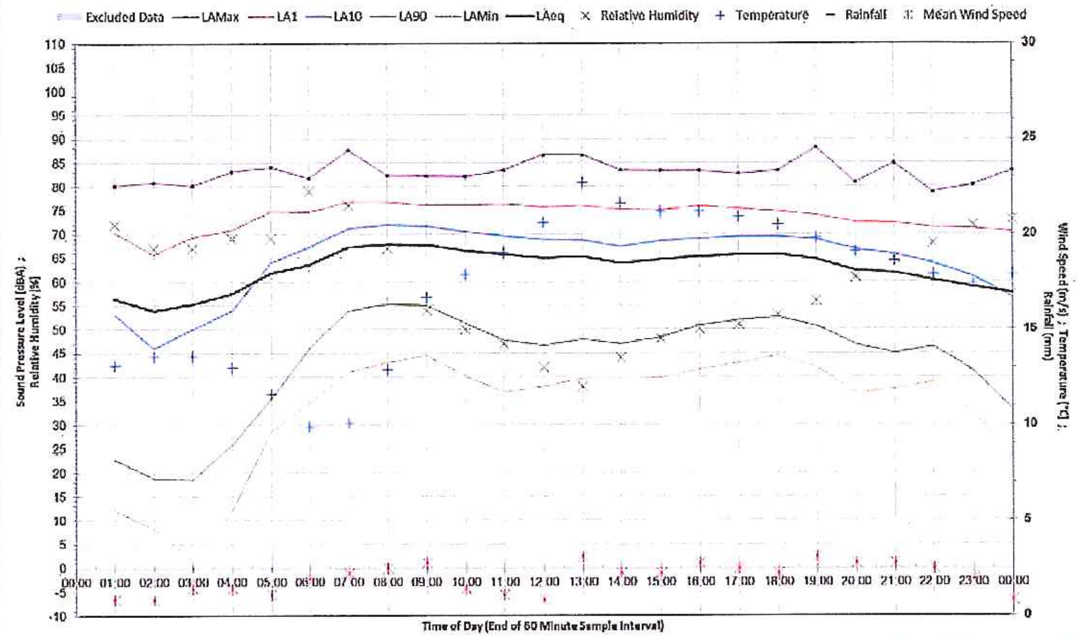

Statistical Ambient Noise Levels
Location L5: Lot2 Midland Highway Friday 6 February 2015
Excluded Data
LAMax
LA1
LA10
LA90
LAMin
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level [dBA] ; Relative Humidity [%]
Wind Speed [m/s] ; Temperature [°C] ; Rainfall [mm]
Time of Day (End of 60 Minute Sample Interval)


Statistical Ambient Noise Levels
Location L5: Lot2 Midland Highway Saturday 7 February 2015
Excluded Data
LAMax
LA1
LA10
LA90
LAMin
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level [dBA] ; Relative Humidity [%]
Wind Speed [m/s] ; Temperature [°C] ; Rainfall [mm]
Time of Day (End of 60 Minute Sample Interval)

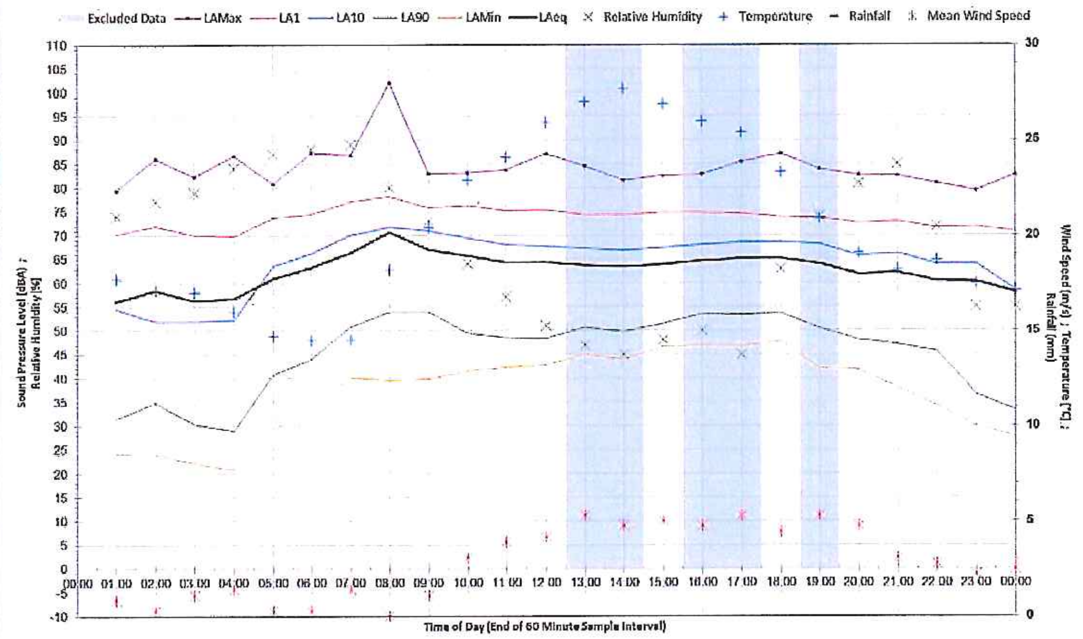

Statistical Ambient Noise Levels
Location L5: Lot2 Midland Highway Sunday 8 February 2015
Excluded Data
LAMax
LA1
LA10
LA90
LAMin
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)

