Ellerton Drive Extension

Noise and Vibration Assessment

Operation and Construction

Report Number 670.10568-R1

13 February 2017

Opus International Consultants (NSW) Pty Ltd
PO Box 42
DICKSON ACT 2602

Version: Revision 8

Ellerton Drive Extension

Noise and Vibration Assessment

Operation and Construction

PREPARED BY:

SLR Consulting Australia Pty Ltd
ABN 29 001 584 612
GPO Box 410
Canberra ACT 2600 Australia

T: +61 2 6287 0800 F: +61 2 6287 0801
canberra@slrconsulting.com www.slrconsulting.com

DOCUMENT CONTROL

Reference	Status	Date	Prepared	Checked	Authorised
670.10568-R1	Revision 8	13 February 2017	Matthew Bryce / Zhang Lai	David Lindsey	Matthew Bryce
670.10568-R1	Revision 7	25 January 2017	Matthew Bryce / Zhang Lai	David Lindsey	Matthew Bryce
670.10568-R1	Revision 6	27 April 2016	Matthew Bryce / Zhang Lai	David Lindsey	Matthew Bryce
670.10568-R1	Revision 5	21 April 2016	Matthew Bryce / Zhang Lai	David Lindsey	Matthew Bryce
670.10568-R1	Revision 4	13 February 2015	Zhang Lai	David Lindsey	Jamie Hladky
670.10568-R1	Revision 3	12 February 2015	Zhang Lai	David Lindsey	Jamie Hladky
670.10568-R1	Revision 2	18 December 2014	Zhang Lai	David Lindsey	Jamie Hladky
670.10568-R1	Revision 1	9 December 2014	Zhang Lai	David Lindsey	Jamie Hladky

Executive Summary

Queanbeyan Palerang Regional Council (QPRC) proposes to construct a four kilometre (km) extension of Ellerton Drive, Queanbeyan, from the existing Ellerton Drive at East Queanbeyan to Old Cooma Road and Edwin Land Parkway at Karabar, in Queanbeyan, New South Wales. A total project length of 4.69 km includes upgrade works to a portion of existing Ellerton Drive.

The existing Ellerton Drive alignment connects to Yass Road and Bungendore Street at a roundabout and terminates approximately 850 m southeast of this roundabout. The proposal is to extend Ellerton Drive from its current terminus to the existing Old Cooma Road and Edwin Land Parkway intersection, forming the "fourth leg" of that intersection.

SLR Consulting Australia Pty Ltd (SLR) was engaged by Opus International Consultants (NSW) Pty Ltd (Opus) to conduct a noise impact assessment for the proposed Ellerton Drive Extension (EDE). The assessment was required as part of the design and documentation processes undertaken by Opus. The objective of SLR's engagement was to assess potential noise and vibration emissions associated with the construction and operation of the proposed extension.

All of the potentially affected noise sensitive receptors were identified and grouped into eight (8) "Noise Catchment Areas" (NCA's). Between March and April 2014, SLR conducted ambient noise monitoring at 11 locations within those NCA's to determine the pre-project ambient noise environment. In addition, concurrent traffic counts were also conducted at the existing Edwin Land Parkway and Old Cooma Road intersection to assist with validation of the road traffic noise model.

OPERATIONAL NOISE CRITERIA

Upon completion of the proposed Ellerton Drive extension, the entire Ellerton Drive would be considered a sub-arterial road. The New South Wales (NSW) *Road Noise Policy* (RNP) assessment criteria applicable for this project were determined to be:

Road Category	Type of Project/Land Use	Assessment Criteria, dBA	
		Daytime (7 am – 10 pm)	**Night-time (10 pm – 7 am)**
Freeway / arterial / sub-arterial roads	Existing residences affected by noise from new freeway/arterial/sub-arterial road corridors	$L_{Aeq(15hour)}$ 55 (external)	$L_{Aeq(9hour)}$ 50 (external)

In addition to the noise criteria above, the RNP describes a "Relative Increase" criterion of 12 dBA above the level of existing traffic noise. This criterion is primarily intended to protect existing quiet areas from excessive changes in amenity. The 2014 noise monitoring indicated that ambient noise levels at many of the existing residences in the vicinity of the EDE were not influenced by significant contributions from road traffic noise. Therefore, the "Relative Increase" criterion was also considered.

ROAD TRAFFIC NOISE MODELLING

Validation of the road traffic noise model was performed based on noise monitoring conducted at the Edwin Land Parkway road reserve and 12 Alfred Place, Karabar. The difference between the model-predicted noise levels and the measured noise levels were within ±2 dB. Consequently, in accordance with the NSW *Environmental Noise Management Manual* (ENMM), it was determined that the road traffic noise model provided results which enable a reliable assessment of the project.

The modelled traffic speed was 60 km/h from the existing section of Ellerton Drive to approximately Ch1200 and 80 km/h from Ch1200 onwards to the Old Cooma Road intersection.

The 'build' and 'no build' operational scenarios were assessed for two timeframes; within one year of the project opening (currently projects as 2019) and for the design year 10 years post-opening.

Executive Summary

OPERATIONAL ROAD TRAFFIC NOISE ASSESSMENT FINDINGS

The predicted road traffic noise levels exceeded the RNP noise criteria at many receptors and consequently noise mitigation was considered. A detailed analysis of noise mitigation options and combinations was undertaken to assist with determining the most "reasonable and feasible" noise mitigation treatments. The recommended noise mitigation treatments are described in the following table and displayed in **Appendix O**. In addition, further noise reduction by way of a low-noise pavement surface, Stone Mastic Asphalt (SMA) was recommended for the entire route.

Area	Barrier Height, m	Barrier Length[1], m	Barrier Type	Wall Location
NCA1	3.0	333	Concrete	Property Boundary
	3.6	177	Concrete	
NCA2	2.4	210[2]	Concrete	Property Boundary
	2.4	116[3]	Concrete	
NCA3	2.4	478	Timber Infill	Outside Shared Pathway
NCA4	2.4	297	Timber Infill	Property Boundary
NCA5	2.4	91	Timber Infill	Outside Shared Pathway
NCA6	n/a	n/a	n/a	n/a
NCA7	4.2	332	Concrete	Road Shoulder outside Kerb
	2.4	55	TBA	Southeast side of bridge
NCA8(A)	4.2	497	Concrete	Outside Shared Pathway
NCA8(B)	4.2	552	Concrete	Outside Shared Pathway

1. Approximate
2. West of Tennyson Drive
3. East of Tennyson Drive

Road traffic noise levels at 43 properties (59 floors) were predicted to remain above the RNP guideline noise limits after the implementation of the selected noise mitigation treatments. Those properties are detailed in **Table 15** in **Section 4.6.2**.

A procedure for determining the extent of building treatments has also been described and it is expected that the provision of alternative ventilation (assuming that windows are closed) would be sufficient in many cases.

CONSTRUCTION NOISE

Noise associated with construction activities was considered with regard to the NSW *Interim Construction Noise Guidelines* (ICNG).

Based on the likely construction stages, activities and plant/equipment, it was found that predicted construction noise levels would exceed the project construction Noise Management Levels by a significant margin, but would not exceed the 'Highly Noise Affected' limit of 75 dBA $L_{Aeq(15minute)}$. It is common for such outcomes to occur during construction programs, particularly in areas of relatively low ambient noise.

It is recommended that a range of mitigation measures be implemented as part of a Construction Noise Management Plan, to assist in reducing construction noise emissions.

Executive Summary

CONSTRUCTION AND OPERATIONAL VIBRATION

Recommended safe working distances for vibration generating plant have been provided to assist in identifying and managing potential ground vibration levels and minimise the potential risk of structural (cosmetic) damage to the residences and adverse response reactions by occupants.

Vibration emissions associated with vehicles on the EDE once operational would not be expected to generate significant levels of vibration when observed at nearby sensitive receptors. Consequently, no further consideration of operational vibration will be required.

Table of Contents

Table of Contents

TABLES

FIGURES

APPENDICES

Table of Contents

1 INTRODUCTION

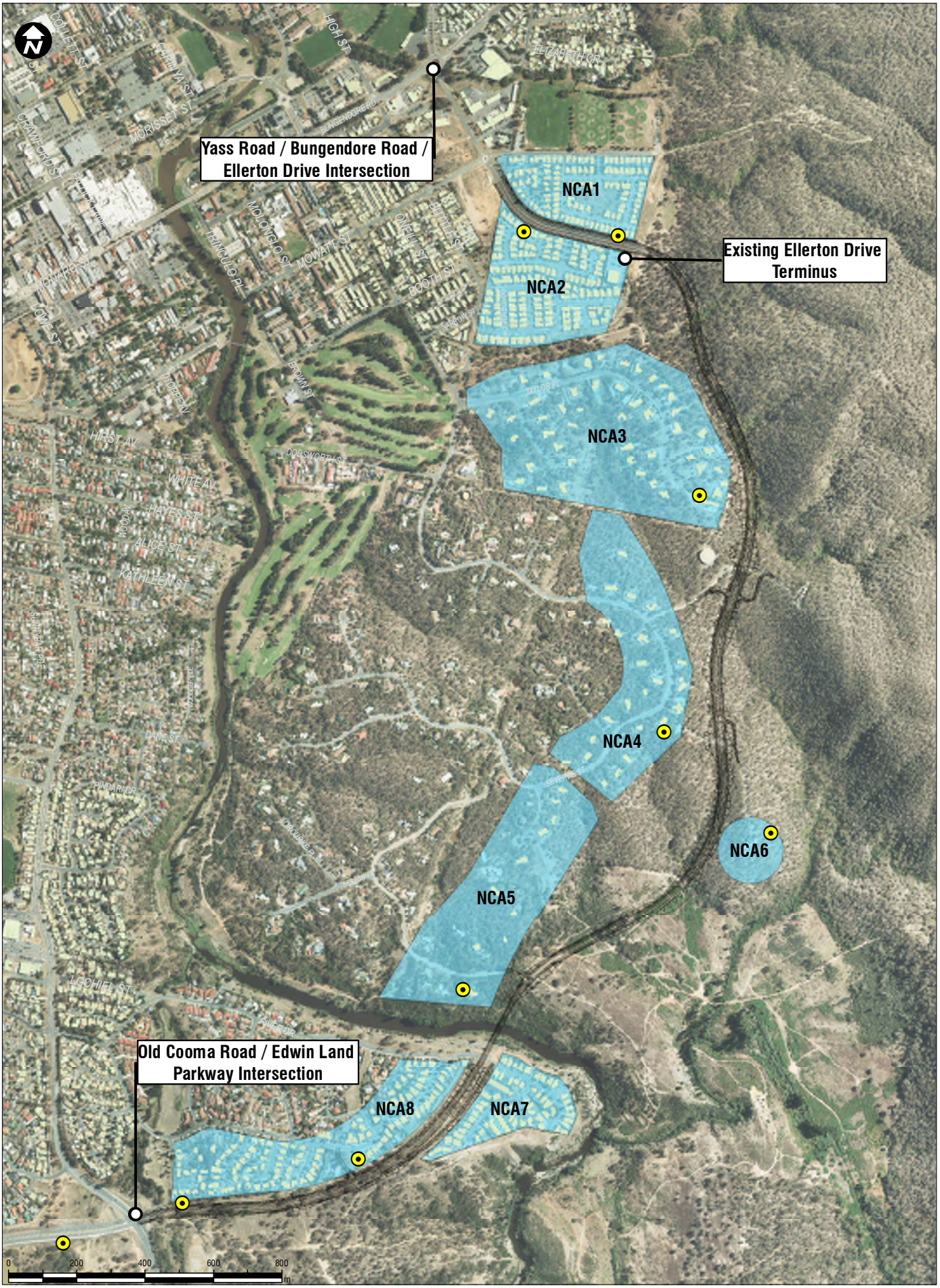
1.1 Project Description

Queanbeyan Palerang Regional Council (QPRC) proposes to construct a four kilometre (km) extension of Ellerton Drive, Queanbeyan, from the existing Ellerton Drive at East Queanbeyan to Old Cooma Road and Edwin Land Parkway at Karabar, in Queanbeyan, New South Wales. A total project length of 4.69 km includes upgrade works to a portion of existing Ellerton Drive.

The existing Ellerton Drive alignment connects to Yass Road and Bungendore Street at a roundabout and terminates approximately 850 m southeast of this roundabout. The proposal is to extend Ellerton Drive from its current terminus to the existing Old Cooma Road and Edwin Land Parkway intersection, forming the “fourth leg” of that intersection.

A previous traffic study commissioned by the QCC determined that the Queanbeyan road network must be upgraded to accommodate the rising population. The Ellerton Drive Extension (EDE) was identified to be a major component of the required upgrades.

The proposed EDE project is shown in **Figure 1**. **Figure 1** also indicates the locations of the potentially affected sensitive receivers along the route of the proposed alignment, grouped in separate Noise Catchment Areas (NCA).



H:\Projects-SLR\630-SVNTL\670-CAN\670.10568 Ellerton Drive Extension\SLR 670.10568_F01_RoadAlignment_01.mxd

SLR
SUITE 3, LEVEL 4
11 LONDON CRT
CANBERRA ACT 2600
AUSTRALIA
T: 61 2 6287 0800
F: 61 2 6287 0801
www.slrconsulting.com

Project No.:	670.10568
Date:	19/04/2016
Drawn by:	LH
Scale:	1:15,000
Sheet Size:	A4
Projection:	GDA 1994 MGA Zone 55

Noise Monitoring

Noise Catchment Areas (NCA)

Proposed EDE Design

Queanbeyan City Council

ELLERTON DRIVE EXTENTION

Road Alignment and Surrounds

FIGURE 1

1.2 Report Objectives

SLR Consulting Australia Pty Ltd (SLR) was engaged by Opus International Consultants (NSW) Pty Ltd (Opus) to assess operational and construction noise and vibration emissions associated with the EDE. This assessment forms part of the design and documentation process undertaken by Opus.

1.3 Relevant Policies, Guidelines and Standards

The assessment of noise and vibration for the construction and operation of the EDE are based on the following publications managed by the Environment Protection Authority (EPA), including:

- Operational Noise – *Road Noise Policy* (RNP), DECCW 2011
- Construction Noise – *Interim Construction Noise Guideline* (ICNG), DECC 2009
- Construction Vibration (Human Comfort) – *Assessing Vibration - a technical guideline,* DEC 2006
- Construction Vibration (Structural Damage) British Standard (BS) 7385:1993 Part 2 *Evaluation and measurement for vibration in buildings Part 2* (BS 7385.2).

The following documents are also referenced in this study:

- Noise survey results analysis – NSW *Industrial Noise Policy* (INP)
- Noise measurement procedure (operational) – Australian Standard (AS) 2702:1984 *Acoustic Methods of Measurement of Road Traffic Noise* (AS 2702)
- Noise measurement procedure (construction) – AS 1055:1997 *Acoustics – Description and Measurement of Environmental Noise* (AS 1055)
- Acoustic instrumentation – AS IEC 61672.1-2004 Electroacoustics - *Sound Level Meters*, and AS IEC 60942:2004 *Electroacoustics – Sound calibrators*
- Roads and Maritime Services (RMS) assessment requirements – *Preparing an Operational Noise and Vibration Assessment*, RMS July 2011
- RMS noise management response – *Environmental Noise Management Manual* (ENMM), 2001
- NSW Transport Construction Authority *Construction Noise Strategy* (CNS), 2011

1.4 Acoustic Terminology

Specific acoustic terminology used within this assessment is described in **Appendix A**.

2 EXISTING AMBIENT NOISE ENVIRONMENT

In order to characterise the noise environment across the project area (in relation to both construction and operation) and to establish existing ambient noise levels upon which to base the noise emission targets, noise monitoring was performed at selected representative locations within the project area.

As indicated in **Figure 1**, a total of 8 NCA's have been determined to assist with the noise assessment. At least one noise monitoring location was established within each NCA to assist with understanding the existing ambient environment.

2.1 Monitoring Methodology

Noise monitoring surveys were undertaken in general accordance with AS 2702 (road traffic noise) and AS 1055 (ambient noise).

2.1.1 Unattended Noise Monitoring

Unattended noise monitoring was conducted at the nominated locations between 7 March 2014 and 17 March 2014 using ARL type EL-316 environmental noise "loggers". The instrument signal calibration was confirmed before and after each measurement survey, with the variation in signal levels not exceeding ±0.5 dBA.

All loggers were programmed to record continuous statistical noise level indices in 15 minute intervals including the L_{Amax}, L_{A1}, L_{A10}, L_{A50}, L_{A90}, L_{A99}, L_{Amin} and L_{Aeq}.

2.1.2 Attended Noise Monitoring

Operator-attended ambient noise survey was conducted at all noise monitoring locations in order to support the identification and occurrence of ambient noise sources.

Attended noise measurements were performed using a calibrated Rion NA-28 Sound Level Meter (S/N: 01060054). The instrument signal calibration was confirmed before and after the measurements, with the variation in signal levels not exceeding ±0.5 dBA.

All items of acoustic instrumentation were designed to comply with AS IEC 61672.1:2004 *Electroacoustics – Sound Level Meters* and AS IEC 60942:2004 *Electroacoustics – Sound calibrators*, and carried current NATA or manufacturer calibration certificates.

2.1.3 Traffic Volumes

In accordance with the RMS document *Preparing an Operational Traffic and Construction Noise and Vibration Assessment Report*, traffic counting was undertaken concurrently with the unattended noise monitoring near the Old Cooma Road and Edwin Land Parkway intersection. Traffic counting was conducted on all three existing approaches of this intersection.

In addition to the concurrent traffic counting, past traffic data at the Bungendore Road, Yass Road and existing Ellerton Drive intersection was also provided by the Council to assist with the noise study.

2.2 Monitoring Results

2.2.1 Unattended Noise Monitoring

The noise logging results were analysed in accordance with RNP and ICNG methodology. In addition, noise measurements obtained during periods of adverse weather have been excluded from the results in accordance with the procedure outlined in the NSW *Industrial Noise Policy* (INP).

A summary of the ambient noise logger results during ICNG and RNP defined time periods (where applicable) is contained in **Table 1**. A full graphical representation of the noise monitoring results at each location is provided in **Appendix B** to **Appendix L**.

Table 1 Unattended Noise Logging Results

Noise Monitoring Location and Logger ID	Monitoring Period[1]	Noise Level, dBA			
		RBL[2]	L_{Aeq}	L_{10}	L_1
NCA1: 55 Thomas Royal Garden Logger S/N: 16-207-049	Daytime	31	46	41	51
	Evening	28	46	40	48
	Night-time	23	40	30	38
NCA2.1: 50 Stone Haven Circuit Logger S/N: 16-207-043	Daytime	36	50	49	59
	Evening	33	58	47	58
	Night-time	24	42	34	45
NCA2.2: 16 Geebung Place Logger S/N: 16-203-528	Daytime	29	48	42	52
	Evening	32	44	40	46
	Night-time	26	38	67	43
NCA3: 40 Taylor Place Logger S/N: 16-203-530	Daytime	30	57	39	49
	Evening	28	52	40	48
	Night-time	23	38	31	37
NCA4: 46 Severne Street Logger S/N: 16-306-044	Daytime	27	46	39	49
	Evening	28	53	42	50
	Night-time	25	41	39	46
NCA5: 35 Lonergan Drive Logger S/N: 16-306-041	Daytime	30	51	44	51
	Evening	32	57	43	48
	Night-time	29	46	39	45
NCA6: 40a Severne Street Logger S/N: 16-203-526	Daytime	30	45	40	47
	Evening	29	47	49	53
	Night-time	26	44	45	52
NCA7: 26 Doeberl Place Logger S/N: 16-004-033	Daytime	30	51	41	48
	Evening	29	45	40	47
	Night-time	25	44	30	37
NCA8(A): 78 Barracks Flat Drive Logger S/N: 16-306-044	Daytime	30	47	43	53
	Evening	29	52	41	49
	Night-time	24	49	33	39
NCA8(B): 12 Alfred Place Logger S/N: 16-203-526	Daytime Daytime[3]	40	57 53	53	60
	Evening	34	54	49	55
	Night-time Night-time[3]	26	53 48	42	50
Edwin Land Parkway Road Reserve (near 19 Nimbus Place) Logger S/N: 16-207-049	Daytime[3]		59		
	Night-time[3]		51		

1. ICNG defined periods unless noted – Day: 7.00 am to 6.00 pm Monday to Saturday, 8.00 am to 6.00 pm Sunday; Evening: 6.00 pm to 10.00 pm; Night: 10.00 pm to 7.00 am Monday to Saturday, 10.00 pm to 8.00 am Sunday.
2. Calculated in accordance with the NSW INP (See **Appendix A**)
3. RNP defined periods – Day: 7.00 am to 10.00 pm; Night: 10.00 pm to 7.00 am.

2.2.2 Attended Noise Monitoring

A summary of the 15 minute operator-attended ambient noise results is shown in **Table 2**.

Table 2 Operator-Attended Ambient Noise Survey at Noise Logging Location

Noise Survey Location	Measurement Details	Measured Noise Level, dBA			Description of Ambient Noise Sources, L_{Amax}
		L_{A90}	L_{Aeq}	L_{Amax}	
NCA1: 55 Thomas Royal Garden	17/03/14 04:09 pm Light winds 1-2 m/s Cloud cover 2/8	41	44	60	Distant traffic noise: 41-42 Distant truck: up to 45 Wind in trees: 41-45 Dog bark: 51 Noisy exhaust from bike: up to 60 Dominated by distant traffic (likely to be from Bungendore Street / Kings Highway)
NCA2.1: 50 Stone Haven Circuit	17/03/14 03:37 pm Light winds 1-2 m/s Cloud cover 2/8	43	50	65	Distant traffic noise: 45-49 Truck on Ellerton Drive: up to 65 Dominated by distant traffic (likely to be from Bungendore Street / Kings Highway)
NCA2.2: 16 Geebung Place	17/03/14 03:13 pm Light winds 1-2 m/s Cloud cover 2/8	40	50	68	Distant road traffic and heavy vehicles: faintly audible Distant construction noise (excavator or the like): up to 45 Car door slam: 45-47 Constant insect noise Interference by resident: up to 66
NCA3: 40 Taylor Place	07/03/14 08:42 am Wind calm Cloud cover 0/8	35	41	65	Distant traffic noise: 36-39 Household noise: up to 39 Aircraft: up to 52 Dog: 39-41, Birds: up to 43 Resident door slam: up to 65
NCA4: 46 Severne Street	17/03/14 05:19 pm Light winds 1-2 m/s Cloud cover 2/8	34	42	65	Distant traffic: 33-35 Birds: 46-65 Hammering noise from odd number neighbour: up to 41
NCA5: 35 Lonergan Drive	06/03/14 08:20 am Light winds 1-2 m/s Cloud cover 3/8	30	44	64	Light aircraft: up to 39 Local traffic: 32-36 Car traffic within Karabar: 39-45 Bus travelling uphill on residential street in Karabar: 48-52 Distant car radio noise: up to 31 Birds (cockatoo): up to 64
NCA6: 40A Severne Street	17/03/14 04:49 pm Mild winds 2-3 m/s Cloud cover 2/8	39	44	58	Distant traffic noise: 35-38 Hammering noise from neighbour: 39-41, Birds: 46-58
NCA7: 26 Doeberl Place	17/03/14 06:31 pm Wind calm Cloud cover 1/8	36	40	56	Traffic on Old Cooma Rd:36-39 Dog barking: 53-56
NCA8(B): 12 Alfred Place	17/04/14 08:10 am Wind calm Cloud cover 1/8	42	55	79	Traffic on Old Cooma Rd:44-47 Truck on ELP: 45-52 Truck exhaust: 54-58, Birds: 65 Dog barking next door:75-79

3 NOISE AND VIBRATION CRITERIA

3.1 Road Traffic Noise

3.1.1 Guideline Overview

For traffic operating on public roads, the NSW *Road Noise Policy* (RNP) issued in 2011 is appropriate for assessing road traffic noise emissions. The RNP identifies strategies that address the issue of road traffic noise from:

- Existing roads.
- New road projects.
- Road redevelopment projects.
- New traffic-generating developments.

The RNP noise criteria aim to protect amenity inside and immediately around residences, schools, hospitals and other sensitive land uses, rather than at all points in a given locality, which would not be practical or possible. Although it is not mandatory to achieve the noise criteria in the RNP, project proponents need to provide justification if it is not considered feasible or reasonable to achieve them.

The guideline recognises that there are generally more opportunities to minimise noise from new roads and road corridors, especially those in greenfield locations, through judicious road design and land use planning. The scope to reduce noise from existing roads and corridors is more limited.

The RNP criteria are applicable both at the time of project opening and also in a design year, typically taken to be ten years after project completion.

3.1.2 Noise Assessment Criteria – Residential Land Uses

Upon completion of the proposed Ellerton Drive extension, the entire Ellerton Drive would be considered to be a sub-arterial road in the context of the RNP. **Table 3** summarises the RNP assessment criteria for residences to be applied for this project. The criteria are applicable at the most affected point 1 m in front of a building at a height of 1.5 metres from the floor. For multi-level residential buildings, the criteria are applicable at the two floors of the building that are most exposed to traffic noise.

Table 3 RNP Criteria – Residential Land Uses

Road Category	Type of Project/Land Use	Assessment Criteria, dBA	
		Daytime (7 am – 10 pm)	**Night-time (10 pm – 7 am)**
Freeway / arterial / sub-arterial roads	Existing residences affected by noise from new freeway/arterial/sub-arterial road corridors	$L_{Aeq(15hour)}$ 55 (external)	$L_{Aeq(9hour)}$ 50 (external)

In addition, the RNP describes a “Relative Increase” criterion of 12 dBA above the level of existing traffic noise. This criterion is primarily intended to protect existing quiet areas from excessive changes in amenity. The 2014 noise monitoring indicated that ambient noise levels at many of the existing residences in the vicinity of the EDE were not influenced by significant contributions from road traffic noise. Therefore, the “Relative Increase” criterion” was also considered in this assessment.

It must be noted that not all properties that exceed the RNP assessment noise criteria for the day or night would automatically qualify for consideration of noise mitigation. The magnitude of exceedance is considered in guidelines described in the ENMM, to determine which properties qualify for additional noise mitigation (beyond the adoption of road design and traffic management measures).

This is a multi-step process and initially involves the identification of those properties where there is:

- An exceedance of the RNP assessment noise criteria for the day or night of more than 2 dBA; and
- The proposal results in a predicted change in the noise environment of more than 2 dBA, when comparing the future scenario including the proposal (ie "build") and the 'future existing' scenario excluding the proposal (ie "no build").

Where properties qualify for further consideration of noise mitigation, the options available are further assessed in terms of their:

- Reasonableness – which includes considerations of cost (ie the relationship between cost and noise reduction provided), equity, visual impacts, the change in noise levels etc); and
- Feasibility – ie engineering considerations, including whether it can be readily built, consideration of stormwater access, safety issues, maintenance requirements, etc.

3.1.3 Sleep Disturbance

Guidance for the assessment of sleep disturbance given in the RNP is reproduced as follows:

> *"Triggers for, and effects of sleep disturbance from, exposure to intermittent noise such as noise from road traffic are still being studied. There appears to be insufficient evidence to set new indicators for potential sleep disturbance due to road traffic noise. The NSW Roads and Traffic Authority's Practice Note 3 (NSW Roads and Traffic Authority 2008) outlines a protocol for assessing and reporting on maximum noise levels and the potential for sleep disturbance."*

The ENMM (Practice Note III) protocol for assessing the potential for sleep disturbance is based on individual vehicle pass-by noise measurements. The number of night-time pass-by events where the $L_{AFmax} - L_{Aeq(1hr)}$ difference is greater than 15 dB is to be determined.

With regard to reaction to potential sleep disturbance events, the RNP gives the following guidance:

From the research on sleep disturbance to date it can be concluded that:

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

It is generally accepted that internal noise levels in a dwelling, with the windows open are approximately 10 dB lower than external noise levels. Therefore, the first conclusion above suggests that short term external noises of 60 dBA to 65 dBA are unlikely to cause awakening reactions.

The second conclusion suggests that one or two noise events per night with maximum external noise levels of 75 dBA to 80 dBA are not likely to affect health and wellbeing significantly.

3.2 Construction Noise

The ICNG document sets out ways to manage the impacts of construction noise on residences and other sensitive land uses.

The ICNG provides construction noise management levels (NMLs) for residential and other noise sensitive receptors based on the background noise environment and the proposed times of construction work. The NMLs are non-mandatory criteria to identify where feasible and reasonable noise mitigation measures are likely to be required in order to reduce and control noise levels.

A description of the construction NMLs process is provided in **Table 4**. The NMLs for the EDE project have been determined from the RBL values (shown in **Table 1**) and are listed in **Table 5**.

Table 4 Construction Noise Management Levels At Residences

Construction Period	NML, dBA $L_{Aeq(15minute)}$	Application
Standard day time construction hours: Monday to Friday 7:00 am to 6:00 pm Saturday 8:00 am to 1:00 pm	Noise affected RBL dBA L_{A90} + 10 dBA	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $L_{Aeq(15min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels, duration and contact details.
Highly noise affected	Highly noise affected 75 dBA L_{Aeq}	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: • Time identified by the community when they are less sensitive to noise (such as before or after school for works near schools, or mid-morning or mid-afternoon for works near residences) • If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside of standard day time construction hours	Noise affected RBL dBA L_{A90} + 5 dBA	A strong justification would typically be required for works outside the recommended standard hours The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible, reasonable practices have been applied and noise is more than 5 dBA above the noise affected level the proponent should negotiate with the community

Table 5 Construction Noise Management Levels

Receiver Group	Noise Management Levels – NMLs, dBA $L_{Aeq(15minute)}$		
	Daytime Period	Evening Period	Night-time Period
NCA1	41	35	35
NCA2	46	38	35
NCA3 to NCA8	40	35	35

The NMLs apply at the property boundary that is most exposed to construction noise and at a height of 1.5 m above ground level. With regard to commercial receptors, construction noise should not exceed 75 dBA $L_{Aeq(15minute)}$ at the most-affected occupied point of the premises.

In addition to the NMLs, where construction would be required during the night-time period the potential for sleep disturbance to residential receivers should therefore be assessed.

The EPA's current approach to assessing potential sleep disturbance (*Application Notes to Industrial Noise Policy*) is to apply an initial screening criterion of background (RBL) + 15 dBA and to undertake further analysis if the screening criterion cannot be achieved. The sleep disturbance screening criterion applies outside bedroom windows during the night-time period.

Where the screening criterion cannot be met, the further analysis should consider the number of likely sleep disturbance events during the night, the level of exceedance and noise from other events.

3.3 Operational Vibration

Vibration emissions associated with vehicles on the EDE once operational would not be expected to generate significant levels of vibration when observed at nearby sensitive receptors. Consequently, no further consideration of operational vibration will be required.

3.4 Construction Vibration

The effects of vibration in buildings can be divided into three main categories – those in which the occupants or users of the building are inconvenienced or possibly disturbed, those where the building contents may be affected and those where the integrity of the building structure itself may be affected.

3.4.1 Human Comfort Vibration

The EPA's *Assessing Vibration: a technical guideline* provides guideline values for continuous, transient and intermittent events that are based on a Vibration Dose Value (VDV) rather than a continuous vibration level. The VDV is dependent upon the level and duration of the short-term vibration event, as well as the number of events occurring during the daytime or night-time period.

The VDVs recommended in the EPA guideline for vibration of an intermittent nature (ie construction works where more than three distinct vibration events occur) are presented in **Table 6**.

Table 6 Acceptable Vibration Dose Values for Intermittent Vibration (m/s$^{1.75}$)

Location	Daytime[1]		Night-time[1]	
	Preferred value	Maximum value	Preferred value	Maximum value
Critical areas[2]	0.10	0.20	0.10	0.20
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

1 Daytime is 7.00 am to 10.00 pm and night-time is 10.00 pm to 7.00 am.
2 Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. These criteria are only indicative, and there may be a need to assess intermittent values against the continuous or impulsive criteria for critical areas.
Source: BS 6472–1992

3.4.2 Effects on Building Contents

People can perceive floor vibration at levels well below those likely to cause damage to building contents or affect the operation of typical equipment. For most receivers, the controlling vibration criterion will be the human comfort criterion, and it is therefore not normally required to set separate criteria in relation to the effect of construction vibration on most building contents.

3.4.3 Structural Damage Vibration

Structural damage vibration limits are generally based on AS 2187.2: 2006 *Explosives - Storage and Use - Part 2: Use of Explosives* and BS 7385.2:1993 *Evaluation and measurement for vibration in buildings Part 2*.

These standards provide frequency-dependent vibration limits related to cosmetic damage, noting that cosmetic damage is very minor in nature, is readily repairable and does not affect the structural integrity of the building. The recommended vibration limits from BS 7385 for transient vibration for minimal risk of cosmetic damage to residential and industrial buildings is shown in **Table 7**.

Table 7 Transient Vibration Guide Values for Minimal Risk of Cosmetic Damage

Line	Type of Building	Peak component particle velocity in frequency range of predominant pulse	
		4 Hz to 15 Hz	**15 Hz and above**
1	Reinforced or framed structures Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	
2	Unreinforced or light framed structures Residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

3.4.4 Ground-Borne (Regenerated) Noise

Ground-borne (or regenerated) construction noise can be present on construction projects where vibration from activities such as rock-breaking, road heading, rotary cutting and rock drilling/sawing can be transmitted through the ground and into the habitable areas of nearby buildings. Ground-borne noise occurs when this vibration in the ground and/or building elements is regenerated as audible noise within areas of occupancy inside the building.

The ICNG defines internal ground-borne noise goals for residential receivers of 40 dBA $L_{Aeq(15minute)}$ during the evening (6:00 pm to 10:00 pm) and 35 dBA $L_{Aeq(15minute)}$ during the night-time (10:00 pm to 7:00 am). The goals apply only when ground-borne noise levels are higher than airborne noise levels.

4 OPERATIONAL NOISE ASSESSMENT

4.1 Assessment Methodology

A road traffic noise model was set up within the SoundPLAN (Version 7.1) prediction software package. SoundPLAN is a software package which enables compilation of a sophisticated computer model comprising a digitised ground map (containing ground contours and buildings), the location and acoustic power levels of significant sources of road traffic noise, and the location of sensitive receptors.

The Calculation of Road Traffic Noise (CoRTN) prediction methodology within SoundPLAN was utilised. CoRTN allows traffic noise levels to be considered based on traffic volume and composition, type of road surface, vehicle speed, road alignment and gradient, reflections off building surfaces, ground absorption and shielding from ground topography and physical noise barriers.

The noise model predicted noise levels at all facades of each potentially-affected noise sensitive receptor identified within the project area.

4.2 Noise Model Inputs

The modelled traffic speed was 60 km/h from the existing section of Ellerton Drive to approximately Ch1200 and 80 km/h from Ch1200 onwards to the Old Cooma Road intersection.

The road pavement surface modelled was dense graded asphalt (DGA).

Existing property boundary fences have been incorporated into the model where the fence would be expected to provide noise reduction. Fences that would not provide reduction, ie those with gaps between palings or were in poor condition, where not included in the noise model.

Traffic data recorded during the noise survey period at NCA8.2 and the Edwin Land Parkway road reserve and past traffic count data are shown in **Table 8**.

"Light" and "Heavy" classifications include Class 1 and 2 vehicles and Class 3 to 12 vehicles respectively.

Table 8 Traffic Volumes – Pre-project

Traffic Counting Location		**15 Hour (7 am – 10 pm)**		**9 Hour (10 pm – 7 am)**	
		Light	**Heavy**	**Light**	**Heavy**
2014 Concurrent Traffic Count (existing Edwin Land Parkway and Old Cooma Road intersection)					
Edwin Land Parkway	Eastbound	2115	104	204	12
	Westbound	2112	120	210	11
Old Cooma Road (north of ELP)	Northbound	3206	240	297	24
	Southbound	3243	230	269	27
Old Cooma Road (south of ELP)	Northbound	1821	270	185	30
	Southbound	1883	264	203	29
Past Traffic Count Nov-Dec 2013 (Bungendore Road, Yass Road and existing Ellerton Drive intersection)					
Yass Road	Northbound	5403	548	818	73
	Southbound	5765	489	408	40
Bungendore Road (west of Yass Road)	Eastbound	10308	668	1049	69
	Westbound	10088	642	831	92
Bungendore Road (east of Yass Road)	Eastbound	5432	353	399	56
	Westbound	5069	249	527	41

The relevant traffic forecast data used for the prediction of traffic noise from the future EDE are presented in **Table 9**.

Table 9 Forecast Traffic Volumes – Post-opening

Traffic Counting Location		15 Hour (7 am – 10 pm)		9 Hour (10 pm – 7 am)	
		Light	Heavy	Light	Heavy
Within One Year of Project Opening					
Ellerton Drive Extension	Northbound	1576	175	143	16
	Southbound	1865	207	186	21
Edwin Land Parkway	Eastbound	4228	207	435	25
	Westbound	2705	154	281	14
Old Cooma Road (north of ELP)	Northbound	7771	582	728	564
	Southbound	6013	426	564	57
Old Cooma Road (south of ELP)	Northbound	6120	907	552	88
	Southbound	5865	822	558	79
Yass Road	Northbound	7081	601	596	58
	Southbound	5539	561	483	43
Bungendore Road (west of Yass Road)	Eastbound	9200	596	864	57
	Westbound	9162	583	829	92
Bungendore Road (east of Yass Road)	Eastbound	6733	437	565	79
	Westbound	7617	374	649	51
Design Year (10 Years after Project Opening)					
Ellerton Drive Extension	Northbound	2017	106	132	7
	Southbound	3059	161	263	14
Edwin Land Parkway	Eastbound	5929	290	577	33
	Westbound	5006	284	500	26
Old Cooma Road (north of ELP)	Northbound	9040	677	905	74
	Southbound	7144	506	702	70
Old Cooma Road (south of ELP)	Northbound	10233	1517	957	153
	Southbound	10195	1430	975	139
Yass Road	Northbound	8457	717	710	69
	Southbound	7255	735	646	58
Bungendore Road (west of Yass Road)	Eastbound	9316	603	888	59
	Westbound	8054	513	721	80
Bungendore Road (east of Yass Road)	Eastbound	8220	533	694	97
	Westbound	8520	419	726	57

4.3 Noise Model Validation

The predicted operational noise levels for the existing 2014 situation have been compared to the noise levels measured during the 2014 noise monitoring surveys (refer to **Table 1**) for the purpose of model validation. This is shown in **Table 10**.

Table 10 Model Validation – Comparison of Predicted Noise Levels to Measured Noise Levels

Noise Logging Location	Noise Logging Address	Measured Existing Noise Levels (dBA)		Predicted Existing Noise Levels (dBA)		Comparison (dBA)	
		Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$
NCA8.2	12 Alfred Place	53	48	53	46	0	-2
ELP	Edwin Land Parkway Road Reserve	59	51	57	50	-2	-1

The ENMM states that "*it should be recognised that noise prediction modelling has some accuracy limitations and will commonly produce acceptable errors of around 2 dBA*". This approach to validation has been found to be acceptable on a number of past projects in NSW.

On the basis of the comparison of the noise model predictions with the pre-project measurement results, it is concluded that the noise model is validated and suitable for use for predictions of future road traffic noise levels.

4.4 Predicted Operational Noise Levels

The 'build' and 'no build' operational scenarios have been assessed for the "one year of project opening" (2019) and for the "design year" (ie 10 years after opening).

The predicted road traffic noise levels within one year of opening for the "no build' and 'build' scenarios, as well as the change in noise levels and the level above the RNP criteria for the representative receivers in each NCA are shown in **Table 11**. The results of the noise predictions for all receivers are presented in **Appendix M**.

The predicted road traffic noise levels for the design year (10 years after project opening) 'no build' and 'build' scenarios, as well as the relative increase in noise level and the level above the RNP criteria for the representative receivers in each NCA are shown in **Table 12**. The results of the noise predictions for all receivers are presented in **Appendix N**.

Appendix O provides figures of all assessed buildings and their address.

It can be seen in the prediction result tables and the noise contour figures that the predicted EDE road traffic noise levels exceed the either the absolute RNP criteria and/or the relative increase criteria at many locations.

Feasible and reasonable noise mitigation measures have been considered at locations where exceedances of the RNP criteria were predicted.