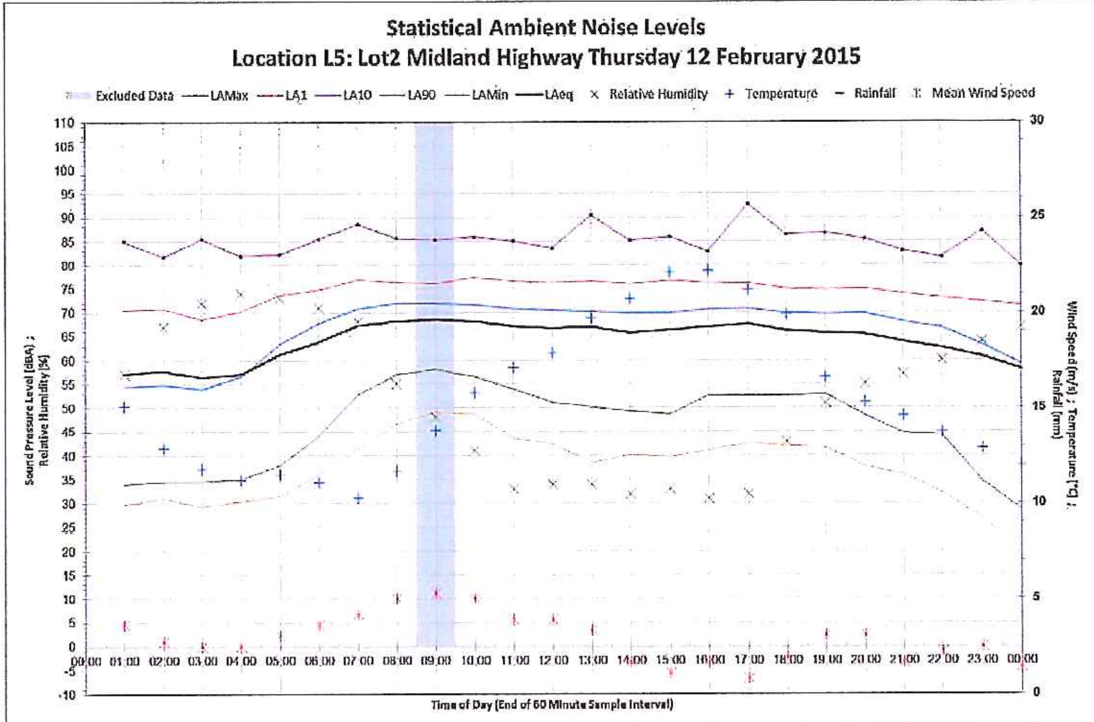

Statistical Ambient Noise Levels
Location L5: Lot2 Midland Highway Monday 9 February 2015
Excluded Data
LAMax
LA1
LA10
LA90
LAMin
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)

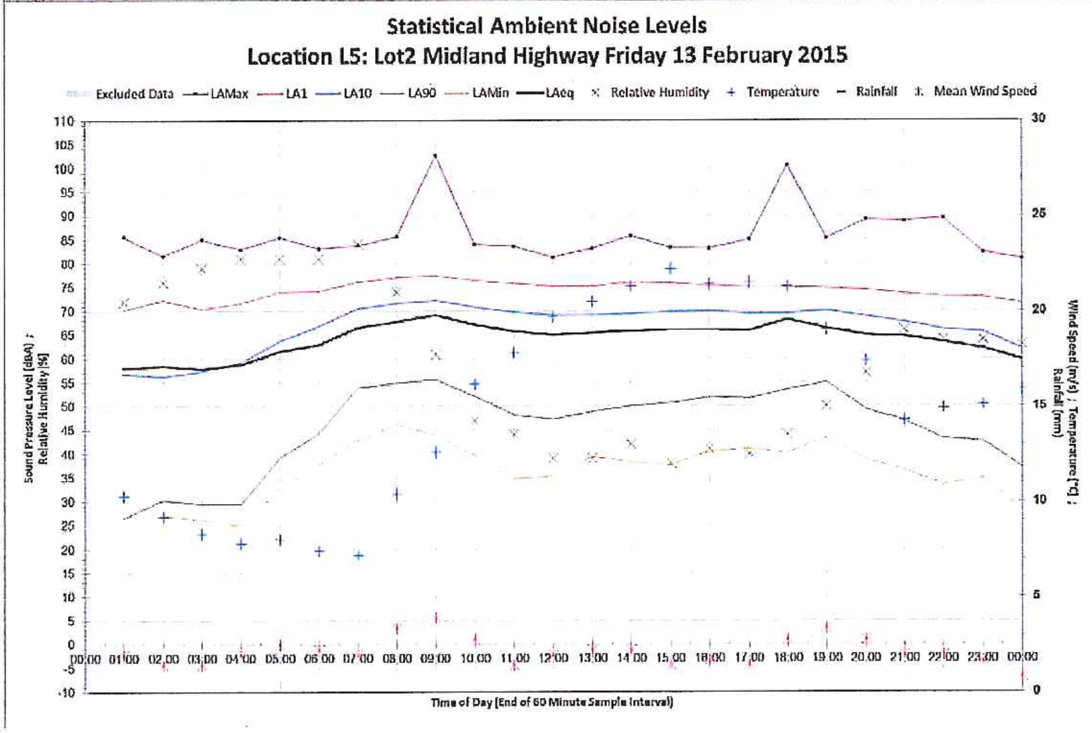
Statistical Ambient Noise Levels
Location L5: Lot2 Midland Highway Tuesday 10 February 2015