Table 11 Predicted Road Traffic Noise Levels – Within 1 year of opening

Representative Receiver Address	Predicted Noise Levels, dBA				Relative Increase, dBA		'Build' Scenario Exceeds RNP Criteria Day: $L_{Aeq(15hour)}$ 55 dBA Night: $L_{Aeq(9hour)}$ 50 dBA		'Build' Scenario Exceed 12 dB 'Relative Increase Criteria'?		'Build' Scenario Noise Level Acute? Day $L_{Aeq(15hour)}$ 65 Night $L_{Aeq(9hour)}$ 60	
	'No Build' Scenario		'Build' Scenario									
	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$
NCA1 53 Thomas Royal Garden	43	36	62	55	18.6	18.4	7	5	YES	YES	No	No
NCA2 2 Tennyson Drive	43	36	60	52	16.7	16.5	5	2	YES	YES	No	No
NCA3 40 Taylor Place	40	33	48	40	7.6	7.3	-	-	No	No	No	No
NCA4 40 Severne Street	37	30	51	44	14.0	13.7	-	-	YES	YES	No	No
NCA5 26 Lonergan Drive	38	34	54	47	16.5	13.2	-	-	YES	YES	No	No
NCA6 40A Severne Street	38	31	56	49	18.5	18.2	2	-	YES	YES	No	No
NCA7 32 Doeberl Place	40	33	60	53	20.0	19.7	5	3	YES	YES	No	No
NCA8(A) 108 Barracks Flat Drive	33	26	58	51	25.2	25.0	3	1	YES	YES	No	No
NCA8(B) 20 Caroline Place	55	48	62	55	7.1	7.1	7	5	No	No	No	No

Table 12 Predicted Operational Noise Levels – Design Year (10 years after opening)

Representative Receiver Address	Predicted Noise Levels, dBA				Relative Increase, dBA		'Build' Scenario Exceeds RNP Criteria Day: $L_{Aeq(15hour)}$ 55 dBA Night: $L_{Aeq(9hour)}$ 50 dBA		'Build' Scenario Exceed 12 dB 'Relative Increase Criteria'?		'Build' Scenario Noise Level Acute? Day $L_{Aeq(15hour)}$ 65 Night $L_{Aeq(9hour)}$ 60	
	'No Build' Scenario		'Build' Scenario									
	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$
NCA1 53 Thomas Royal Garden	44	37	63	55	19.5	18.5	8	5	YES	YES	No	No
NCA2 2 Tennyson Drive	44	37	60	52	15.9	14.7	5	2	YES	YES	No	No
NCA3 40 Taylor Place	38	31	48	40	10.3	9.3	-	--	No	No	No	No
NCA4 40 Severne Street	38	31	52	44	14.2	12.9	-	-	YES	YES	No	No
NCA5 26 Lonergan Drive	38	33	55	46	16.5	13.2	-	-	YES	YES	No	No
NCA6 40A Severne Street	39	32	57	49	17.9	16.7	2	-	YES	YES	No	No
NCA7 32 Doeberl Place	42	35	63	55	20.8	19.8	8	5	YES	YES	No	No
NCA8(A) 108 Barracks Flat Drive	37	29	58	50	21.6	20.4	3	-	YES	YES	No	No
NCA8(B) 20 Caroline Place	57	50	63	55	6.1	5.3	8	5	No	No	No	No

4.5 Assessment of Reasonable and Feasible Mitigation Measures

4.5.1 Procedure Overview

The RNP describes the following noise mitigation measures to be considered, in order of priority:

1. Road design and traffic management
2. Quieter pavement surfaces
3. In-corridor noise barriers/mounds
4. At-property treatments or localised barriers/mounds

The priority of mitigation measures recognises that noise control at the source is preferable over noise path control and noise mitigation at the receiver.

The RNP notes that it is not mandatory to achieve the noise assessment criteria, and that noise mitigation measures should be both feasible and reasonable. Selecting reasonable measures from those that are feasible involves judging whether the overall noise benefits outweigh the overall adverse social, economic and environmental effects, including the cost of the abatement measure. To make such a judgement, consideration may be given to noise impacts, noise mitigation benefits, the cost effectiveness of noise mitigation and community views.

4.5.2 Reasonable and Feasible Definition

Where the noise goals in the design year 'build' scenario are found to be exceeded as a result of a project, the RNP and the ENMM require the project to adopt "reasonable and feasible" mitigation measures to meet the targets.

Practice Note IV of the ENMM defines what "reasonable and feasible" factors may be considered when investigating noise mitigation measures.

"**Reasonableness**" relates to the application of wider judgements. The factors to be considered are:

- The noise reduction provided and the number of people protected
- The cost of mitigation, including the total cost and cost variations with different benefits provided
- Community views and wishes
- Visual impacts
- Existing and future noise levels, including changes in noise levels
- The benefits arising from the proposed road or road development

"**Feasibility**" relates to engineering considerations (what can be practically built) and may include:

- The inherent limitations of different techniques to reduce noise emissions from road traffic noise sources
- Safety issues, such as restrictions on road vision
- Road corridor site constraints such as space limitations
- Floodway and stormwater flow obstruction
- Access requirements
- Maintenance requirements

4.6 Road Traffic Noise Mitigation

SLR has considered many combinations of noise mitigation treatments for each of the NCA's. A full list of these and associated predicted road traffic noise levels can be found in **Appendix P**. Whilst the full suite of options have been considered for both Dense Graded Asphalt (DGA) and Stone Mastic Asphalt (SMA), only the results for the Stone Mastic Asphalt (SMA) road surface have been shown.

It is proposed to use SMA for the road surface pavement type for the complete alignment. That pavement type is expected to be 2 dBA quieter than DGA.

4.6.1 Noise Barriers

Based on the various combinations of mitigation treatments considered and the SMA road surface, the final selections of noise barriers are shown in **Table 13**. The selections were made in the context of the feasible and reasonable principles discussed above.

Table 13 Selected Noise Mitigation Treatments

Area	Barrier Height, m	Barrier Length[1], m	Barrier Type	Wall Location
NCA1	3.0	333	Concrete	Property Boundary
	3.6	177	Concrete	
NCA2	2.4	210[2]	Concrete	Property Boundary
	2.4	116[3]	Concrete	
NCA3	2.4	478	Timber Infill	Outside Shared Pathway
NCA4	2.4	297	Timber Infill	Property Boundary
NCA5	2.4	91	Timber Infill	Outside Shared Pathway
NCA6	n/a	n/a	n/a	n/a
NCA7	4.2	332	Concrete	Road Shoulder outside Kerb
	2.4	55	TBA	Southeast side of bridge
NCA8(A)	4.2	497	Concrete	Outside Shared Pathway
NCA8(B)	4.2	552	Concrete	Outside Shared Pathway

1. Approximate
2. West of Tennyson Drive
3. East of Tennyson Drive

The selected noise mitigations are shown on figures in **Appendix O, Appendix S** and **Appendix T**.

The predicted road traffic noise levels with the selected noise mitigation treatments in place can be seen in contour form in **Appendix S** and **Appendix T** for the day and night periods respectively. The predicted road traffic noise levels as well as the relative increase in noise level and the level above the RNP criteria for the all receivers in each NCA are shown in **Table 14**.

It should be noted that the topography in the vicinity of Lonergan Drive (NCA5) is such that noise barriers do not provide effective noise reduction to the receptors. A nominal 2.4 m high barrier has been selected for this area.

A noise barrier must be constructed from material that has a surface mass of no less than 15 kg/m^2. There are many suitable materials that fulfil that requirement, including Hebel and timbers of certain thickness. Panels must remain straight and gaps between the panels and the panels and the ground must be eliminated. Other construction characteristics including stability, wind shear strength and durability must also be taken into consideration.

Table 14 Design Year (10 years after opening) – Predicted Operational Noise Levels: With Selected Noise Mitigation

Receiver Address	Predicted Noise Levels, dBA				Relative Increase, dBA		'Build' Scenario Exceeds RNP Criteria Day: $L_{Aeq(15hour)}$ 55 dBA Night: $L_{Aeq(9hour)}$ 50 dBA		'Build' Scenario Exceed 12 dB 'Relative Increase Criteria'?	
	'No Build' Scenario		'Build' Scenario							
	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$
NCA1										
6 PATRICK BRICK COURT - GF	53	45	53	45	0.0	-0.3	--	--	--	--
6 PATRICK BRICK COURT - F 1	55	47	55	47	0.5	0.2	--	--	--	--
8 PATRICK BRICK COURT - GF	51	44	51	43	-0.3	-0.7	--	--	--	--
8 PATRICK BRICK COURT - F 1	55	47	60	52	5.5	5.2	5	2	--	--
10 PATRICK BRICK COURT - GF	52	44	51	43	-0.8	-1.0	--	--	--	--
19 PATRICK BRICK COURT - GF	45	38	51	43	6.1	5.1	--	--	--	--
21 PATRICK BRICK COURT - GF	45	38	52	44	7.5	6.5	--	--	--	--
23 PATRICK BRICK COURT - GF	44	37	51	43	7.4	6.4	--	--	--	--
23 PATRICK BRICK COURT - F 1	46	39	58	50	11.8	10.8	3	--	--	--
25 PATRICK BRICK COURT - GF	44	37	52	44	7.6	6.6	--	--	--	--
25 PATRICK BRICK COURT - F 1	47	40	59	51	11.7	10.9	4	1	--	--
27 PATRICK BRICK COURT - GF	48	40	53	46	5.4	5.8	--	--	--	--
29 PATRICK BRICK COURT - GF	48	40	53	45	5.5	5.0	--	--	--	--
29 PATRICK BRICK COURT - F 1	51	43	60	52	9.2	8.9	5	2	--	--
31 PATRICK BRICK COURT - GF	47	40	52	44	4.8	4.2	--	--	--	--
31 PATRICK BRICK COURT - F 1	51	43	59	51	8.2	7.7	4	1	--	--
33 PATRICK BRICK COURT - GF	42	35	50	42	8.4	7.6	--	--	--	--
33 PATRICK BRICK COURT - F 1	46	38	57	49	11.8	10.8	2	--	--	--
31 THOMAS ROYAL GARDENS - GF	43	36	52	44	8.7	7.7	--	--	--	--
33 THOMAS ROYAL GARDENS - GF	46	39	53	46	7.4	7.4	--	--	--	--

Receiver Address	Predicted Noise Levels, dBA				Relative Increase, dBA		'Build' Scenario Exceeds RNP Criteria Day: $L_{Aeq(15hour)}$ 55 dBA Night: $L_{Aeq(9hour)}$ 50 dBA		'Build' Scenario Exceed 12 dB 'Relative Increase Criteria'?	
	'No Build' Scenario		'Build' Scenario							
	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$
35 THOMAS ROYAL GARDENS - GF	44	37	51	43	7.3	6.2	--	--	--	--
37 THOMAS ROYAL GARDENS - GF	44	37	51	43	7.4	6.4	--	--	--	--
39 THOMAS ROYAL GARDENS - GF	44	37	51	43	7.4	6.4	--	--	--	--
41 THOMAS ROYAL GARDENS - GF	44	37	52	44	8.5	7.4	--	--	--	--
43 THOMAS ROYAL GARDENS - GF	44	37	53	45	9.4	8.4	--	--	--	--
45 THOMAS ROYAL GARDENS - GF	44	37	53	46	9.4	9.4	--	--	--	--
47 THOMAS ROYAL GARDENS - GF	44	37	53	45	9.5	8.5	--	--	--	--
49 THOMAS ROYAL GARDENS - GF	44	37	52	45	8.5	8.5	--	--	--	--
51 THOMAS ROYAL GARDENS - GF	44	37	53	45	9.5	8.5	--	--	--	--
53 THOMAS ROYAL GARDENS - GF	44	37	50	42	6.5	5.5	--	--	--	--
55 THOMAS ROYAL GARDENS - GF	43	36	51	43	7.7	6.7	--	--	--	--
57 THOMAS ROYAL GARDENS - GF	43	36	51	43	7.8	6.8	--	--	--	--
59 THOMAS ROYAL GARDENS - GF	43	36	51	42	7.6	5.6	--	--	--	--
61 THOMAS ROYAL GARDENS - GF	43	36	51	43	7.7	6.7	--	--	--	--
NCA2										
91 ELLERTON DRIVE - GF	44	37	50	42	6.4	5.3	--	--	--	--
44 STONEHAVEN CIRCUIT - GF	51	43	54	46	2.5	2.5	--	--	--	--
46 STONEHAVEN CIRCUIT - GF	51	43	54	46	3.4	3.4	--	--	--	--
48 STONEHAVEN CIRCUIT - GF	48	41	54	46	5.8	4.8	--	--	--	--
50 STONEHAVEN CIRCUIT - GF	50	43	52	45	2.4	1.5	--	--	--	--
52 STONEHAVEN CIRCUIT - GF	50	42	53	45	2.9	2.8	--	--	--	--
54 STONEHAVEN CIRCUIT - GF	50	42	52	44	1.6	1.6	--	--	--	--

Receiver Address	Predicted Noise Levels, dBA				Relative Increase, dBA		'Build' Scenario Exceeds RNP Criteria Day: $L_{Aeq(15hour)}$ 55 dBA Night: $L_{Aeq(9hour)}$ 50 dBA		'Build' Scenario Exceed 12 dB 'Relative Increase Criteria'?	
	'No Build' Scenario		'Build' Scenario							
	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$
56 STONEHAVEN CIRCUIT - GF	49	42	52	44	3.0	1.9	--	--	--	--
58 STONEHAVEN CIRCUIT - GF	49	41	52	44	3.3	3.2	--	--	--	--
60 STONEHAVEN CIRCUIT - GF	46	39	54	45	7.5	6.4	--	--	--	--
62 STONEHAVEN CIRCUIT - GF	46	38	52	44	6.2	6.0	--	--	--	--
1 TENNYSON DRIVE - GF	44	37	53	45	8.7	7.6	--	--	--	--
2 TENNYSON DRIVE - GF	44	37	55	47	11.0	9.8	--	--	--	--
10 NORTHCLIFFE PLACE - GF	44	37	55	47	11.0	9.9	--	--	--	--
12 NORTHCLIFFE PLACE - GF	44	37	59	51	14.7	13.5	4	1	YES	YES
21 NORTHCLIFFE PLACE - GF	42	35	53	45	11.3	10.1	--	--	--	--
23 NORTHCLIFFE PLACE - GF	45	38	56	48	10.9	9.8	1	--	--	--
12 GEEBUNG PLACE - GF	40	33	46	38	5.5	4.5	--	--	--	--
14 GEEBUNG PLACE - GF	40	33	45	37	5.3	4.3	--	--	--	--
15 GEEBUNG PLACE - GF	42	35	49	41	6.8	5.9	--	--	--	--
16 GEEBUNG PLACE - GF	40	33	45	37	5.0	4.0	--	--	--	--
NCA3										
14 TAYLOR PLACE - GF	43	36	46	38	3.2	2.4	--	--	--	--
16 TAYLOR PLACE - GF	43	36	47	39	3.9	3.0	--	--	--	--
18 TAYLOR PLACE - GF	42	35	48	40	5.6	4.5	--	--	--	--
20 TAYLOR PLACE - GF	39	32	48	40	8.7	7.5	--	--	--	--
21 TAYLOR PLACE - GF	39	32	47	39	7.7	6.7	--	--	--	--
22 TAYLOR PLACE - GF	41	34	48	40	7.2	6.0	--	--	--	--
22 TAYLOR PLACE - F1	41	34	49	41	8.1	7.0	--	--	--	--

Receiver Address	Predicted Noise Levels, dBA				Relative Increase, dBA		'Build' Scenario Exceeds RNP Criteria Day: $L_{Aeq(15hour)}$ 55 dBA Night: $L_{Aeq(9hour)}$ 50 dBA		'Build' Scenario Exceed 12 dB 'Relative Increase Criteria'?	
	'No Build' Scenario		'Build' Scenario							
	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$
24 TAYLOR PLACE - GF	41	34	49	41	8.3	7.2	--	--	--	--
25 TAYLOR PLACE - GF	39	33	47	39	8.0	6.0	--	--	--	--
26 TAYLOR PLACE - GF	40	33	48	40	8.4	7.3	--	--	--	--
30 TAYLOR PLACE - GF	41	34	53	45	12.2	10.9	--	--	YES	--
30 TAYLOR PLACE - F1	41	34	55	46	13.6	12.3	--	--	YES	YES
32 TAYLOR PLACE - GF	39	32	53	44	13.6	12.3	--	--	YES	YES
32 TAYLOR PLACE - F1	39	32	54	46	15.1	13.8	--	--	YES	YES
34 TAYLOR PLACE - GF	40	34	48	40	7.5	5.5	--	--	--	--
36 TAYLOR PLACE - GF	40	34	48	40	7.7	5.5	--	--	--	--
38 TAYLOR PLACE - GF	37	30	53	44	15.7	14.4	--	--	YES	YES
40 TAYLOR PLACE - GF	38	31	46	38	8.2	7.1	--	--	--	--
42 TAYLOR PLACE - GF	39	32	45	37	5.9	5.0	--	--	--	--
NCA4										
26 SEVERNE STREET - GF	42	35	43	35	0.2	-0.1	--	--	--	--
28 SEVERNE STREET - GF	39	32	41	34	2.1	1.3	--	--	--	--
30 SEVERNE STREET - GF	38	31	43	35	4.4	3.3	--	--	--	--
32 SEVERNE STREET - GF	42	35	46	38	3.4	2.6	--	--	--	--
34 SEVERNE STREET - GF	38	32	45	37	7.0	5.8	--	--	--	--
36 SEVERNE STREET - GF	38	31	45	37	6.9	5.7	--	--	--	--
38 SEVERNE STREET - GF	39	32	45	37	6.6	5.6	--	--	--	--
40 SEVERNE STREET - GF	38	31	47	39	9.3	8.0	--	--	--	--
42 SEVERNE STREET - GF	38	31	43	35	4.9	3.9	--	--	--	--

Receiver Address	Predicted Noise Levels, dBA				Relative Increase, dBA		'Build' Scenario Exceeds RNP Criteria Day: $L_{Aeq(15hour)}$ 55 dBA Night: $L_{Aeq(9hour)}$ 50 dBA		'Build' Scenario Exceed 12 dB 'Relative Increase Criteria'?	
	'No Build' Scenario		'Build' Scenario							
	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$
44 SEVERNE STREET - GF	38	31	42	34	3.9	2.9	--	--	--	--
46 SEVERNE STREET - GF	38	31	45	37	6.9	5.8	--	--	--	--
48 SEVERNE STREET - GF	38	31	45	37	7.1	6.0	--	--	--	--
50 SEVERNE STREET - GF	40	33	46	38	5.4	4.5	--	--	--	--
NCA5										
52 SEVERNE STREET - GF	39	32	43	35	4.0	2.9	--	--	--	--
1 WOODMAN PLACE - GF	39	32	44	36	4.9	4.0	--	--	--	--
3 WOODMAN PLACE - GF	38	31	45	37	6.7	5.6	--	--	--	--
5 WOODMAN PLACE - GF	41	34	47	39	5.7	4.6	--	--	--	--
11 WOODMAN PLACE - GF	40	33	44	36	4.3	3.4	--	--	--	--
12 WOODMAN PLACE - GF	41	34	48	40	7.1	5.9	--	--	--	--
13 WOODMAN PLACE - GF	40	33	52	44	11.7	10.5	--	--	--	--
22 LONERGAN DRIVE - GF	40	33	48	40	7.8	6.7	--	--	--	--
24 LONERGAN DRIVE - GF	40	33	51	43	11.1	9.9	--	--	--	--
26 LONERGAN DRIVE - GF	38	33	52	43	13.6	10.3	--	--	YES	--
26 LONERGAN DRIVE - F1	38	33	52	44	14.3	11.1	--	--	YES	--
29 LONERGAN DRIVE - GF	39	32	47	39	7.8	6.7	--	--	--	--
29 LONERGAN DRIVE - F1	40	33	48	40	7.9	6.9	--	--	--	--
31 LONERGAN DRIVE - GF	38	32	49	41	10.7	8.7	--	--	--	--
33 LONERGAN DRIVE - GF	39	32	52	44	13.0	11.8	--	--	YES	--
35 LONERGAN DRIVE - GF	36	29	52	43	15.6	14.4	--	--	YES	YES
35 LONERGAN DRIVE - F1	36	29	52	44	16.3	15.1	--	--	YES	YES

Receiver Address	Predicted Noise Levels, dBA				Relative Increase, dBA		'Build' Scenario Exceeds RNP Criteria Day: $L_{Aeq(15hour)}$ 55 dBA Night: $L_{Aeq(9hour)}$ 50 dBA		'Build' Scenario Exceed 12 dB 'Relative Increase Criteria'?	
	'No Build' Scenario		'Build' Scenario							
	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$
NCA6										
40A SEVERNE STREET - GF	39	32	55	47	15.9	14.7	--	--	YES	YES
NCA7										
123 BARRACKS FLAT DRIVE - GF	37	30	49	40	11.8	10.5	--	--	--	--
125 BARRACKS FLAT DRIVE - GF	38	32	50	42	11.7	10.4	--	--	--	--
127 BARRACKS FLAT DRIVE - GF	38	31	50	41	11.1	10.6	--	--	--	--
129 BARRACKS FLAT DRIVE - GF	38	31	49	41	10.6	10.2	--	--	--	--
130 BARRACKS FLAT DRIVE - GF	38	31	50	42	12.4	11.6	--	--	YES	--
130 BARRACKS FLAT DRIVE - F 1	39	32	53	45	13.8	13.4	--	--	YES	YES
131 BARRACKS FLAT DRIVE - GF	37	30	48	39	10.4	9.2	--	--	--	--
132 BARRACKS FLAT DRIVE - GF	36	29	49	41	13.2	12.0	--	--	YES	--
132 BARRACKS FLAT DRIVE - F 1	39	32	51	42	11.3	10.1	--	--	--	--
134 BARRACKS FLAT DRIVE - GF	38	31	49	41	11.3	9.9	--	--	--	--
134 BARRACKS FLAT DRIVE - F 1	39	32	50	42	10.8	9.5	--	--	--	--
135 BARRACKS FLAT DRIVE - GF	36	29	47	39	11.4	10.1	--	--	--	--
136 BARRACKS FLAT DRIVE - GF	37	30	48	40	10.7	9.9	--	--	--	--
137 BARRACKS FLAT DRIVE - GF	35	29	46	38	10.5	9.2	--	--	--	--
139 BARRACKS FLAT DRIVE - GF	35	28	45	37	10.7	9.4	--	--	--	--
140 BARRACKS FLAT DRIVE - GF	37	30	46	38	8.6	7.4	--	--	--	--
141 BARRACKS FLAT DRIVE - GF	35	28	45	36	10.0	8.7	--	--	--	--
142 BARRACKS FLAT DRIVE - GF	37	30	46	37	8.1	7.0	--	--	--	--
146 BARRACKS FLAT DRIVE - GF	37	30	45	36	7.5	6.3	--	--	--	--

Receiver Address	Predicted Noise Levels, dBA				Relative Increase, dBA		'Build' Scenario Exceeds RNP Criteria Day: $L_{Aeq(15hour)}$ 55 dBA Night: $L_{Aeq(9hour)}$ 50 dBA		'Build' Scenario Exceed 12 dB 'Relative Increase Criteria'?	
	'No Build' Scenario		'Build' Scenario							
	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$
2 DOEBERL PLACE - GF	37	30	47	39	10.2	9.0	--	--	--	--
6 DOEBERL PLACE (SOUTH) - GF	38	31	53	46	14.7	14.4	--	--	YES	YES
6 DOEBERL PLACE (SOUTH) - F 1	39	32	55	48	15.5	15.6	--	--	YES	YES
6 DOEBERL PLACE (NORTH) - GF	39	32	50	47	11.2	15.1	--	--	--	YES
6 DOEBERL PLACE (NORTH) - F 1	40	33	54	49	14.4	15.7	--	--	YES	YES
6 DOEBERL PLACE - GF	36	29	49	41	13.5	12.4	--	--	YES	YES
6 DOEBERL PLACE - F 1	37	30	52	44	14.6	13.4	--	--	YES	YES
18 DOEBERL PLACE - GF	39	32	47	39	7.7	6.8	--	--	--	--
20 DOEBERL PLACE - GF	39	33	51	43	11.5	10.7	--	--	--	--
22 DOEBERL PLACE - GF	39	32	51	43	11.3	10.5	--	--	--	--
24 DOEBERL PLACE - GF	39	32	50	42	10.6	9.6	--	--	--	--
24 DOEBERL PLACE - F 1	40	33	52	44	11.6	11.0	--	--	--	--
26 DOEBERL PLACE - GF	38	31	51	43	12.3	11.4	--	--	YES	--
28 DOEBERL PLACE - GF	38	31	50	42	12.0	10.9	--	--	--	--
28 DOEBERL PLACE - F 1	39	32	52	44	12.9	12.2	--	--	YES	YES
30 DOEBERL PLACE - GF	39	32	53	45	13.6	12.9	--	--	YES	YES
Unit 3, 32 DOEBERL PLACE - GF	39	32	51	43	11.9	11.0	--	--	--	--
Unit 4, 32 DOEBERL PLACE - GF	39	32	52	45	12.7	12.2	--	--	YES	YES
Unit 5, 32 DOEBERL PLACE - GF	40	33	48	40	7.8	6.7	--	--	--	--
Unit 6, 32 DOEBERL PLACE - GF	40	33	49	41	8.2	7.3	--	--	--	--
Unit 7, 32 DOEBERL PLACE - GF	40	33	49	41	9.3	8.4	--	--	--	--
Unit 8, 32 DOEBERL PLACE - GF	40	34	52	44	11.4	10.6	--	--	--	--

Receiver Address	Predicted Noise Levels, dBA				Relative Increase, dBA		'Build' Scenario Exceeds RNP Criteria Day: $L_{Aeq(15hour)}$ 55 dBA Night: $L_{Aeq(9hour)}$ 50 dBA		'Build' Scenario Exceed 12 dB 'Relative Increase Criteria'?	
	'No Build' Scenario		'Build' Scenario							
	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$
Unit 8, 32 DOEBERL PLACE - F 1	42	35	54	47	12.2	11.8	--	--	YES	--
Unit 9, 32 DOEBERL PLACE - GF	40	34	52	45	11.9	11.3	--	--	--	--
Unit 9, 32 DOEBERL PLACE - F 1	42	35	54	47	12.7	12.4	--	--	YES	YES
Unit 10, 32 DOEBERL PLACE - GF	41	34	53	45	12.0	11.4	--	--	--	--
Unit 10, 32 DOEBERL PLACE - F 1	42	35	55	48	13.4	12.9	--	--	YES	YES
Unit 11, 32 DOEBERL PLACE - GF	41	34	53	45	12.3	11.4	--	--	YES	--
Unit 11, 32 DOEBERL PLACE - F 1	42	35	55	48	13.6	12.9	--	--	YES	YES
Unit 12, 32 DOEBERL PLACE - GF	41	34	53	46	12.7	11.8	--	--	YES	--
Unit 12, 32 DOEBERL PLACE - F 1	42	35	56	49	14.2	13.7	1	--	YES	YES
Unit 13, 32 DOEBERL PLACE - GF	41	34	56	49	15.3	14.4	1	--	YES	YES
Unit 13, 32 DOEBERL PLACE - F 1	42	35	58	50	15.7	15.0	2	--	YES	YES
NCA8(A)										
69 RIVER DRIVE - GF	40	33	48	40	7.5	6.3	--	--	--	--
69 RIVER DRIVE - F 1	42	35	49	40	6.9	5.7	--	--	--	--
73 RIVER DRIVE - GF	40	33	48	40	7.7	6.4	--	--	--	--
73 RIVER DRIVE - F 1	41	34	49	41	7.4	6.3	--	--	--	--
75 RIVER DRIVE - GF	40	33	48	40	8.0	6.9	--	--	--	--
78 BARRACKS FLAT DRIVE - GF	38	30	48	40	9.5	9.6	--	--	--	--
78 BARRACKS FLAT DRIVE - F 1	39	32	52	44	13.2	12.2	--	--	YES	YES
79 BARRACKS FLAT DRIVE - GF	39	32	46	38	6.6	6.3	--	--	--	--
80 BARRACKS FLAT DRIVE - GF	39	32	49	41	9.8	8.8	--	--	--	--
80 BARRACKS FLAT DRIVE - F 1	41	33	53	45	11.9	11.8	--	--	--	--

Receiver Address	Predicted Noise Levels, dBA				Relative Increase, dBA		'Build' Scenario Exceeds RNP Criteria Day: $L_{Aeq(15hour)}$ 55 dBA Night: $L_{Aeq(9hour)}$ 50 dBA		'Build' Scenario Exceed 12 dB 'Relative Increase Criteria'?	
	'No Build' Scenario		'Build' Scenario							
	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$
82 BARRACKS FLAT DRIVE - GF	39	32	49	41	9.5	8.6	--	--	--	--
82 BARRACKS FLAT DRIVE - F 1	43	36	51	43	8.5	7.4	--	--	--	--
84 BARRACKS FLAT DRIVE - GF	37	30	46	38	9.7	8.6	--	--	--	--
86 BARRACKS FLAT DRIVE - GF	39	32	46	38	7.4	6.4	--	--	--	--
88 BARRACKS FLAT DRIVE - GF	41	34	46	38	5.8	4.9	--	--	--	--
90 BARRACKS FLAT DRIVE - GF	41	34	52	44	11.7	10.6	--	--	--	--
92 BARRACKS FLAT DRIVE - F 1	42	35	50	42	8.1	7.1	--	--	--	--
94 BARRACKS FLAT DRIVE - GF	42	35	47	39	4.8	3.8	--	--	--	--
96 BARRACKS FLAT DRIVE - GF	39	32	48	40	9.3	8.4	--	--	--	--
96 BARRACKS FLAT DRIVE - F 1	42	35	50	42	8.1	7.1	--	--	--	--
98 BARRACKS FLAT DRIVE - GF	38	31	50	42	11.9	10.9	--	--	--	--
98 BARRACKS FLAT DRIVE - F 1	41	34	52	43	10.3	9.2	--	--	--	--
100 BARRACKS FLAT DRIVE - GF	37	30	49	41	11.7	10.7	--	--	--	--
100 BARRACKS FLAT DRIVE - F 1	41	34	50	42	9.5	8.4	--	--	--	--
104 BARRACKS FLAT DRIVE - GF	38	31	49	41	10.6	10.0	--	--	--	--
105 BARRACKS FLAT DRIVE - GF	41	33	49	40	7.5	7.3	--	--	--	--
105 BARRACKS FLAT DRIVE - F 1	42	34	49	41	7.1	6.9	--	--	--	--
106 BARRACKS FLAT DRIVE - GF	37	30	48	40	10.5	9.4	--	--	--	--
107 BARRACKS FLAT DRIVE - GF	41	33	49	40	7.6	7.4	--	--	--	--
108 BARRACKS FLAT DRIVE - GF	37	29	47	39	10.7	9.7	--	--	--	--
108 BARRACKS FLAT DRIVE - F 1	40	33	49	41	9.3	8.2	--	--	--	--
110 BARRACKS FLAT DRIVE - GF	35	28	50	41	14.2	13.0	--	--	YES	YES

Receiver Address	Predicted Noise Levels, dBA				Relative Increase, dBA		'Build' Scenario Exceeds RNP Criteria Day: $L_{Aeq(15hour)}$ 55 dBA Night: $L_{Aeq(9hour)}$ 50 dBA		'Build' Scenario Exceed 12 dB 'Relative Increase Criteria'?	
	'No Build' Scenario		'Build' Scenario							
	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$
110 BARRACKS FLAT DRIVE - F 1	38	31	51	42	12.2	11.0	--	--	YES	--
112 BARRACKS FLAT DRIVE - GF	39	31	49	41	10.9	10.2	--	--	--	--
114 BARRACKS FLAT DRIVE - GF	37	30	50	42	12.4	11.2	--	--	YES	--
116 BARRACKS FLAT DRIVE - GF	35	28	50	41	14.1	13.0	--	--	YES	YES
116 BARRACKS FLAT DRIVE - F 1	39	32	50	42	11.7	10.5	--	--	--	--
118 BARRACKS FLAT DRIVE - GF	36	29	49	41	12.8	11.6	--	--	YES	--
120 BARRACKS FLAT DRIVE - GF	37	30	49	41	11.4	10.3	--	--	--	--
122 BARRACKS FLAT DRIVE - GF	38	31	47	38	9.0	7.9	--	--	--	--
126A BARRACKS FLAT DRIVE - GF	35	28	47	39	12.1	10.9	--	--	YES	--
126A BARRACKS FLAT DRIVE - F 1	38	31	49	41	11.2	10.0	--	--		--
126B BARRACKS FLAT DRIVE - GF	35	28	48	40	13.1	11.9	--	--	YES	--
126B BARRACKS FLAT DRIVE - F 1	38	31	50	42	11.9	10.8	--	--	--	--
NCA8(B)										
74 BARRACKS FLAT DRIVE - GF	43	36	49	41	5.9	5.0	--	--	--	--
77 BARRACKS FLAT DRIVE - GF	45	38	47	41	2.7	3.0	--	--	--	--
1 WEBBER PLACE - GF	41	34	46	39	5.9	5.6	--	--	--	--
3 WEBBER PLACE - GF	37	30	46	38	9.1	8.4	--	--	--	--
3 WEBBER PLACE - F 1	42	35	48	40	5.8	5.4	--	--	--	--
5 WEBBER PLACE - GF	40	33	46	38	6.5	5.7	--	--	--	--
7 WEBBER PLACE - GF	37	30	46	38	9.4	8.6	--	--	--	--
7 WEBBER PLACE - F 1	42	35	49	41	6.6	5.8	--	--	--	--
9 WEBBER PLACE - GF	40	32	48	40	8.0	7.3	--	--	--	--

Receiver Address	Predicted Noise Levels, dBA				Relative Increase, dBA		'Build' Scenario Exceeds RNP Criteria Day: $L_{Aeq(15hour)}$ 55 dBA Night: $L_{Aeq(9hour)}$ 50 dBA		'Build' Scenario Exceed 12 dB 'Relative Increase Criteria'?	
	'No Build' Scenario		'Build' Scenario							
	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$
9 WEBBER PLACE - F 1	44	37	50	42	6.1	5.2	--	--	--	--
11 WEBBER PLACE - GF	44	36	47	40	3.9	3.2	--	--	--	--
12 WEBBER PLACE - GF	46	39	48	40	2.1	1.5	--	--	--	--
12 WEBBER PLACE - F 1	52	44	53	45	0.9	0.3	--	--	--	--
13 WEBBER PLACE - GF	45	37	48	40	3.5	2.8	--	--	--	--
11 FITZGIBBON PLACE - GF	45	38	45	37	0.7	-0.1	--	--	--	--
13 FITZGIBBON PLACE - GF	47	40	48	41	1.3	0.6	--	--	--	--
15 FITZGIBBON PLACE - GF	49	42	51	43	1.1	0.7	--	--	--	--
16 FITZGIBBON PLACE - GF	50	42	51	43	1.0	0.5	--	--	--	--
17 FITZGIBBON PLACE - GF	52	45	52	45	-0.1	-0.5	--	--	--	--
15 CAROLINE PLACE - GF	52	45	53	45	0.6	0.2	--	--	--	--
17 CAROLINE PLACE - GF	52	45	53	46	1.0	0.6	--	--	--	--
18 CAROLINE PLACE - GF	53	46	52	45	-0.7	-0.9	--	--	--	--
19 CAROLINE PLACE - GF	55	48	56	48	0.5	0.1	1	--	--	--
20 CAROLINE PLACE - GF	57	50	58	50	0.6	0.2	3	--	--	--
12 ALFRED PLACE - GF	57	49	55	48	-1.5	-1.8	--	--	--	--
14 ALFRED PLACE - GF	57	50	55	48	-2.3	-2.5	--	--	--	--
16 ALFRED PLACE - GF	57	50	55	47	-2.5	-2.7	--	--	--	--
18 ALFRED PLACE - GF	57	50	54	47	-2.4	-2.6	--	--	--	--
18 ALFRED PLACE - F 1	58	50	57	50	-0.5	-0.8	2	--	--	--
20 ALFRED PLACE - GF	54	46	52	45	-1.2	-1.4	--	--	--	--
20 ALFRED PLACE - F 1	57	50	56	49	-1.2	-1.4	1	--	--	--

4.6.2 Building Treatments

Specific building treatments may be considered at properties where, after reasonable and feasible road design and traffic management measures have been considered, and the changes in road traffic noise levels involved and exceedance of the RNP criteria are deemed to be insignificant (refer to **Section 3.1.2**), exceedances of the RNP criteria remain.

Following application of the ENMM guidelines to the properties where the RNP criteria for the day or night was predicted, as identified in **Table 14**, the properties that would qualify for building treatments are provided in **Table 15**.

Table 15 Properties to be considered for building treatments

Area	Address and Floor Level	Basis for Inclusion
NCA1	8 Patrick Brick Court - F1	Exceeds day and night limit, change in noise level > 2 dBA
	23 Patrick Brick Court - F1	Exceeds day limit, change in noise level > 2 dBA
	25 Patrick Brick Court - F1	Exceeds day and night limit, change in noise level > 2 dBA
	29 Patrick Brick Court - F1	Exceeds day and night limit, change in noise level > 2 dBA
	31 Patrick Brick Court - F1	Exceeds day and night limit, change in noise level > 2 dBA
	33 Patrick Brick Court - F1	Exceeds day limit, change in noise level > 2 dBA
NCA2	12 Northcliffe Place - GF	Exceeds day limit and relative increase criterion
	23 Northcliffe Place - GF	Exceeds day limit, change in noise level > 2 dBA
NCA3	30 Taylor Place - GF	Exceeds relative increase criterion
	30 Taylor Place - F1	Exceeds relative increase criterion
	32 Taylor Place - F1	Exceeds relative increase criterion
	32 Taylor Place - GF	Exceeds relative increase criterion
	38 Taylor Place - GF	Exceeds relative increase criterion
NCA5	26 Lonergan Drive - GF	Exceeds relative increase criterion
	26 Lonergan Drive - F1	Exceeds relative increase criterion
	33 Lonergan Drive - GF	Exceeds relative increase criterion
	35 Lonergan Drive - GF	Exceeds relative increase criterion
	35 Lonergan Drive - F1	Exceeds relative increase criterion
NCA6	40A Severne Street - GF	Exceeds relative increase criterion
NCA7	130 Barracks Flat Drive - GF	Exceeds relative increase criterion
	130 Barracks Flat Drive - F1	Exceeds relative increase criterion
	132 Barracks Flat Drive - GF	Exceeds relative increase criterion
	6 Doeberl Place (South Building) - GF (Unit 18)	Exceeds relative increase criterion
	6 Doeberl Place (South Building) - F1 (Unit 18)	Exceeds relative increase criterion
	6 Doeberl Place (North Building) - GF (Unit 1)	Exceeds relative increase criterion
	6 Doeberl Place (North Building) - F1 (Unit 1)	Exceeds relative increase criterion
	6 Doeberl Place - GF (Units 10 - 13)	Exceeds relative increase criterion
	6 Doeberl Place - F1 (Units 10 - 13)	Exceeds relative increase criterion
	26 Doeberl Place - GF	Exceeds relative increase criterion
	28 Doeberl Place - F1	Exceeds relative increase criterion
	30 Doeberl Place - GF	Exceeds relative increase criterion
	Unit 4 32 Doeberl Place - GF	Exceeds relative increase criterion
	Unit 8 32 Doeberl Place - F1	Exceeds relative increase criterion
	Unit 9 32 Doeberl Place - F1	Exceeds relative increase criterion
	Unit 10 32 Doeberl Place - F1	Exceeds relative increase criterion

	Unit 11 32 Doeberl Place - GF	Exceeds relative increase criterion
	Unit 11 32 Doeberl Place - F1	Exceeds relative increase criterion
	Unit 12 32 Doeberl Place - G1	Exceeds relative increase criterion
	Unit 12 32 Doeberl Place - F1	Exceeds day limit and relative increase criterion
	Unit 13 32 Doeberl Place - GF	Exceeds day limit and relative increase criterion
	Unit 13 32 Doeberl Place - F1	Exceeds day limit and relative increase criterion
NCA8(A)	78 Barracks Flat Drive - F1	Exceeds relative increase criterion
	110 Barracks Flat Drive - GF	Exceeds relative increase criterion
	110 Barracks Flat Drive - F1	Exceeds relative increase criterion
	114 Barracks Flat Drive - GF	Exceeds relative increase criterion
	116 Barracks Flat Drive - GF	Exceeds relative increase criterion
	118 Barracks Flat Drive - GF	Exceeds relative increase criterion
	126A Barracks Flat Drive - GF	Exceeds relative increase criterion
	126B Barracks Flat Drive - GF	Exceeds relative increase criterion
NCA8(B)	20 Caroline Place - GF	Exceeds day limit, change in noise level > 2 dBA

Building treatments effectively require occupants to keep their windows and doors closed and consequently, alternative ventilation is usually required to maintain adequate air movement.

An obvious disadvantage is that building treatments would not have any effect on road traffic noise levels outside the dwelling, ie in private outdoor space, yard areas and balconies.

The acoustic treatment of individual dwellings is generally not favoured and is generally the final resolution for reasons including:

- It may not be effective for lightweight buildings.
- It provides no protection to outdoor areas.
- Mechanical ventilation is often required, leading to higher energy consumption.

Based on past experience, the following procedure is recommended to determine the extent of specific building treatments that will be required:

- Inspect the relevant properties and determine the status of the dwelling, noting including and not limited to the type of construction, type of interior spaces most exposed to road noise, window sizes, glazing type etc.
- Conduct sound insulation testing to determine the existing noise reduction that can be provided by the existing construction.
- Utilise the road traffic noise predictions to establish if the existing facade construction is sufficient to achieve appropriate internal noise objectives.
- Determine whether any changes/modification/upgrade of the facade element is required based on existing sound insulation properties and type of spaces affected. Typically, if applicable, the weakest elements of the facade are the windows and doors (including the frame system).
- Consult with relevant property owner/occupants in relation to specific personal preferences.
- Determine the most appropriate/preferred method of alternative means of natural ventilation. Examples of suitable products/method include Acoustica Aeropac Ventilator (or similar) or split or ducted systems to draw fresh air from the quiet side of the house to the rooms of concern.

It should be noted that it is common for existing facade constructions to be sufficient to result in acceptable internal noise levels, when all components of the facade are closed. Therefore, in many cases, the extent of building treatment required is the provision of alternative ventilation (subject to individual consultation with the dwelling owners) to ensure sufficient airflow inside the dwelling, so as to meet the relevant requirements of the Building Code of Australia.

It should also be noted that the provision of alternative ventilation may require an upgrade to electrical mains, particularly in older buildings.

5 CONSTRUCTION NOISE AND VIBRATION ASSESSMENT

5.1 Construction Noise

The construction stages typically associated with construction of new road and associated equipment are shown in **Table 16** along with the Sound Power Level (SWL) data for individual items of plant together with the combined SWL for each scenario.