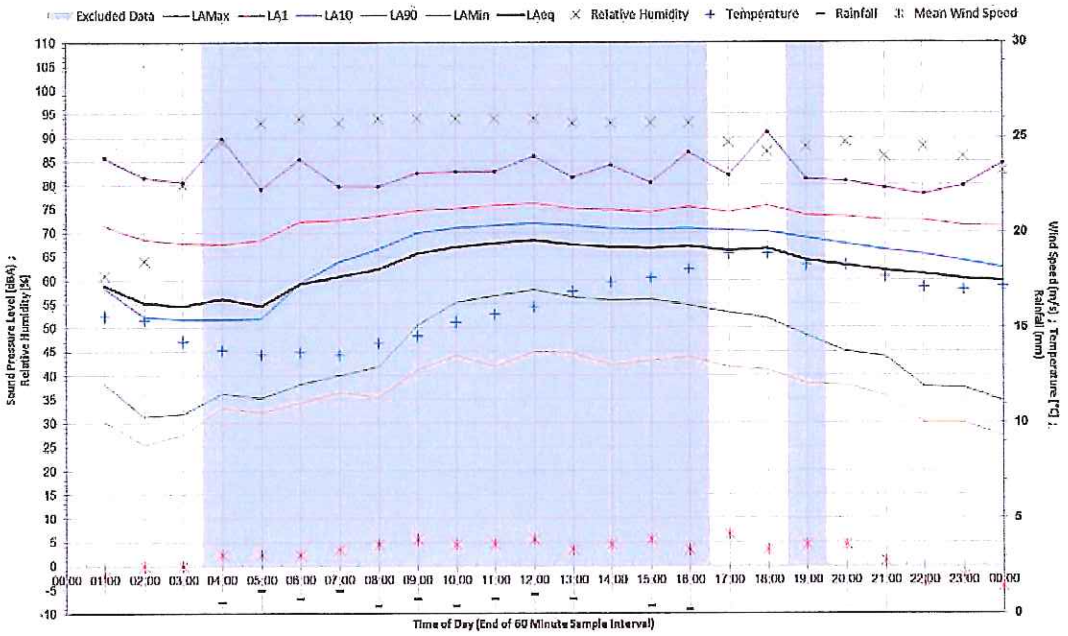
Statistical Ambient Noise Levels
Location L5: Lot2 Midland Highway Wednesday 11 February 2015



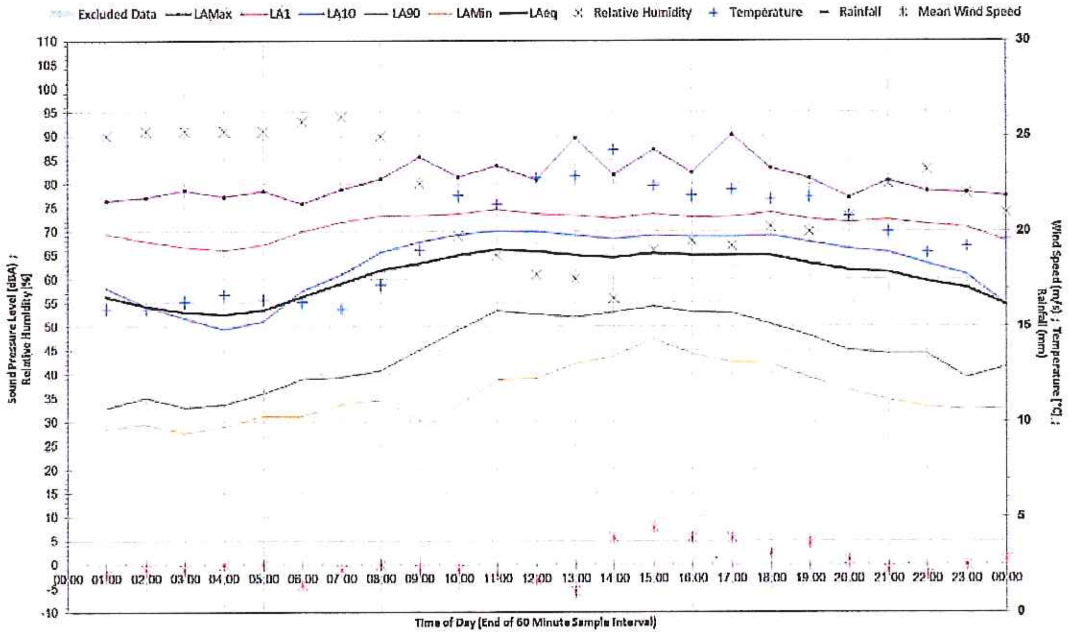

Statistical Ambient Noise Levels
Location L5: Lot2 Midland Highway Thursday 12 February 2015
Excluded Data
LAMax
LA1
LA10
LA90
LAMin
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)


Statistical Ambient Noise Levels
Location L5: Lot2 Midland Highway Friday 13 February 2015
Excluded Data
LAMax
LA1
LA10
LA90
LAMin
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 60 Minute Sample Interval)

Statistical Ambient Noise Levels
Location L5: Lot2 Midland Highway Saturday 14 February 2015



Statistical Ambient Noise Levels
Location L5: Lot2 Midland Highway Sunday 15 February 2015