Table 16 Construction Works

Stage	Scenario	Equipment	No of Items	SWL, dBA L_{Aeq}		SWL, dBA L_{Amax}	
				Item	Activity	Item	Activity
1	Clearing and Grubbing, Tree Removal	Excavator (20 tonne)	1	99	109	105	116
		Truck (10 tonne)	1	98		103	
		Chainsaw	1	108		116	
2	Bored piling and precast placement	Bored piling rig	1	108	106	112	112
		Mobile Crane (25 tonne)	2	99		105	
		Truck	2	98		103	
3	Construction of New Kerbs, Drainage Pits and Pipes	Excavator (20 tonne)	1	99	119	105	124
		Truck (10 tonne)	1	98		103	
		Jackhammer[1, 2]	1	108		113	
		Excavator (Breaker)[1, 2]	1	121		124	
		Concrete Truck / Agitator	1	106		112	
		Concrete Pump	1	106		109	
		Vibratory Roller (12 tonne)[1]	1	109		114	
4	Compaction of Road Pavement and Laying of Asphalt Paving	Scraper	1	118	123	123	125
		Dozer	1	110		114	
		Compactor	1	110		116	
		Vibratory Roller	1	109		114	
		Excavator	1	99		105	
		Grader	1	107		115	
		Water truck	1	107		114	
		Excavator mounted drill	1	121		124	
		Asphalt paving machine	1	120		125	
5	Noise Wall Construction	Excavator (20 tonne)	1	99	110	105	112
		Truck (10 tonne)	1	98		103	
		Concrete Truck / Agitator	1	106		112	
		Concrete Pump	1	106		109	
		Mobile Crane (25 tonne)	1	99		105	

1. Denotes an “annoying” item of equipment, as defined in the ICNG, and includes a +5 dBA adjustment
2. Overall SWL assumes a maximum 7.5 minutes “on-time” in any 15-minute period

5.2 Assessment of Construction Noise

It is understood that construction works are to be conducted during 'standard' hours only, as defined in the ICNG. The standard daytime hours are 7:00 am to 6:00 pm Monday to Friday and 8:00 am to 1:00 pm Saturday.

Based on the scenarios and the sound power levels outlined in **Table 16**, construction noise levels have been predicted at the nearest receivers. The highest predicted level in each NCA for the construction stages are shown in **Table 17** along with the likely exceedance relative to the Noise Management Level for each area.

Table 17 Predicted Construction Noise Levels

Area	Construction Noise Level, dBA $L_{Aeq(15minute)}$					Noise Management Level, dBA	Predicted Exceedance, dBA
	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5		
NCA1	52	<30	62	66	53	41	≤ 25
NCA2	52	<30	62	66	53	46	≤ 20
NCA3	54	<30	64	68	55	40	≤ 28
NCA4	52	<30	62	66	53	40	≤ 26
NCA5	57	53	67	71	58	40	≤ 31
NCA6	50	<30	60	64	51	40	≤ 24
NCA7	58	62	68	72	59	40	≤ 32
NCA8	48	60	58	62	49	40	≤ 22

Predicted construction noise levels at the noise-sensitive receptors during the proposed construction scenarios did not exceed 75 dBA $L_{Aeq(15minute)}$ and therefore the receptors would not be considered 'Highly Noise Affected' in the context of the ICNG.

The predicted construction noise levels show that the NMLs were exceeded by up to 31 dBA during standard construction hours. This triggers the investigation and implementation of feasible and reasonable construction noise management and mitigation measures.

The values are representative of a "worst-case scenario' where all equipment listed for each scenario operates at the same time. In practice however, noise levels will depend on the number of plant items and equipment operating at any one time and their precise location relative to a receiver.

Noise levels will also vary due to the movement of plant and equipment about the worksites. In some cases, reductions in noise levels will occur when plant are located in cuttings or behind embankments, buildings or other items of equipment.

It should be noted that the levels of exceedance shown in **Table 17** are not uncommon for projects of this nature. Consequently, it is common and appropriate in these circumstances to apply mitigation measures to minimise noise emissions from construction activities and reduce the likelihood of noise-related complaints.

5.3 Construction Noise Management

To manage potential impacts and mitigate construction noise levels to, where reasonable and feasible, achieve the NMLs, the following measures have been recommended. The ICNG recognises that construction works can be inherently noisy, often required in proximity to noise sensitive receptors and that noise mitigation needs to be appropriate for the temporary nature of the works.

The ICNG and the CNS documents consider the short-term and mobile nature of the proposed construction activities.

Examples of mitigation measures which may be considered appropriate for these works are:

- Use of localised or intervening acoustic screening around significantly noisy items of plant where practicable. Fixed plant items (generators, mixers, concrete pumping etc) may lend themselves to this type of mitigation more readily than mobile plant, however the potential for intervening screening of mobile plant should also be investigated, eg along haul routes, around laydown areas and compounds etc.

  This would be expected to provide between 5 dBA and 10 dBA of additional noise attenuation provided the line-of-sight between all receivers and the construction equipment is broken. The screening is most affective when it is located either close to the noise source or the receiver.
- Schedule the acoustically significant activities/locations to be undertaken predominantly during less noise-sensitive periods, where available and possible. The community should be consulted to assist in identifying less noise sensitive periods.
- Briefing of the work team in order to create awareness of the locality of sensitive receivers and the importance of minimising noise emissions.
- Ensuring any spoil is placed and not dropped into awaiting trucks.
- Use less noise-intensive equipment where reasonable and feasible.
- Fit non-tonal (broadband) reversing alarms to construction vehicles.
- Schedule respite periods where possible.
- Minimise “Out of Hours” works as far as is practicable.

Prior to construction, when more specific information is available in relation to the proposed construction works, it is recommended to prepare a site-specific Construction Noise and Vibration Management Plan (CNVMP).

This would address each major stage of the construction works and identify acoustically significant plant items/activities along with the appropriate mitigation and management measures, consistent with the requirements of the ICNG.

The objectives of the CNVMP are as follows:

- Assist in minimising noise emissions during the construction works.
- Determine noise and vibration monitoring, reporting and response procedures.
- Describe specific mitigation treatments, management methods and procedures to be implemented to control noise and vibration during construction.
- Describe construction timetabling to minimise noise impacts including time and duration restrictions, respite periods and frequency.
- Describe procedures for notifying residents of construction activities likely to affect their amenity through noise and vibration.
- Define contingency plans to be implemented in the event of non-compliances and/or noise complaints.

5.4 Construction Vibration

Some construction activities for the project are considered vibration-intensive including ground treatments (eg compaction, excavations) and pile boring.

The CNS provides guideline safe working distances for typical vibration-intensive plant. The safe working distances reproduced in **Table 18** are minimum separation distances between vibration generating plant and vibration sensitive receptors where the objectives for both human comfort and cosmetic damage are likely to be met in order to minimise potential ground-borne vibration impacts.

The safe working distances for these types of plant can be referenced as a guideline to planning and scheduling the construction works to manage potential impacts at residential receptors.

The propagation of vibration emitted from a source would be site specific with the level of vibration potentially experienced at a receptor dependent upon the vibration energy generated by the source, the predominant frequencies of vibration, the localised geotechnical conditions and the interaction of structures and features which can dampen vibration.

Table 18 Recommended safe working distances for vibration intensive plant

Plant Item	Rating/Description	Safe Working Distance	
		Cosmetic Damage[1]	Human Response[2]
Vibratory Roller	< 50 kN (Typically 1-2 tonnes)	5 m	15 – 20 m
	< 50 kN (Typically 2-4 tonnes)	6 m	20 m
	< 50 kN (Typically 4-6 tonnes)	1 m	40 m
	< 50 kN (Typically 7-13 tonnes)	15 m	100 m
	< 50 kN (Typically 13-18 tonnes)	20 m	100 m
	< 50 kN (Typically > 18 tonnes)	25 m	100 m
Small Hydraulic Hammer	300 kg – 18 to 34t excavator	2 m	7 m
Medium Hydraulic Hammer	1600 kg – 5 to 12t excavator	7 m	23 m
Large Hydraulic Hammer	1600 kg – 12 to 18t excavator	22 m	73 m
Pile Boring	≤ 800 mm	2 m (nominal)	N/A
Jackhammer	Hand held	1 m (nominal)	Avoid contact with structure

1. Referenced from BS 7385
2. Referenced from the AVTG

In applying the recommended safe working distances the following is to be noted:

- The safe working distances are indicative and will vary depending on the particular plant items in use and the local geotechnical conditions.
- The safe working distances for human comfort are considered conservative and have been based on continuous vibration. Intermittent vibration with higher vibration levels occurring over shorter periods would be considered more acceptable.

Where deemed necessary, vibration management measures to minimise risk of cosmetic damage or adverse human response could include:

- Substitution of high vibration generating plant with an alternative lower energy source or alternative construction technique.
- Treatment of the source using vibration damping, vibration isolation and effective maintenance.
- In situ vibration monitoring whereby an alarm is triggered to stop works where measured vibration levels exceeding a nominated vibration goal, such as 3 mm/s, at the station structure.

6 CONCLUSIONS

SLR has considered noise and vibration associated with the construction and operation of the proposed Ellerton Drive Extension project.

The assessment has been conducted in accordance with all legislation, policy and guidelines applicable to road projects in New South Wales.

6.1 Operational Road Traffic Noise

SLR undertook noise monitoring in the vicinity of the proposed road alignment in 2014 (refer to **Section 1.2**). The results of that monitoring were used to establish noise limits for noise from road traffic and Noise Management Levels for the assessment of construction noise. A full description of noise and vibration criteria applicable to the project can be found in **Section 3**.

Road traffic noise modelling was undertaken to predict noise levels associated with vehicles on the proposed road alignment, and to predict future road traffic noise levels in the absence of the proposed road alignment. A description of the modelling process and relevant inputs can be found in **Section 0**.

The predicted noise levels exceeded the project noise limits and consequently noise mitigation was considered. A detailed analysis of noise mitigation options and combinations was undertaken to assist with determining the most "reasonable and feasible" noise mitigation treatments. The noise mitigation treatments are described in **Table 19** and displayed in **Appendix O**.

Table 19 Selected Noise Mitigation Treatments

Area	Barrier Height, m	Barrier Length[1], m	Barrier Type	Wall Location
NCA1	3.0	333	Concrete	Property Boundary
	3.6	177	Concrete	
NCA2	2.4	210[2]	Concrete	Property Boundary
	2.4	116[3]	Concrete	
NCA3	2.4	478	Timber Infill	Outside Shared Pathway
NCA4	2.4	297	Timber Infill	Property Boundary
NCA5	2.4	91	Timber Infill	Outside Shared Pathway
NCA6	n/a	n/a	n/a	n/a
NCA7	4.2	332	Concrete	Road Shoulder outside Kerb
	2.4	55	TBA	Southeast side of bridge
NCA8(A)	4.2	497	Concrete	Outside Shared Pathway
NCA8(B)	4.2	552	Concrete	Outside Shared Pathway

1. Approximate
2. West of Tennyson Drive
3. East of Tennyson Drive

Road traffic noise levels at 43 properties (59 floors) were predicted to remain above the project noise limits after the implementation of the selected noise mitigation treatments. Those properties are detailed in **Table 15** in **Section 4.6.2**. A procedure for determining the extent of building treatments has also been described and it is expected that the provision of alternative ventilation (assuming that windows are closed) would be sufficient in many cases.

6.2 Construction Noise and Vibration

Construction noise levels for the modelled scenarios/activities were predicted to be above the construction NMLs. A range of noise management measures may be established as part of a Construction Noise and Vibration Management Plan to assist in controlling construction noise levels to, where reasonable and feasible, achieve the NMLs at all noise sensitive receptors.

Recommended safe working distances for vibration generating plant have been provided to assist in managing potential ground vibration levels and minimise the potential risk of structural (cosmetic) damage to the residences and adverse response reactions by occupants.

ACOUSTIC TERMINOLOGY

1 Sound Level or Noise Level

The terms "sound" and "noise" are almost interchangeable, except that "noise" often refers to unwanted sound.

Sound (or noise) consists of minute fluctuations in atmospheric pressure capable of evoking the sense of hearing. The human ear responds to changes in sound pressure over a very wide range. The loudest sound pressure to which the human ear responds is ten million times greater than the softest. The decibel (abbreviated as dB) scale reduces this ratio to a more manageable size by the use of logarithms.

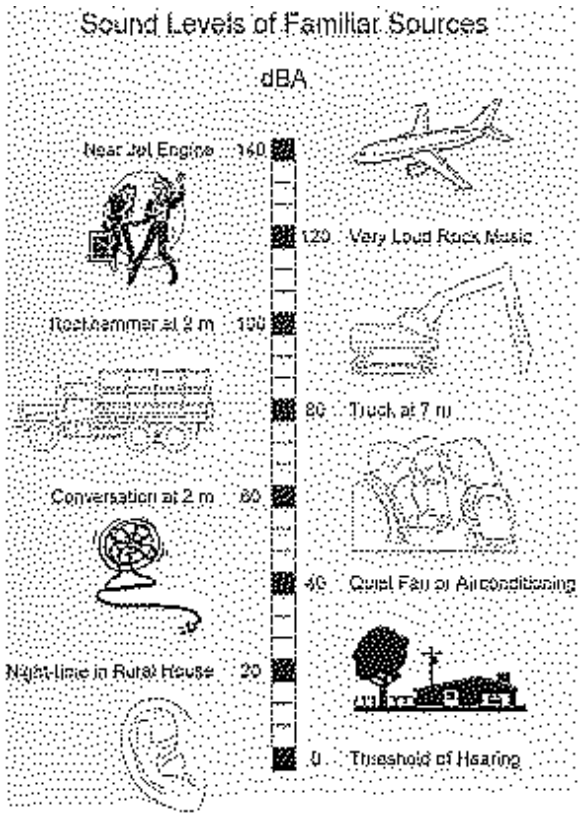
The symbols SPL, L or LP are commonly used to represent Sound Pressure Level. The symbol LA represents A-weighted Sound Pressure Level. The standard reference unit for Sound Pressure Levels expressed in decibels is 2×10^{-5} Pa.

2 "A" Weighted Sound Pressure Level

The overall level of a sound is usually expressed in terms of dBA, which is measured using a sound level meter with an "A-weighting" filter. This is an electronic filter having a frequency response corresponding approximately to that of human hearing.

People's hearing is most sensitive to sounds at mid frequencies (500 Hz to 4000 Hz), and less sensitive at lower and higher frequencies. Thus, the level of a sound in dBA is a good measure of the loudness of that sound. Different sources having the same dBA level generally sound about equally loud.

A change of 1 dBA or 2 dBA in the level of a sound is difficult for most people to detect, whilst a 3 dBA to 5 dBA change corresponds to a small but noticeable change in loudness. A 10 dBA change corresponds to an approximate doubling or halving in loudness. The figure below lists examples of typical noise levels:

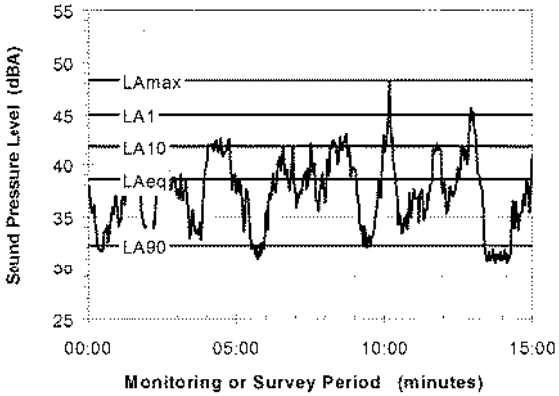


Other weightings (eg B, C and D) are less commonly used than A-weighting. Sound Levels measured without any weighting are referred to as "linear", and the units are expressed as dB(lin) or dB.

3 Statistical Noise Levels

Sounds that vary in level over time, such as road traffic noise and most community noise, are commonly described in terms of the statistical exceedance levels LAN, where LAN is the A-weighted sound pressure level exceeded for N% of a given measurement period. For example, the LA1 is the noise level exceeded for 1% of the time, LA10 the noise exceeded for 10% of the time, and so on.

The following figure presents a hypothetical 15 minute noise survey, illustrating various common statistical indices of interest.



Of particular relevance, are:

L_{A1} The noise level exceeded for 1% of the 15 minute interval and is commonly used for the assessment of short-term noise events. It is often similar in value to the L_{Amax} level.

L_{A10} The noise level exceed for 10% of the 15 minute interval. This is commonly referred to as the 'average maximum noise level'.

$L_{A10(18hour)}$ The arithmetic average of the 18 hourly L_{A10} noise levels between 6:00 am and midnight. It is a widely used descriptor of traffic noise in Australia.

L_{Aeq} The A-weighted equivalent noise level (basically the average noise level). It is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.

$L_{Aeq(T)}$ The L_{Aeq} evaluated over a time period, T.

L_{A90} The noise level exceeded for 90% of the sample period. This noise level is described as the average minimum background sound level (in the absence of the source under consideration), or simply the background level.

L_{Amax} The "maximum noise level" for an event, commonly used in the assessment of potential sleep disturbance during night-time periods.

4 Free Field and Facade Reflections

"Free field" describes a microphone position where there are no reflecting surfaces, other than the ground, close enough to influence the sound pressure level. A position at least 4 m from the closest vertical surface, eg a building facade, is considered free field.

A microphone position closer than 4 m to a reflective surface may be affected by reflected noise. It is common to consider reflected noise by adjusting a predicted noise level by +2.5 dBA to account for the facade that will be there in the future, particularly in the context of road traffic noise.

5 Steady State and Time-varying Noise

Noise whose average characteristics remain relatively constant or do not vary over time are referred to as steady-state noise, eg noise from an airconditioner.

Time-varying noise describes noise that fluctuates in level over time, eg road traffic noise.

6 Assessment Background Level (ABL) and Rating Background Level (RBL) Analysis

The ABL of measured L_{A90} values in each period is determined using the "tenth percentile" method, ie it is the value of the measurement that appears at the tenth percentile position when all values have been placed in ascending order.

For example, for a set of 16 x 15-minute noise values observed over the 4-hour evening period, the value in position 1.6 on the list will be the ABL. Note that the position number is always rounded up where a whole number is the tenth percentile position. Therefore, in this example, the value in position 2 will be the ABL for the evening period.

The RBL (denoted as minLA90,1hour) is the overall single-figure background level representing each assessment period (day/evening/night) over the monitoring period (as opposed to over each day, evening and night period used for the ABL).

It is the median value of the corresponding day/evening/night ABL values. For example, for monitoring conducted over a 7-day period, the evening RBL is the median of the seven evening ABL values, ie the fourth highest (or lowest) value. Where this level is found to be less than 25 dBA, the RBL is set to 25 dBA.

7 Background Creep

This occurs when the background noise levels progressively creep higher and higher over time with the establishment of new developments in an area, causing the gradual degradation of the acoustic environment of affected receptors.

8 Vibration

Vibration may be defined as cyclic or transient motion. This motion can be measured in terms of its displacement, velocity or acceleration. Most assessments of human response to vibration or the risk of damage to buildings use measurements of vibration velocity. These may be expressed in terms of "peak" velocity or "rms" velocity.

The former is the maximum instantaneous velocity, without any averaging, and is sometimes referred to as "peak particle velocity", or PPV. The latter incorporates "root mean squared" averaging over some defined time period.

Vibration measurements may be carried out in a single axis or alternatively as triaxial measurements. Where triaxial measurements are used, the axes are commonly designated vertical, longitudinal (aligned toward the source) and transverse.

The common units for velocity are millimetres per second (mm/s). As with noise, decibel units can also be used, in which case the reference level should always be stated.

A vibration level V, expressed in mm/s can be converted to decibels by the formula $20 \log (V/Vo)$, where Vo is the reference level (10^{-9} m/s). Care is required in this regard, as other reference levels may be used by some organizations.

9 Human Perception of Vibration

People are able to "feel" vibration at levels lower than those required to cause even superficial damage to the most susceptible classes of building (even though they may not be disturbed by the motion). An individual's perception of motion or response to vibration depends very strongly on previous experience and expectations, and on other connotations associated with the perceived source of the vibration. For example, the vibration that a person responds to as "normal" in a car, bus or train is considerably higher than what is perceived as "normal" in a shop, office or dwelling.

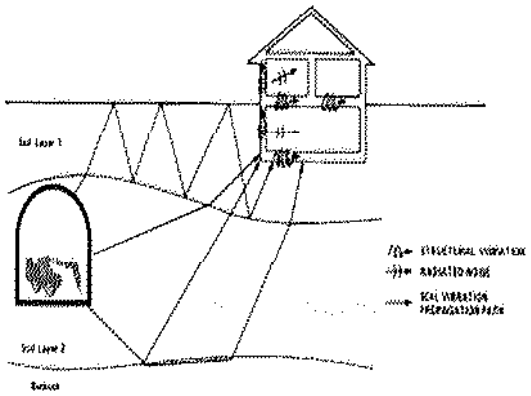
10 Ground-borne Noise, Structure-borne Noise and Regenerated Noise

Noise that propagates through a structure as vibration and is radiated by vibrating wall and floor surfaces is termed "structure-borne noise", "ground-borne noise" or "regenerated noise". This noise originates as vibration and propagates between the source and receiver through the ground and/or building structural elements, rather than through the air.

Typical sources of ground-borne or structure-borne noise include tunnelling works, underground railways, excavation plant (eg rockbreakers), and building services plant (eg fans, compressors and generators).

The term "regenerated noise" is also used in other instances where energy is converted to noise away from the primary source. One example would be a fan blowing air through a discharge grill. The fan is the energy source and primary noise source. Additional noise may be created by the aerodynamic effect of the discharge grill in the airstream. This secondary noise is referred to as regenerated noise:

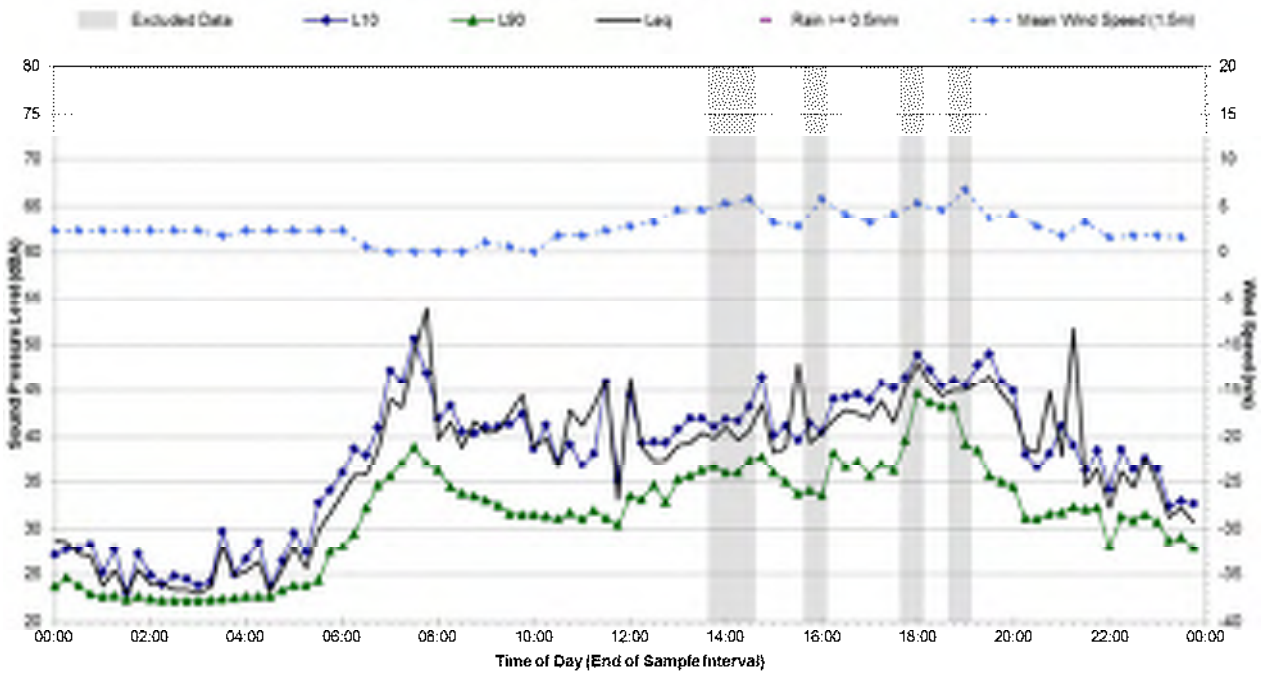
The following figure presents the various paths by which vibration and ground-borne noise may be transmitted between a source and receiver for construction activities occurring within a tunnel:



NOISE LOGGING CHARTS – 55 THOMAS ROYAL GARDEN

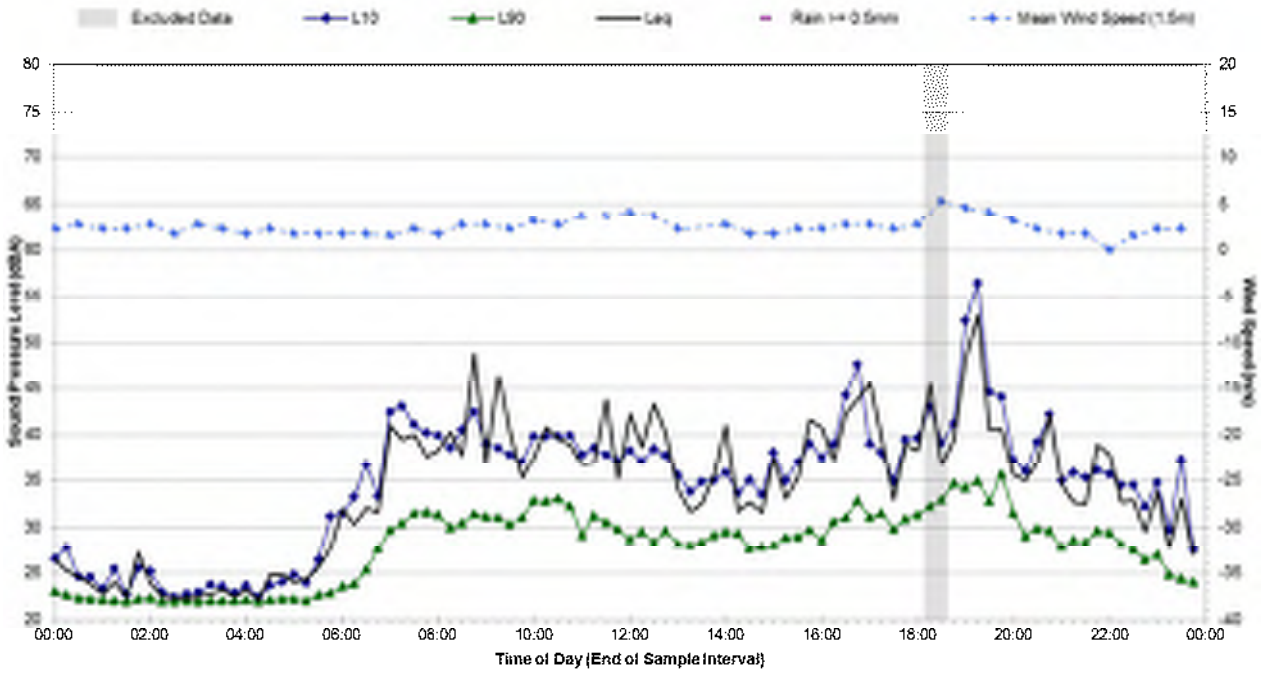
Statistical Ambient Noise Levels

55 Thomas Royal Gardens - Friday, March 14, 2014



Statistical Ambient Noise Levels

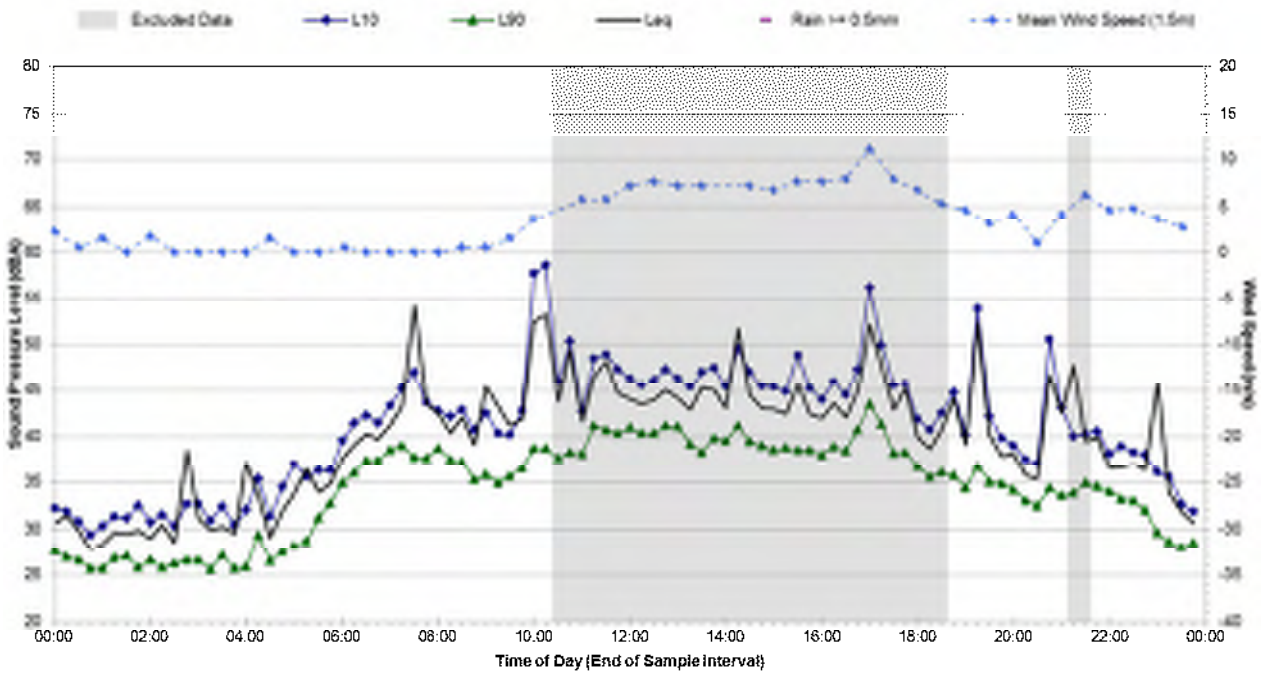
55 Thomas Royal Gardens - Thursday, March 13, 2014