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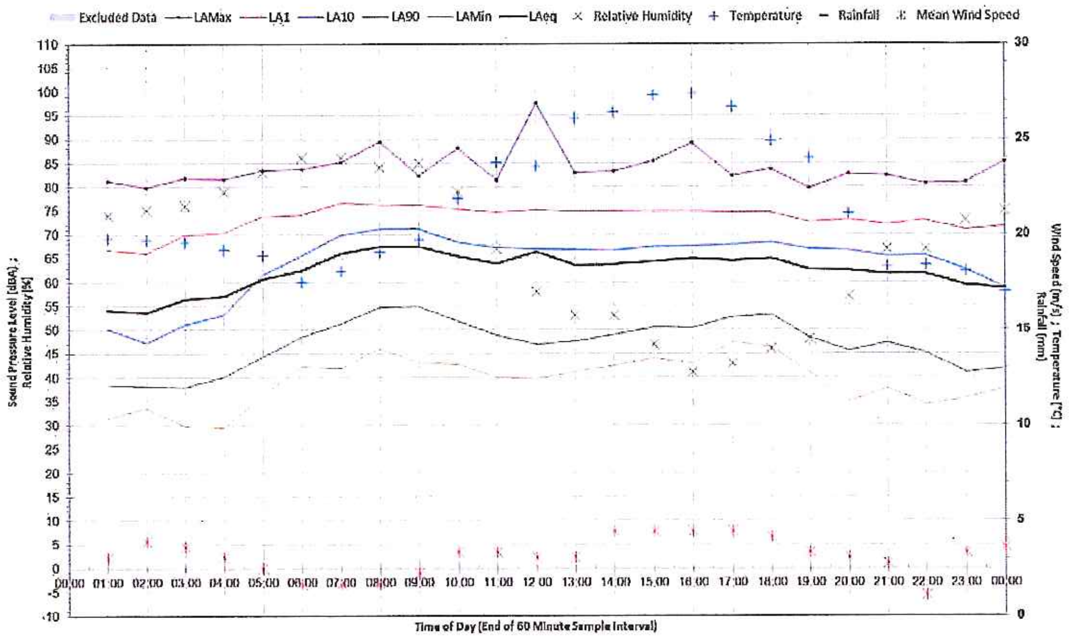

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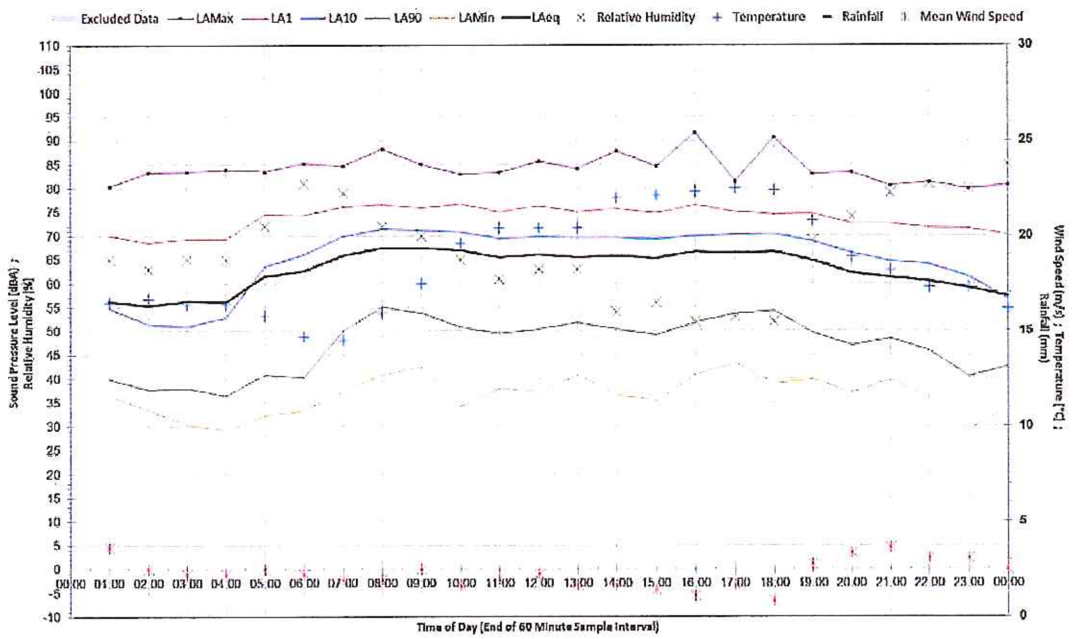

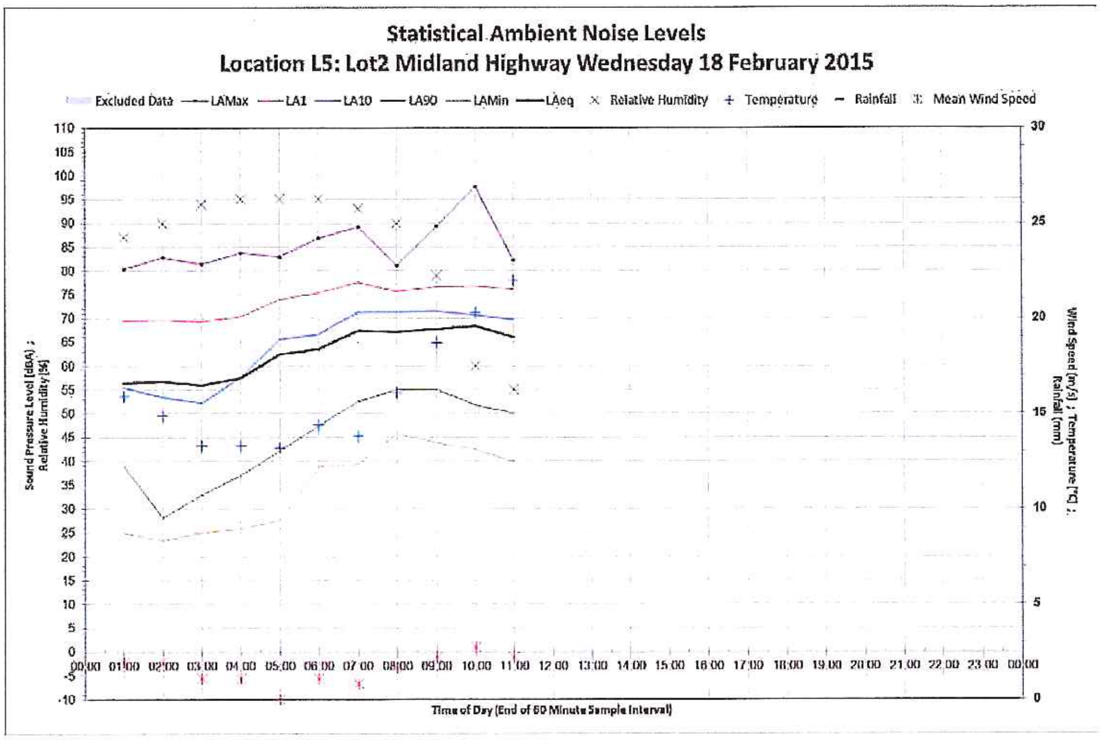
Statistical Ambient Noise Levels
Location L5: Lot2 Midland Highway Wednesday 18 February 2015
Excluded Data — LAMax — LA1 — LA10 — LA90 — LAMin — LAeq × Relative Humidity + Temperature - Rainfall ⁝ Mean Wind Speed
Sound Pressure Level [dBA] ; Relative Humidity [%]
Wind Speed [m/s] ; Temperature [°C] ; Rainfall [mm]
Time of Day (End of 60 Minute Sample Interval)