NOISE LOGGING CHARTS – 55 THOMAS ROYAL GARDEN

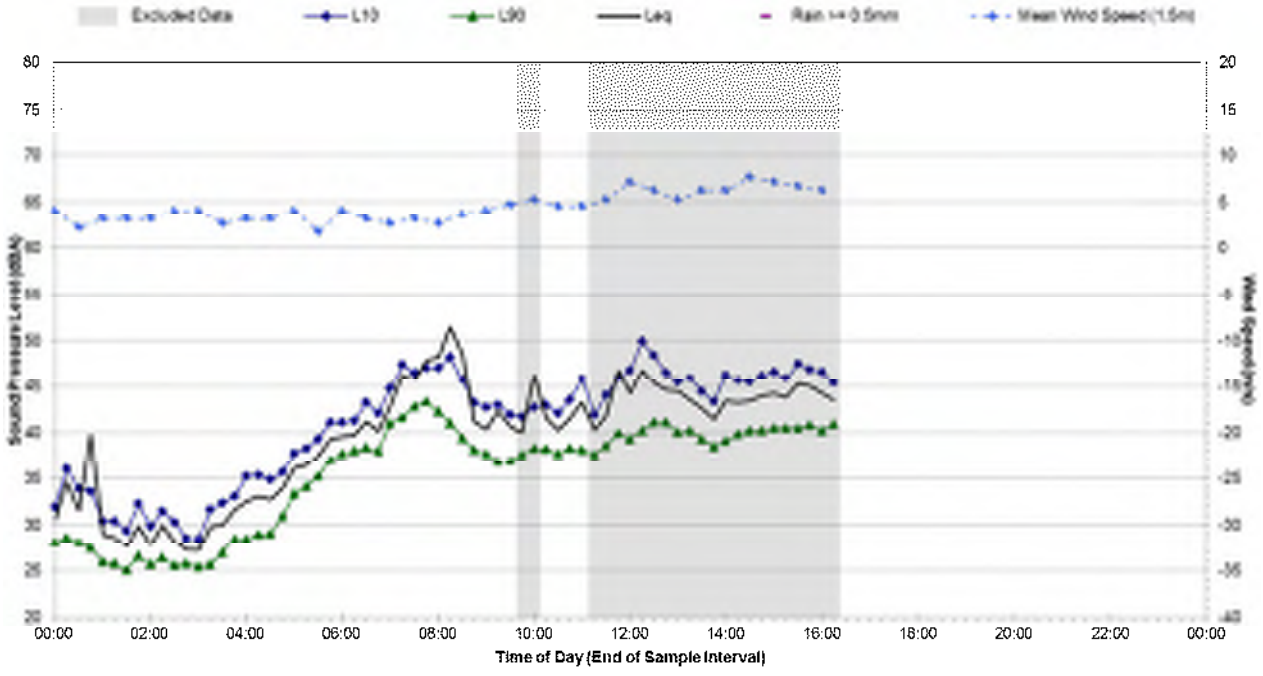
Statistical Ambient Noise Levels

55 Thomas Royal Gardens - Saturday, March 15, 2014

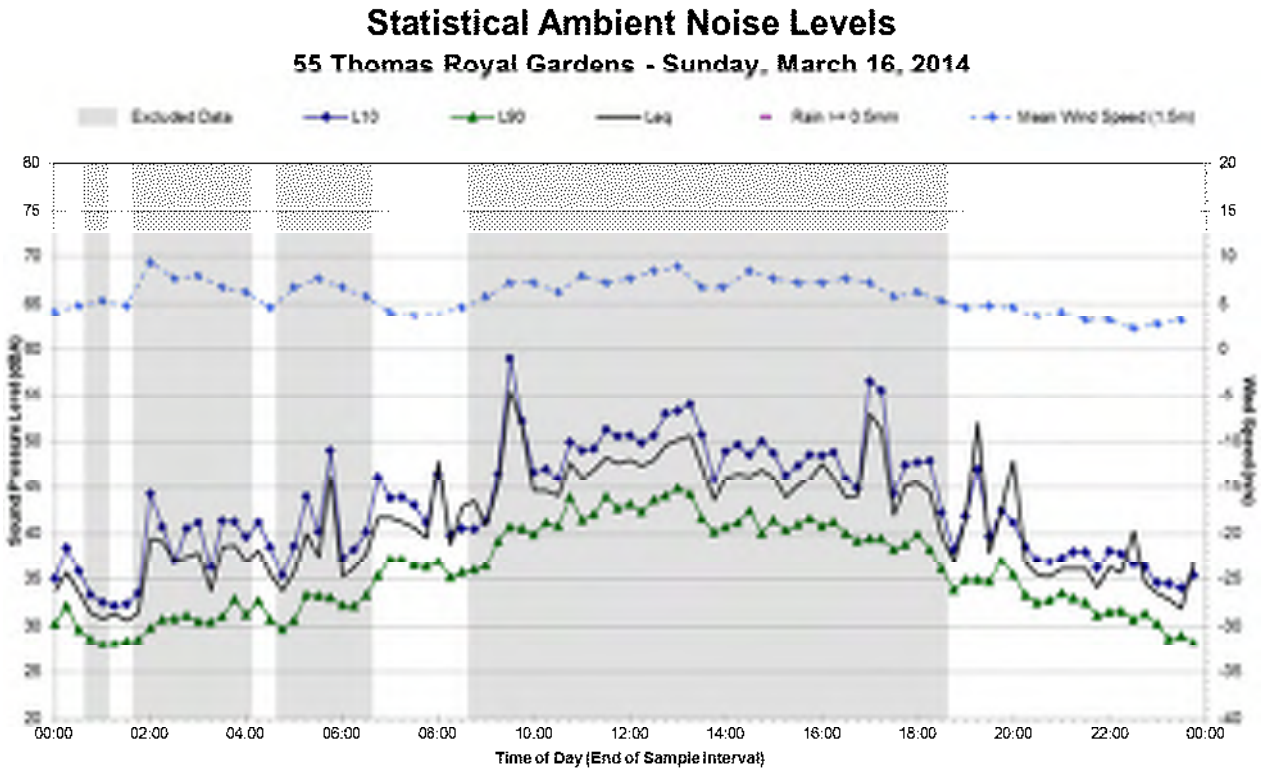


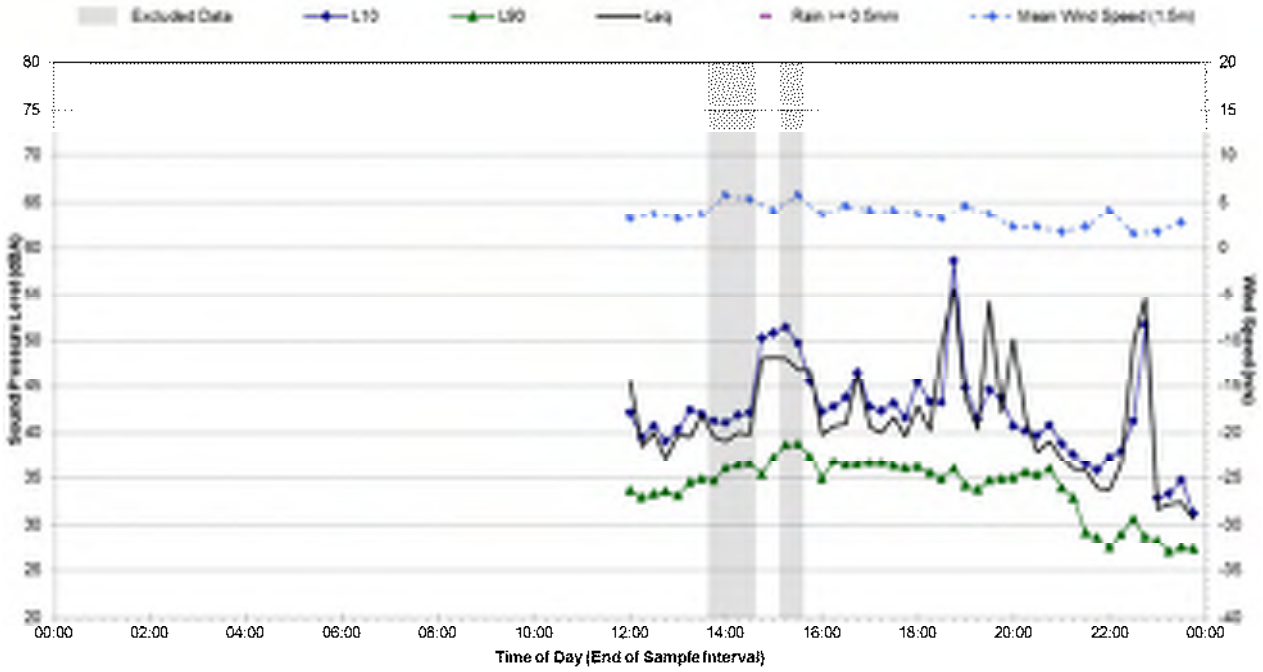
Statistical Ambient Noise Levels

55 Thomas Royal Gardens - Monday, March 17, 2014



NOISE LOGGING CHARTS – 55 THOMAS ROYAL GARDEN

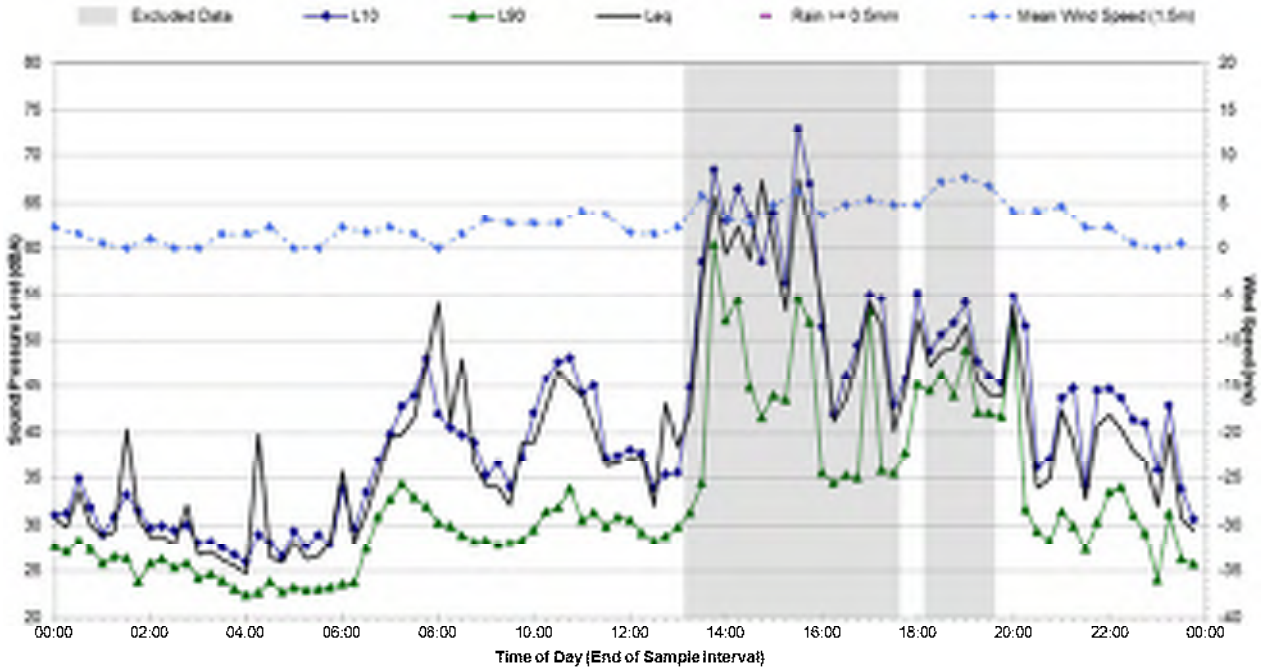




NOISE LOGGING CHARTS – 55 THOMAS ROYAL GARDEN

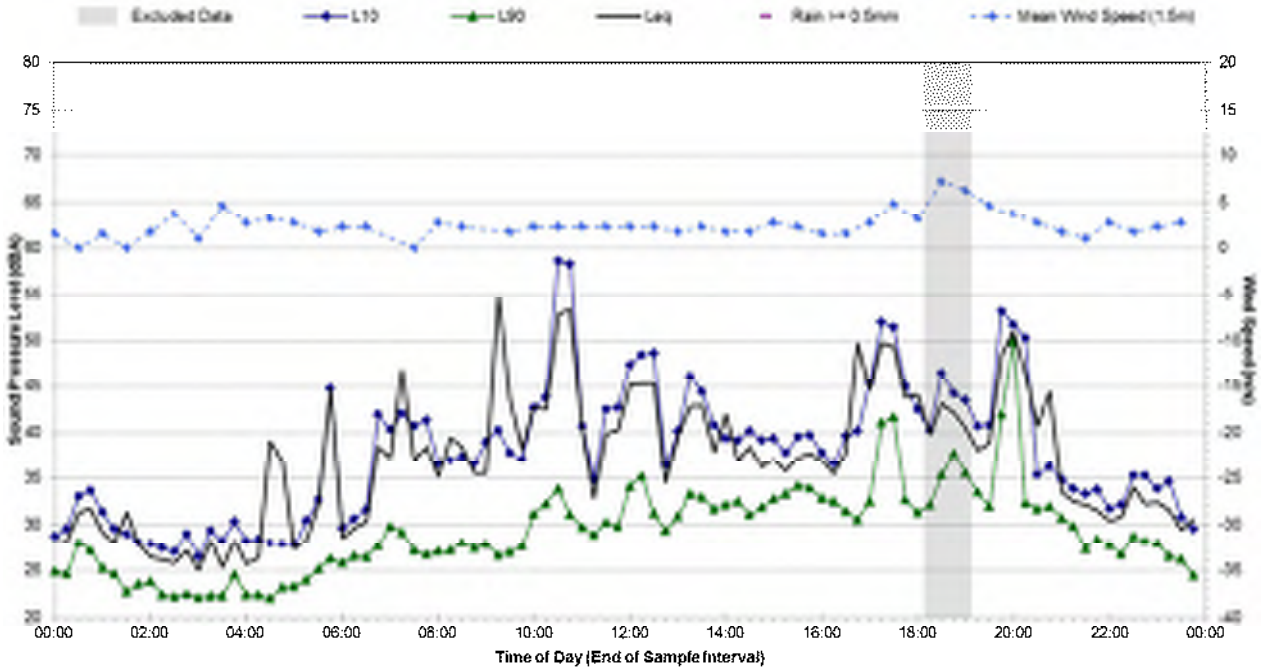
Statistical Ambient Noise Levels

55 Thomas Royal Gardens - Saturday, March 08, 2014



Statistical Ambient Noise Levels

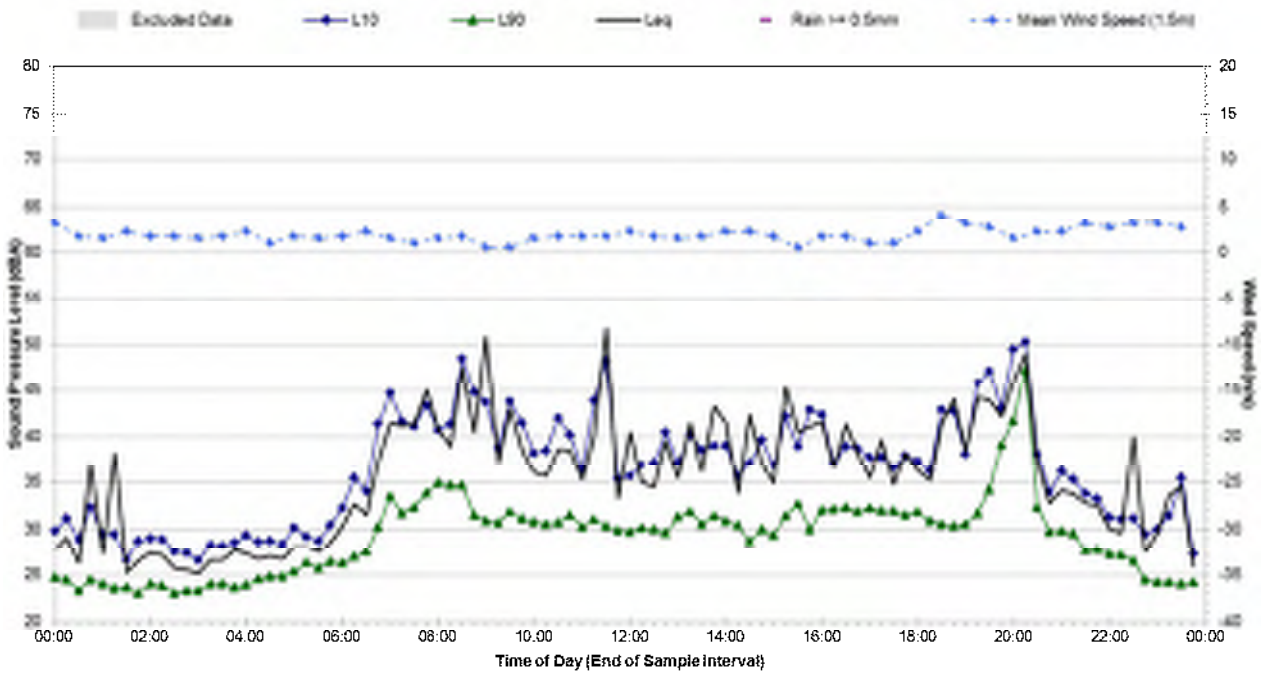
55 Thomas Royal Gardens - Sunday, March 09, 2014



NOISE LOGGING CHARTS – 55 THOMAS ROYAL GARDEN

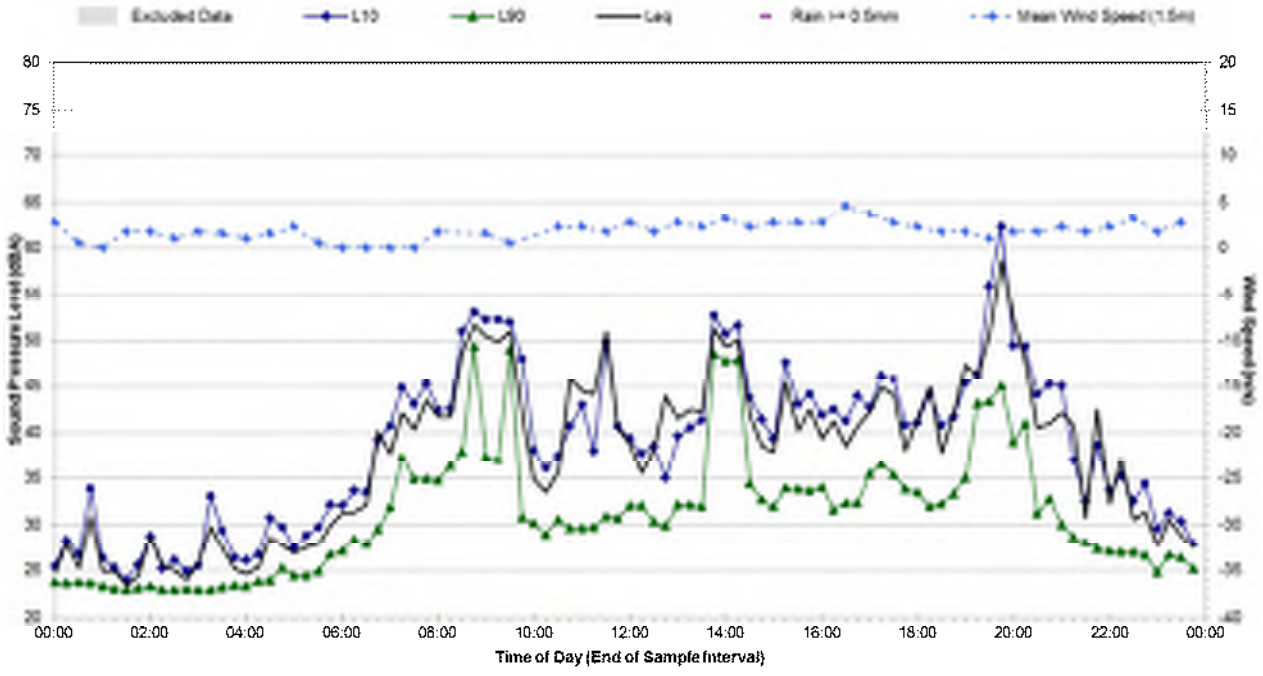
Statistical Ambient Noise Levels

55 Thomas Royal Gardens - Monday, March 10, 2014

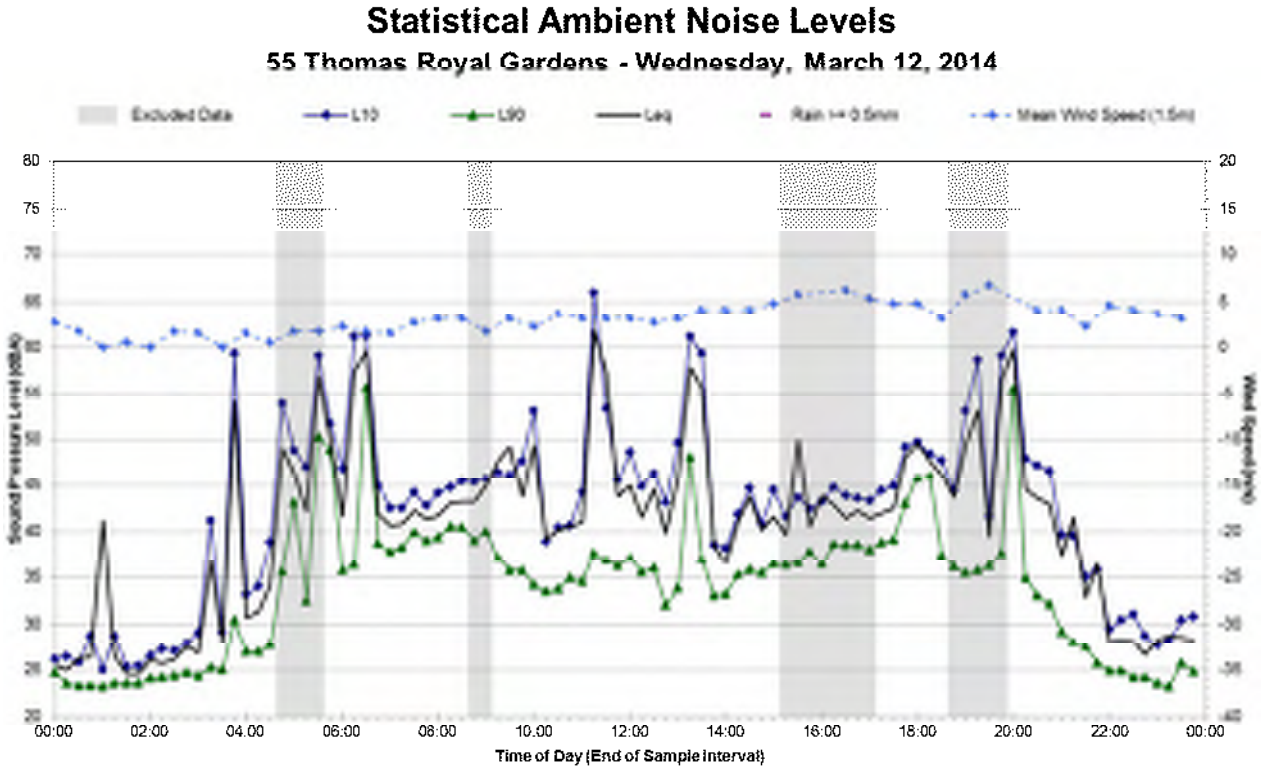


Statistical Ambient Noise Levels

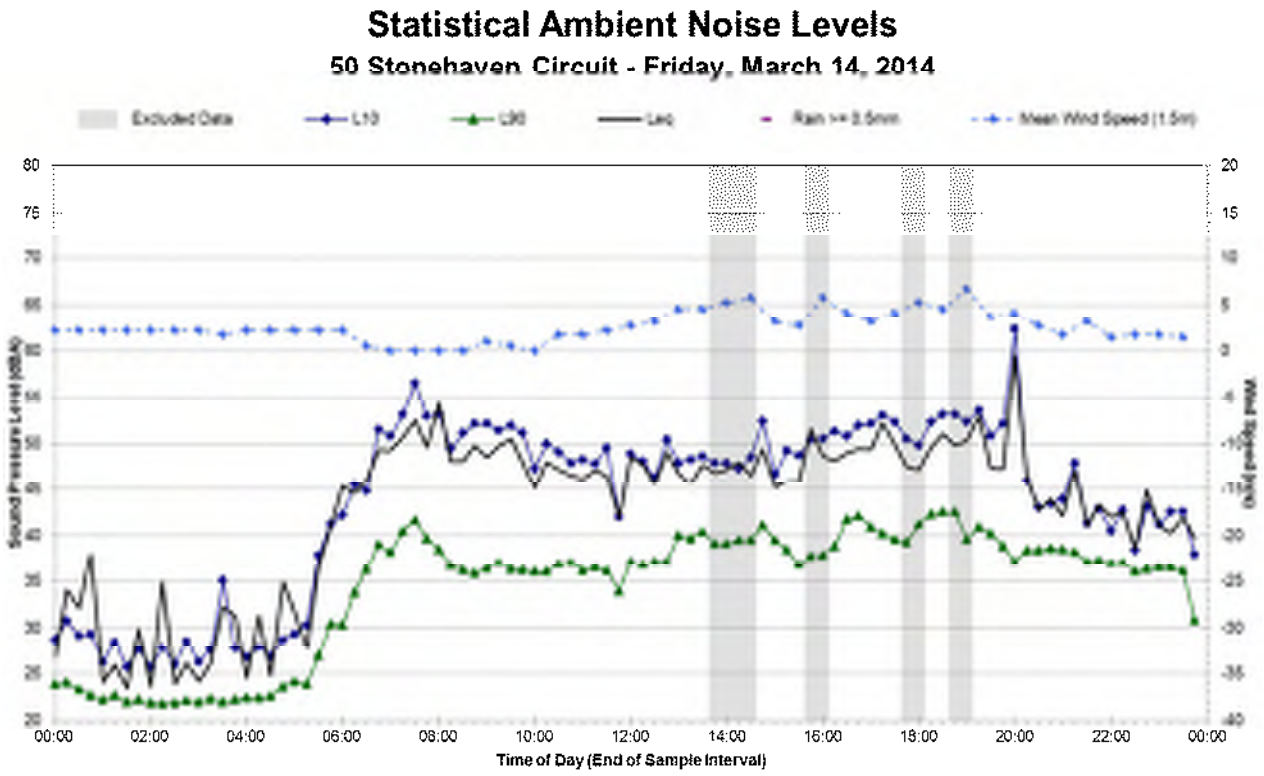
55 Thomas Royal Gardens - Tuesday, March 11, 2014

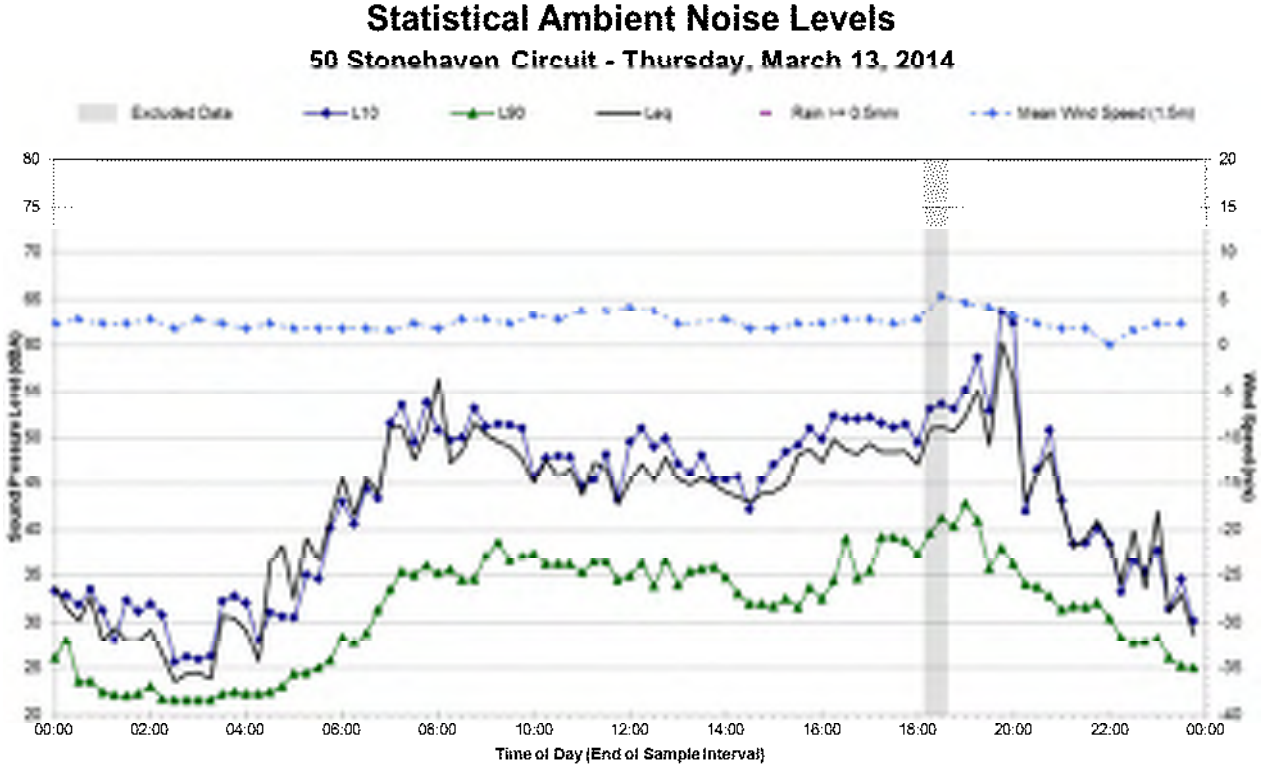


NOISE LOGGING CHARTS – 55 THOMAS ROYAL GARDEN

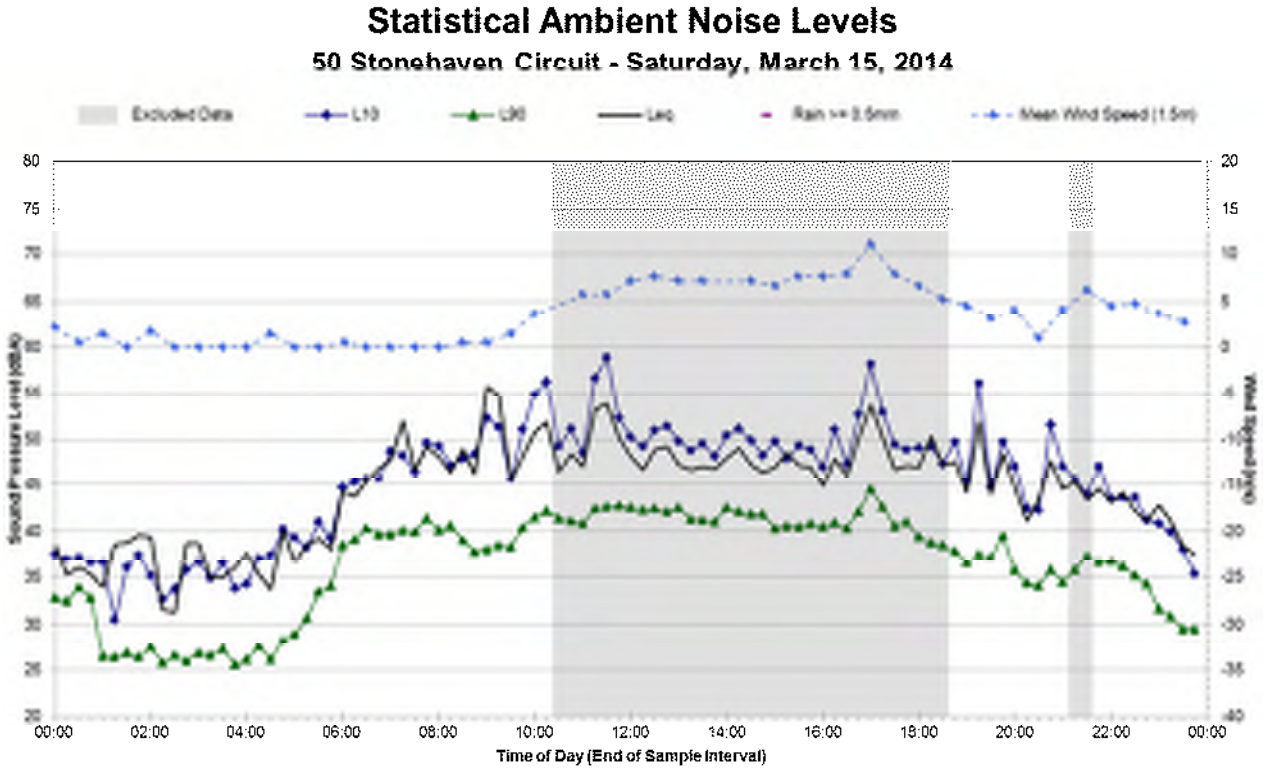


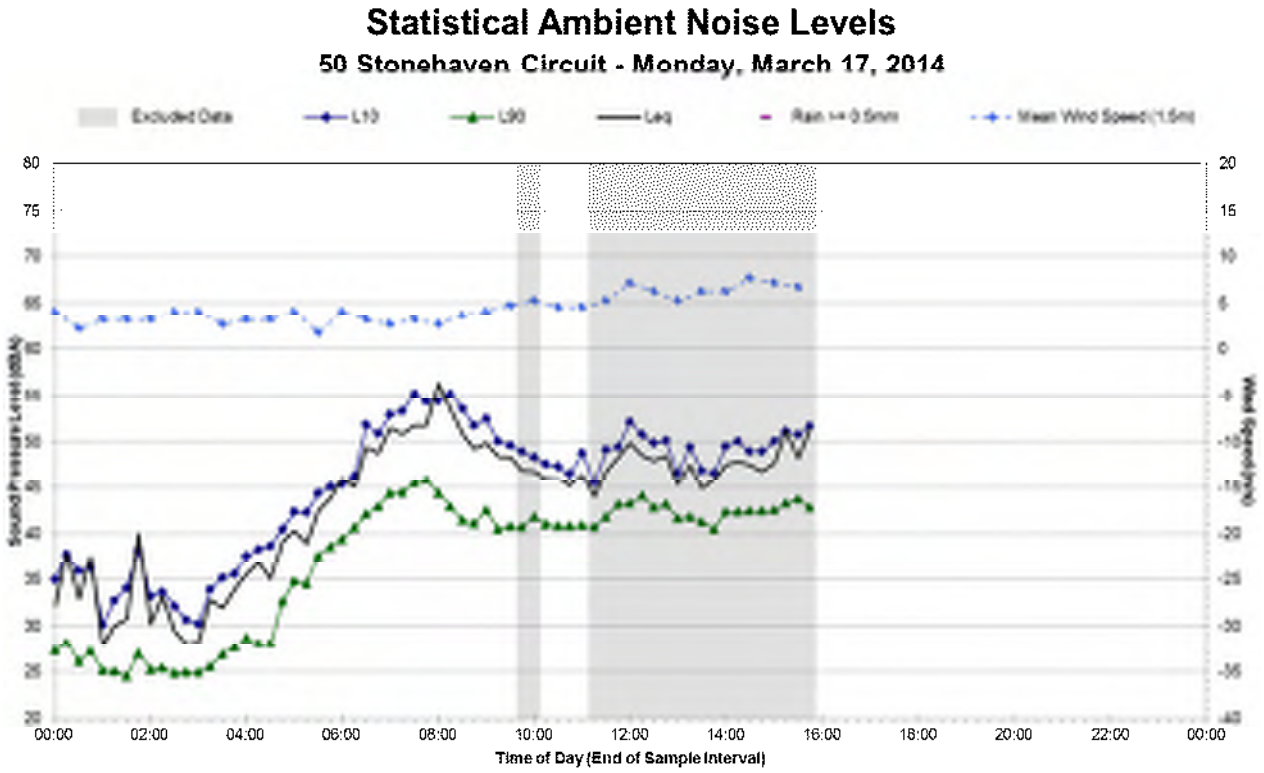
NOISE LOGGING CHARTS – 50 STONEHAVEN CIRCUIT