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Perth to Breadalbane

Ecological Assessment Report

January 2014

Department of Infrastructure
Energy and Resources

Tasmania
Explore the possibilities

Summary

The Department of Infrastructure Energy and Resources (DIER) is investigating an upgrade of the Midland Highway between Perth and Breadalbane in northern Tasmania. The study area of this project is based largely on DIER's 'Perth to Breadalbane' concept design report which was submitted under the 2012 Federal Governments 'Nation Building 2' major transport funding program.

The study area is dominated largely by agricultural land however there are patches of native forest and roadside remnants which support several threatened species. Two small patches (0.2 ha and 0.08 ha) of the threatened forest community *Eucalyptus ovata* forest and woodland are present within the study area however they represent considerably degraded small remnants of this forest type.

Eleven flora species listed under the *Tasmanian Threatened Species Protection Act 1995* (*TSPA* 1995) were identified within the study area:

- *Aphelia gracilis* (slender fanwort)
- *Aphelia pumilio* (dwarf fanwort)
- *Arthropodium strictum* (chocolate lily)
- *Brunonia australis* (blue pincushion)
- *Caesia calliantha* (blue grass lily)
- *Haloragis heterophylla* (variable raspwort)
- *Hypoxis vaginata* (sheathing yellowstar)
- *Siloxerus multiflorus* (small wrinklewort)
- *Tricoryne elatior* (yellow rush lily)
- *Triptilodiscus pygmaeus* (dwarf sunray)
- *Vittadina burbidgeae* (smooth new-holland daisy)

Avoidance of threatened flora sites as much as possible is recommended however it is anticipated that the loss of some known sites will be unavoidable. This will trigger the requirement for a permit application under the *TSPA 1995.*

Important habitat for three state and/or federally (*EPBCA 1999*) listed fauna species were identified within the study area

- *Litoria raniformis* (green and gold frog)
- *Perameles gunnii gunnii* (eastern barred bandicoot)
- *Tyto novaehollandiae castanops* (masked owl)

Avoidance of threatened fauna habitat is also recommended and this should largely be achievable for all three species identified. Potential significant threats to green and gold frog and the eastern barred bandicoot include the construction of barriers which prevent dispersal (batter slopes and inaccessible culverts) and well as increased roadkill (wider road pavement and increased speeds). A detailed assessment of whether or not the project would trigger a referral under the EPBC Act may be required. It seems likely however that significant impacts to these species could be avoided through habitat avoidance and appropriate mitigation measures.

There are considerable infestations of weeds throughout the study area including various declared and environmental weeds. Weed management should be a major environmental consideration under this project.

Contents

Appendices

Tables

Acknowledgments

Report preparation: Tim Leaman (DIER)
Fieldwork: Tim Leaman and Anne Woolford (FPA)
Mapping: Tim Leaman
Photographs: Tim Leaman

Thanks to Richard Schahinger (Botanist – DPIPWE) for advice on threatened flora, survey times and species identification.

Disclaimer

The information provided in this report is prepared by the author and intended for use by the Department of Infrastructure Energy & Resources. Whilst all endeavours have been made to ensure that the information provided is accurate this does not guarantee that the material is free of error. As such the author will not be liable for any error, omission or otherwise. However, should any error or omission be notified, the author will use his best endeavours to correct the material and update this report.

Citation

This report should be cited as Department of Infrastructure, Energy & Resources (2014) 'Perth to Breadalbane Ecological Assessment Report', Department of Infrastructure, Energy & Resources, Hobart.

Cover Photos

Left – *Litoria raniformis* (Green & Gold Frog), Right – *Triptilodiscus pygmaeus* (dwarf sunray). Photographs by Tim Leaman.

1. Introduction

The Department of Infrastructure, Energy and Resources (DIER) is investigating an upgrade of the Midland Highway between Perth and Breadalbane in northern Tasmania. In 2012 DIER commissioned preliminary concept and design services for duplication of this section, which formed the basis of its submission under the previous Federal Government *'Nation Building 2'* (NB2) major transport funding program.

Perth to Breadalbane is a key section of the Midland Highway, Tasmania's major north-south transport corridor and a key link in Tasmania's National Network. The highway is both a critical freight connection, facilitating access from the Southern region to the State's northern ports and the major transport link for passengers travelling between the northern and southern regions.

The precise details of the works that may be required in the Perth to Breadalbane section is not known at this stage, however they are likely to be developed in conjunction with other highway upgrades in the region (including the possible south and north bypasses of Perth). For the purposes of this report all investigations relate to the 'Perth to Breadalbane study area' as identified below in Figure 1.

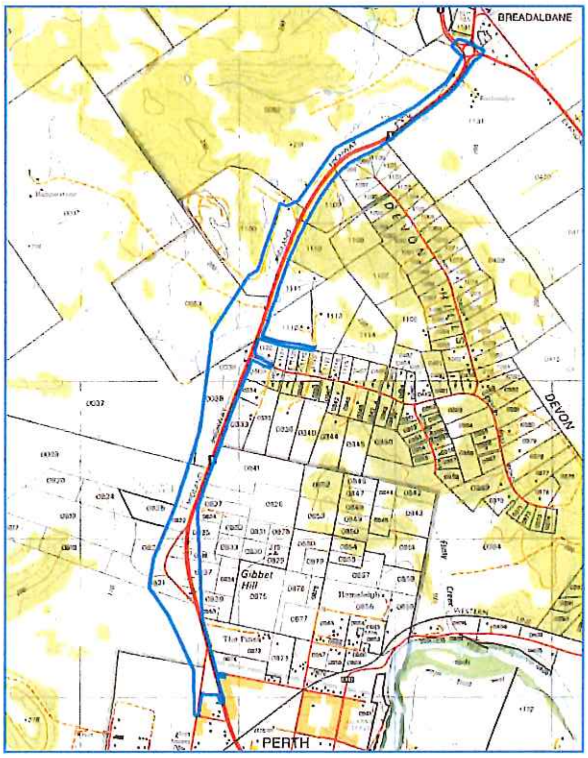

Figure 1 – Perth to Breadalbane study area

2. Methods

The study area was inspected on foot by the author on three separate occasions including 15th-16th October 2013, 11th-13th November 2013 and 10th-11th January 2014. These surveys times were designed to give an appropriate coverage of the survey area and to coincide with the peak flowering times for ephemeral flowering and native grass species. These surveys are considered a practicable account of the values which exist on site. (It should be acknowledged however that these surveys represent a single spring/summer flowering season and that the presence and/or abundance of certain species can fluctuate significantly between years).

All vascular plant species within the survey area were identified according to Buchanan (2012) with vegetation communities classified according to Harris & Kitchener (2005). Positional localities of all threatened species were recorded using a Garmin Etrex Legend HCx GPS to an accuracy of +/- 10 m. The distribution and extent of weeds within the survey area were established using a combination of on ground surveys and aerial photography, however the knowledge obtained from these surveys with regard to weeds should not be considered exhaustive.

Habitat for threatened fauna was documented according to the habitat descriptions provided on the Biodiversity Values Database (FPA, 2013) and based on known threatened fauna species within 5 km of the study area as recorded on the Natural Values Atlas.

A background review of various reports and database records was conducted prior to conducting the field work. This included interrogation on the Natural Values Atlas, TASVEG mapping layers, geology mapping and other reports including Brown (2000), Gill (2002), Howard (2000) and Hogue (2003).

3. Results

3.1 Vegetation

[Refer to Appendix 2 for the mapped locations of vegetation communities]

Agricultural Land (FAG)

Vegetation within the study area is dominated by agricultural land (FAG) with scattered occurrences of eucalypt paddock trees. These agricultural lands are used primarily for stock grazing (including sheep, cows and horses) and are in varying degrees of floristic 'nativeness' depending on their history of cultivation and/or fertiliser application. Most of the agricultural land is domainted by introduced pasture species although there are some drier sections (particularly around Gibbet Hill) which have a higher representation of native grass species (*Austrodanthonia* sp, *Austrostipa* sp and *Themeda triandra*). These areas could possibly be classified as Lowland Grassland Complex (GCL) however they are particularly small in size (<0.1 ha) and as such have been subsumed into the greater FAG community. The true conservation significance of these small areas is displayed by the relatively high numbers of threatened species they support, which is discussed in more detail under '3.2 Threatened Flora Species'.

Agricultural Land (FAG) containing scattered eucalypt paddock trees

Acacia dealbata forest (NAD)

Some sections of the study area support sparsely wooded *Acacia dealbata* forest. Historically these areas would have been heavily disturbed for timber extraction and are likely to have regenerated following incomplete attempts to clear the land for grazing. Prior to clearing these areas probably supported *Eucalyptus amygdalina* forest on dolerite. The largest consolidated example of NAD is currently managed for cattle grazing by the owners of Digga Excavations however despite the pressures of grazing these areas maintain a healthy representation of native flora including multiple threatened species such as *Arthropodium strictum, Caesia calliantha, Hypoxis vaginata* and *Triptilodiscus pygmaeus*. A key threat to this forest community is the existing low density scattering of gorse (*Ulex europaeus*) plants throughout which have the potential to dominate and displace other native flora over time.

***Acacia dealbata* forest (NAD) with grassy understorey**

Eucalyptus amygdalina forest on dolerite (DAD)

Areas of eucalypt forest dominated by E. amygdalina (black peppermint) within the study area are classified as the TASVEG unit DAD or '*Eucalyptus amygdalina* forest on dolerite'. Examples of this forest type which are present are relatively intact however areas to the east of the existing highway alignment are particularly infested within gorse. Threatened species supported by this forst type at this location include *Arthropodium strictum, Brunonia australis, Caesia calliantha* and *Hypoxis vaginata.*

***Eucalyptus amygdalina* forest and woodland on dolerite (DAD)**

Eucalyptus viminalis forest and woodland (DVG)

A narrow band of this *E. viminalis* (white gum) dominated forest occurs in the eastern extent of the study area opposite the entrance to the Digga Excavations/Island Block & Paving entrance. This community contains a healthy number of mature trees with native shrubs, grasses and herbs however it is significantly affected by the presence of gorse. Some threatened flora were recorded from this forest community including *Arthropodium strictum, Caesia calliantha* and *Haloragis heterophylla.*

***Eucalyptus viminalis* forest and woodland (DVG)**

Eucalyptus ovata forest and woodland (DOV)

Two small patches of this forest community are present in the southern end of the study area. These areas are small remnants associated with an unnamed tributary of the Esk River and are completely surrounded by agricultural land. Although DOV is recognised as a threatened forest community under *the Nature Conservation Act 2002*, these particular patches are highly degraded with gorse and cattle and are of very minimal conservation value.

***Eucalyptus ovata* forest and woodland (DOV)**

Table 1. Conservation status of vegetation communities

Vegetation Community	Area present (ha)	Tasmanian Status	National Status
Eucalyptus amygdalina forest on dolerite **DAD**	2.4	Not listed	Not listed
Eucalyptus viminalis forest and woodland **DVG**	1.1	Not listed	Not listed
Eucalyptus ovata forest and woodland **DOV**	0.3	Endangered	Not listed
Agricultural Land **FAG**	66.8	Not listed	Not listed
Extra-urban Miscellaneous **FUM**	1.0	Not listed	Not listed
Acacia dealbata forest **NAD**	7.0	Not listed	Not listed

3.2 Threatened Flora

141 vascular plant species were recorded within the study area (Appendix 1).

Eleven threatened flora species were recorded from within the study area (Table 2). Two of these species (*Tricoryne elatior* and *Triptilodiscus pygmaeus*) are recognised as 'vulnerable' under the Tasmanian *Threatened Species Protection Act 1995* whilst the remaining nine species (*Aphelia gracilis, Aphelia pumilio, Arthropodium stictum, Brunonia australis, Caesia calliantha, Haloragis heterohpylla, Hypoxis vaginata, Siloxerus multiflorus* and *Vittadinia burbidgeae*) are recognised as 'rare'.

Table 2 identifies all threatened flora which have been recorded historically within proximity (5 km) of the study area (including additional species that were identified during these investigations).

The locations of all recorded threatened flora relative to the study area are shown in Appendix 3.

Table 2. Threatened flora known within 5 km of the study area

Species	Status TSPA/EPBCA	Observed within study area	Habitat and Observations
Alternanthera denticulata lesser joyweed	Endangered/-	No	Rocky (dolerite) river margins, disturbed *Melaleuca ericifolia* (paperbark) swamp forest and damp, riparian grasslands. No habitat present within the study area.
Aphelia pumilio dwarf fanwort	Rare/-	**Yes**	Damp conditions, dry open grassland (Themeda) and *Eucalyptus viminalis/Eucalyptus amygdalina* dry sclerophyll forest.
Arthropodium strictum chocolate lily	Rare/-	**Yes**	Open forest and grasslands, often on dry hillsides.
Asperula subsimplex water woodruff	Rare/-	No	Damp areas, marshy places and riverbanks.
Austrostipa nodosa knotty speargrass	Rare/-	No	Eastern half of the State in grassland or open forest. Species not observed – collected speargrass specimens keyed out to *A. pubinodis* and *A.stuposa*.
Bolboschoenus caldwellii sea clubsedge	Rare/-	No	Widespread in shallow, standing, sometimes brackish water, rooted in heavy black mud.
Brunonia australis blue pincushion	Rare/-	**Yes**	Grassy woodlands and dry sclerophyll forests dominated by black peppermint (*Eucalyptus*

			amygdalina) or less commonly white gum (*Eucalyptus viminalis*) or stringybark (*Eucalyptus obliqua*)
Caesia calliantha blue grasslily	Rare/-	**Yes**	Throughout the Midlands in grassland or grassy woodland habitat and has also been recorded from grassy roadsides
Caladenia filamentosa daddy longlegs	Rare/-	No	Lowland heathy and sedgy open eucalypt forest and woodland on sandy soils.
Callitriche umbonata winged waterstarwort	Rare/-	No	Semi-aquatic species recorded from grassy wetlands, soaks in Eucalyptus forest and amongst rocks along stream banks around the Midlands.
Dianella amoena grassland flaxlily	Rare/-	No	Occurs mainly in the Midlands, where it grows in native grasslands and grassy woodlands.
Discaria pubescens spiky anchorplant	Rare/Endangered	No	Grassy banks/roadsides, sandy or gravelly soil in basalt talus slopes and clefts amongst fractured dolerite rocks and flood channels.
Gyrostemon thesioides broom wheelfruit	Endangered/-	No	Allocasuarina forest in the north and east of the State.
Haloragis heterophylla variable raspwort	Rare/-	**Yes**	Damp Themeda grassland and grassy woodland in the Midlands and across to the East Coast
Hypoxis vaginata var. vaginata sheathing yellowstar	Rare/-	**Yes**	Found in the midlands and the north of the State where the plant grows in unimproved pastures and swampy or poorly drained situations
Isoetes elatior tall quillwort	Rare/-	No	Occurs at low altitude with its roots in gravel or silt substrate in moderate to swiftly flowing waters. In calmer waters, it grows in mud or silt.
Juncus amabilis gentle rush	Rare/-	No	Moist situations, generally areas of seepage confined to roadsides.
Juncus prismatocarpus branching rush	Rare/-	No	Found occasionally in swampy places in various places in the State, including Maria Island
Lobelia pratioides poison lobelia	Rare/-	No	The species grows in seasonally inundated to waterlogged soils at the margins of swamps, wetlands and drainage lines, and also in damp depressions within grassland and grassy woodland.
Lythrum salicaria purple loosestrife	Vulnerable/-	No	Swamps, stream banks and rivers mainly in the north and north-east of the State. It can also occur between gaps in Melaleuca ericifolia forest.
Muehlenbeckia axillaris	Vulnerable/-	No	Moist gravely or rocky places on the Central Plateau, extending out to the west, north-west

matted lignum			and lower reaches of the south Esk River.
Myriophyllum integrifolium tiny watermilfoil	Rare/-	No	It grows at the margins of wetlands and in seasonally wet places, including depressions associated with gilgai features
Persicaria decipiens slenderwaterpepper	Vulnerable/-	No	Occurs on the banks of rivers and streams, mostly in the north of the State, including King Island. The species may colonise farm dams
Pilularia novaehollandiae austral pillwort	Vulnerable/-	No	Aquatic or semi-aquatic plant occurs mainly in the central to northern parts of the State, in the mud or silt of shallow rivers and on the seasonally inundated margins of creeks and rivers
Pterostylis ziegeleri grassland greenhood	Rare/-	No	In coastal areas, the species occurs on the slopes of low stabilised sand dunes and in grassy dune swales, while in the Midlands it grows in native grassland or grassy woodland on well-drained clay loams derived from basalt.
Pultenaea prostrata silky bushpea	Vulnerable/Vulnerable	No	Recorded from the Northern and Southern Midlands, where it grows within grassy woodlands or grasslands, mostly on Tertiary basalt or Quaternary alluvium.
Ranunculus pumilio var. pumilio ferny buttercup	Vulnerable/-	No	Occurs mostly in wet places from sea level to altitudes of 800-900 metres
Rumex bidens mud dock	Rare/-	No	The species grows at the margins of lakes, swamps, and slow-moving rivers and streams, and may also occur in drainage channels
Tricoryne elatior yellow rushlily	Rare/-	**Yes**	Grasslands, heaths and open woodland near the coast and inland to approximately 1000 metres altitude in the north-east, the Midlands and the East Coast
Triptilodiscus pygmaeus dwarf sunray	Vulnerable/-	**Yes**	Grasslands, grassy woodlands or rockplates, the underlying substrate being mostly Tertiary basalt or Jurassic dolerite.
Vittadinia burbidgeae smooth new-holland-daisy	Vulnerable/-	**Yes**	Grasslands and grassy woodlands of the midlands and northern midlands.
Vittadinia cuneata var. cuneata fuzzy new-holland-daisy	Rare/-	No	Occurs in areas of low precipitation on both fertile and infertile soils. Predominantly found in dry sclerophyll forest around Hobart, into the midlands and extending up into the north-east. Not observed within study area. All specimens observed to be hairless and attributed to *V.burbidgeae* (Gray & Rozefelds, 2005).
Additional threatened flora not previously recorded within 5 km			

Aphelia gracilis slender fanwort	Rare/-	Yes	Damp, sandy ground and wet places in the Midlands and north-east of the State
Siloxerus multiflorus small wrinklewort	Rare/-	Yes	Found in the north and north-east of the State, on rocks at river mouths, in coastal areas and inland dry forests

Aphelia gracilis (slender fanwort) TSPA: Rare

Aphelia gracilis occurs in poorly drained sites within grasslands and grassy woodlands. Typically it occupies open depressions and soaks which are periodically inundated. Species can be recorded in high numbers where suitable habitat exists. Approximately 520 plants were identified within the study area with the majority of these being attributed to the most southerly occurrence (approx. 500 plants). A permit to 'take' this species may be required.

Aphelia gracilis **(left) and typical habitat (right)**

Aphelia pumilio (dwarf fanwort) TSPA: Rare

Aphelia pumilio occupies periodically moist locations within grasslands and grassy woodlands and can co-occur with *A.gracilis*. Approximately 200 plants were observed across 5 separate locations immediately adjacent to the study area growing on rock plates and depressions with a high degree of surface rock cover. No immediate impacts to these sites are anticipated.

Aphelia pumilio **(left) and typical habitat (right)**

Arthropodium strictum (chocolate lily) TSPA: Rare

Arthropodium strictum is a colourful and aromatic spring/summer flowering lily which occurs in grassy forests, native grasslands and some roadsides and pasture areas supporting a mix of native and introduced species. The species was found at various locations throughout the study area and was at times present in high numbers (10 plants/m^2 or more). The footprint of this project is expected to impact some known sites of this species, therefore it is anticipated that a permit to 'take' will be required.

Arthropodium strictum **(left) example of roadside habitat (right)**

Brunonia australis (blue pincushion) TSPA: Rare

Brunonia australis occurs in dry grassy forests and woodlands and was recorded within the study area growing in grassy *E. amygdalina* (black peppermint) forest on dolerite. A total of approximately 300 plants were observed in a narrow band of forest east of the existing highway opposite the entrance to Digga Excavations/Island Block & Paving. Any widening of the highway on the eastern side in this section would likely take out the majority of these plants so this should be given some careful consideration. A permit to 'take' this species may be required.

Brunonia australis **(left) and its grassy woodland habitat (right)**

Caesia calliantha (blue grass lilly) TSPA: Rare

Caesia calliantha is a colourful spring/summer flowering lily which occurs in grasslands, grassy woodlands and roadsides. The species was observed in low numbers during spring but then peaked in early January within approximately 220 individual recorded throughout the study area. A permit to 'take' this species may be required.

Caesia calliantha **(blue grass lilly)**

Haloragis heterophylla (variable raspwort) TSPA: Rare

Haloragis heterophylla is found in damp grassland and grassy woodland and roadsides. It was recorded from a roadside and from grassy forest within the study area. The growth form of the plant (tangled and sprawling) makes scoring numbers of this plant difficult, however it is approximated that roughly 250 plants occur within the study area. A permit to 'take' this species may be required.

Haloragis heterophylla **(variable raspwort)**