NOISE LOGGING CHARTS – 50 STONEHAVEN CIRCUIT

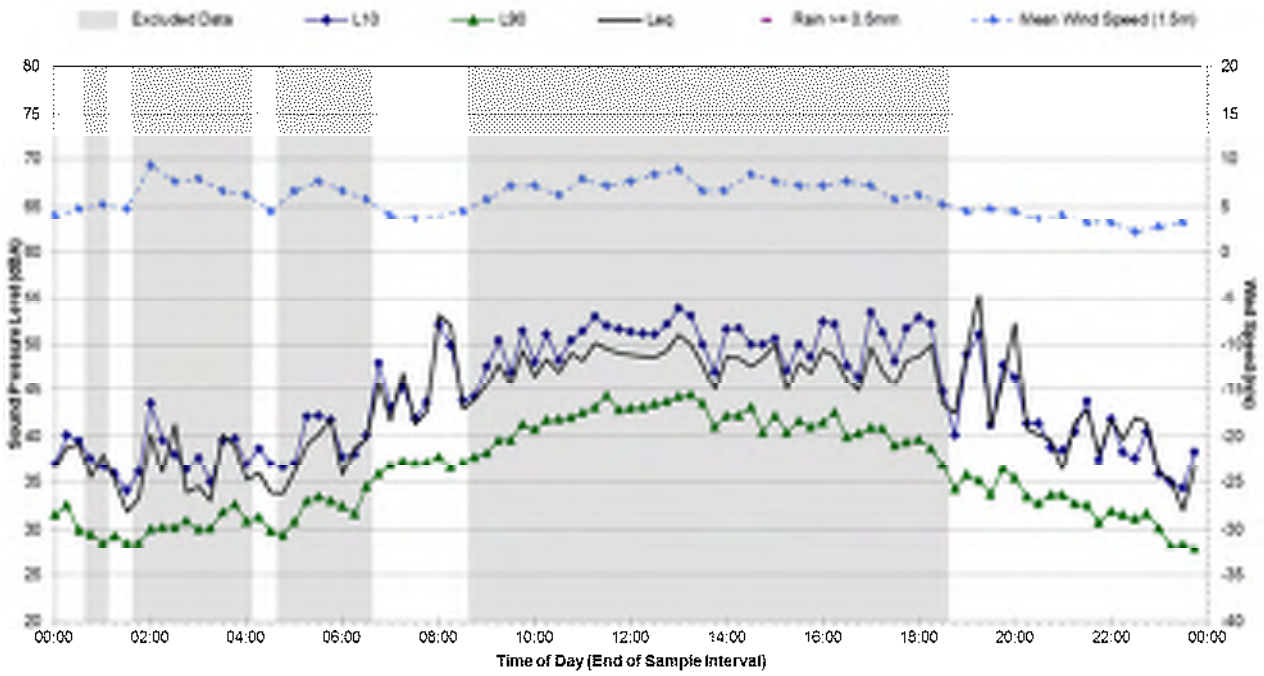




NOISE LOGGING CHARTS – 50 STONEHAVEN CIRCUIT

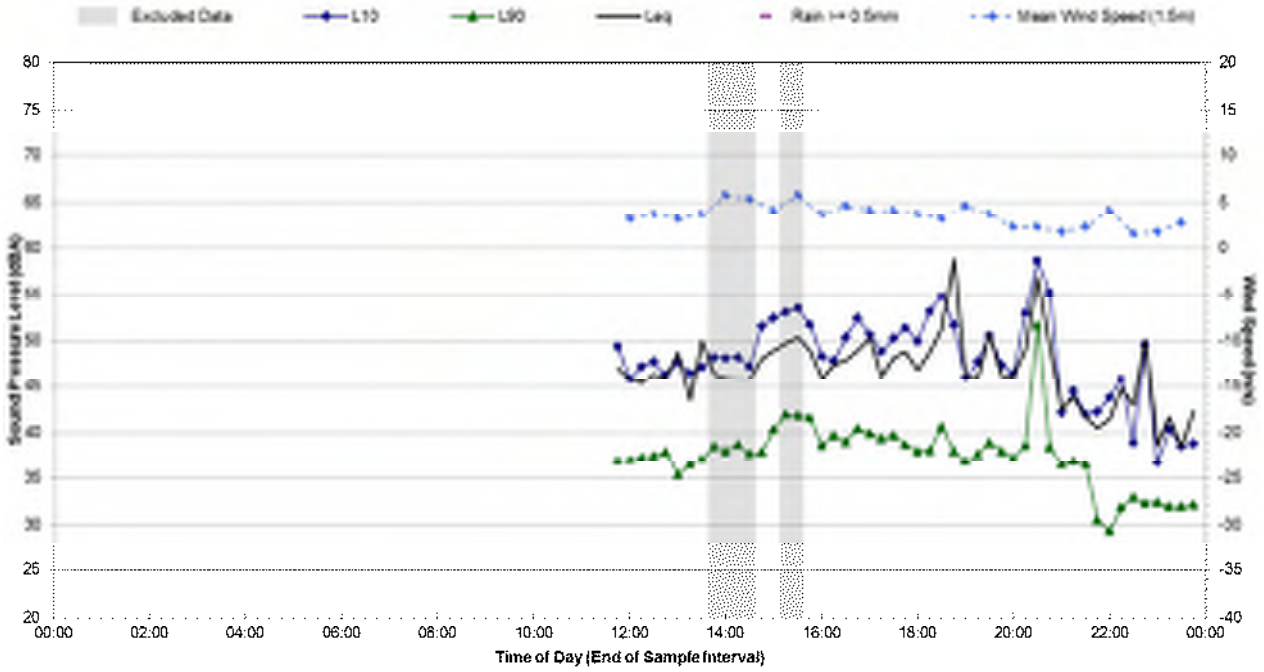
Statistical Ambient Noise Levels

50 Stonehaven Circuit - Sunday, March 16, 2014

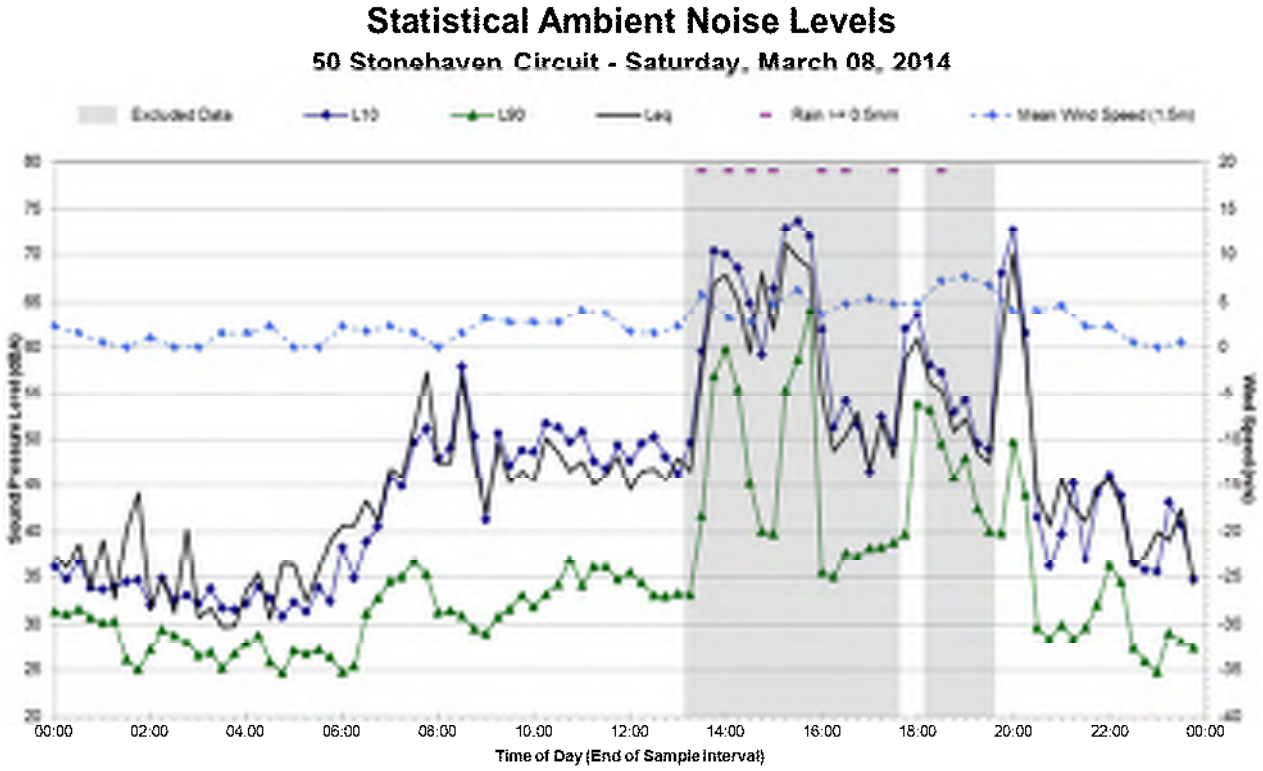


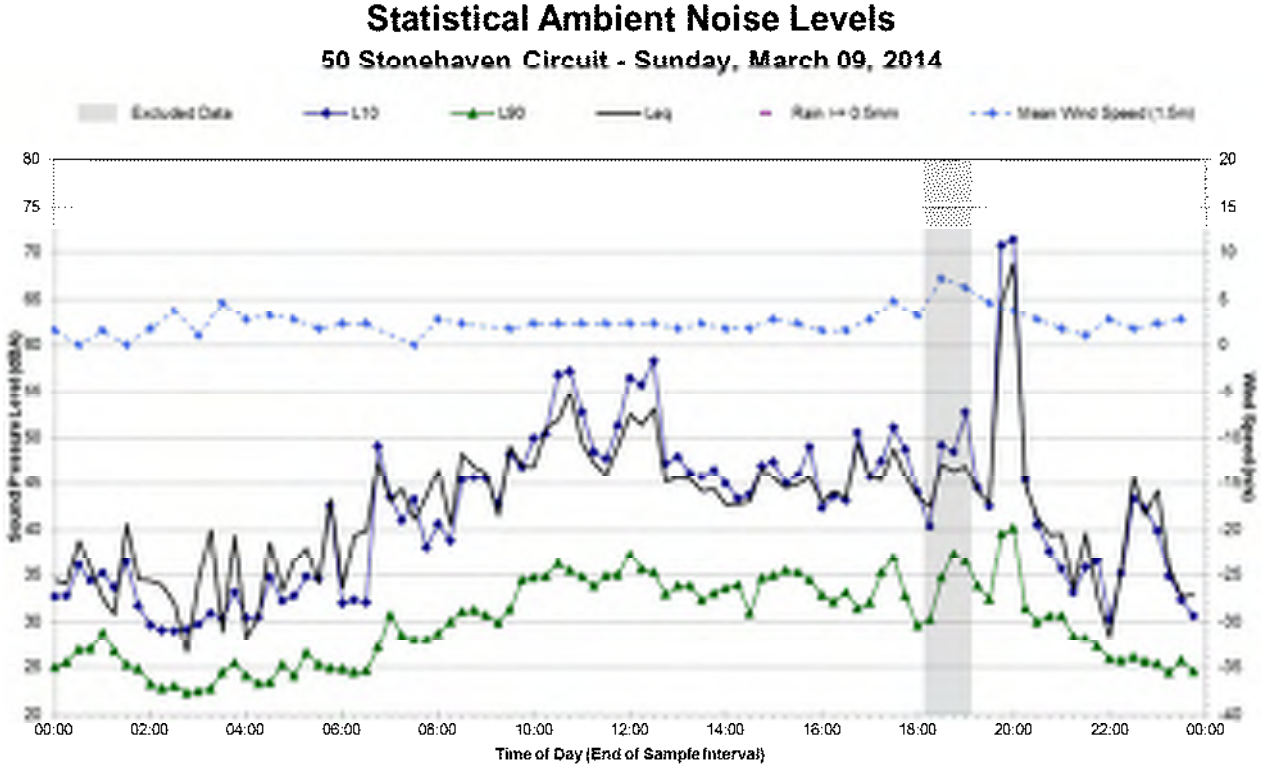
Statistical Ambient Noise Levels

50 Stonehaven Circuit - Friday, March 07, 2014



NOISE LOGGING CHARTS – 50 STONEHAVEN CIRCUIT

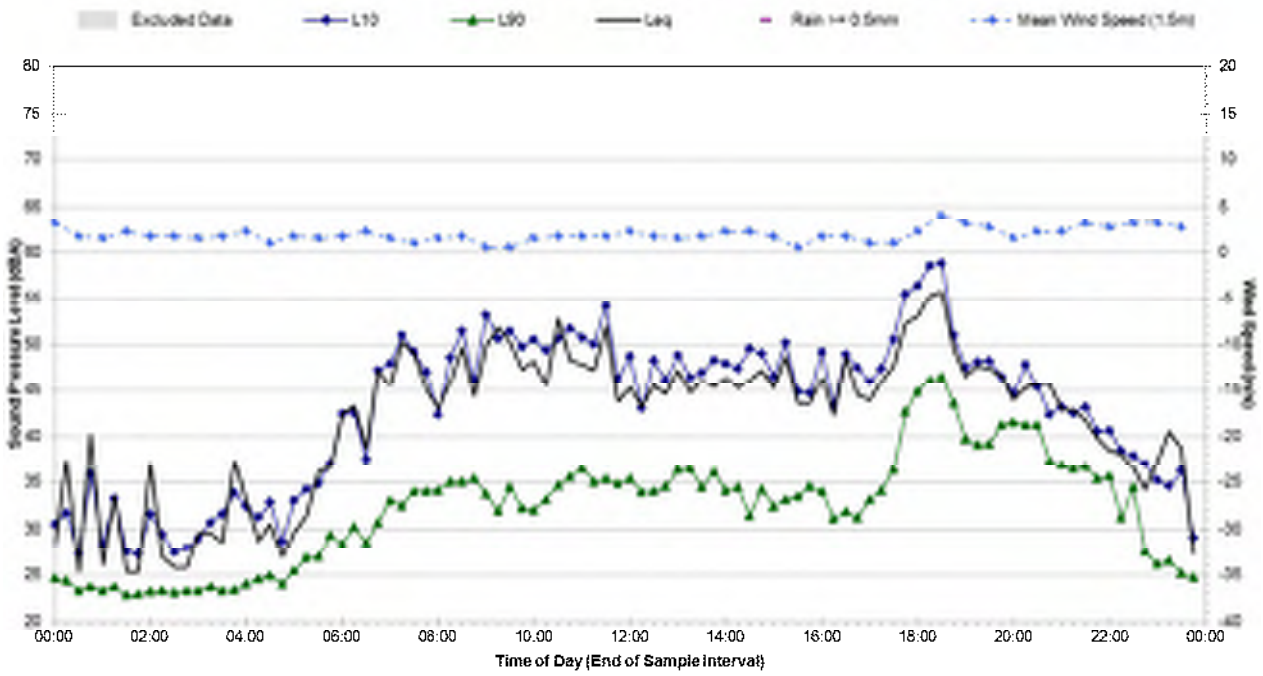




NOISE LOGGING CHARTS – 50 STONEHAVEN CIRCUIT

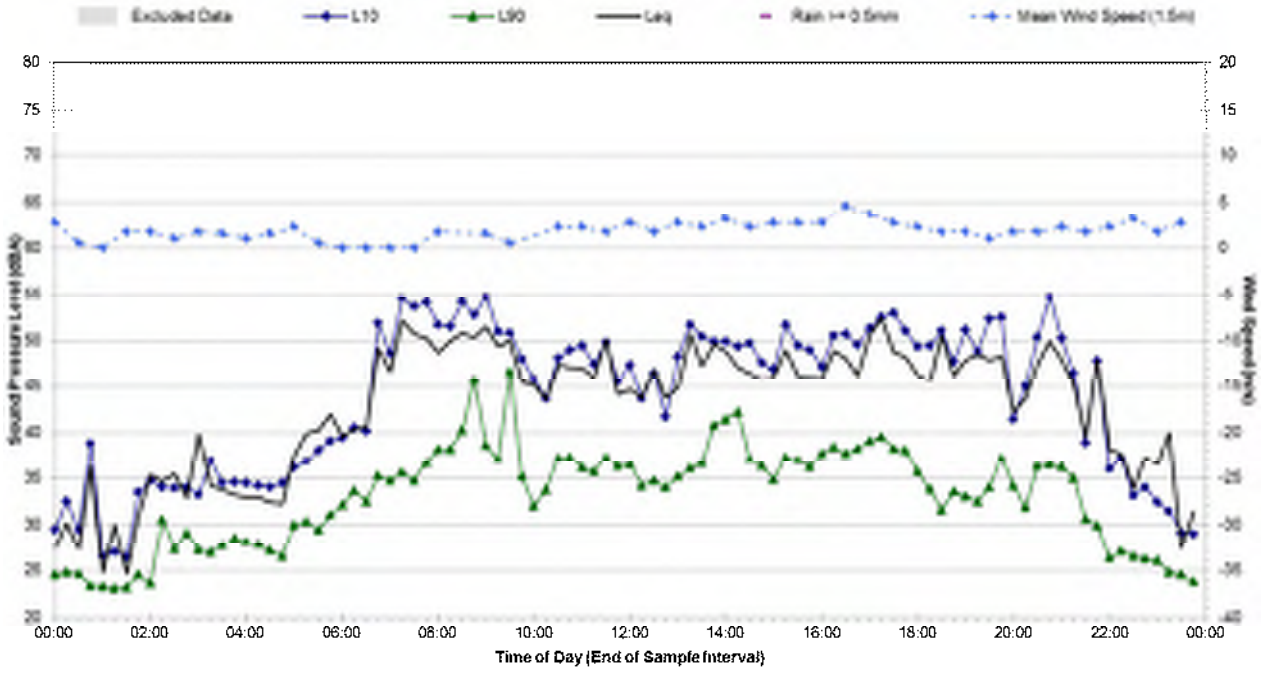
Statistical Ambient Noise Levels

50 Stonehaven Circuit - Monday, March 10, 2014

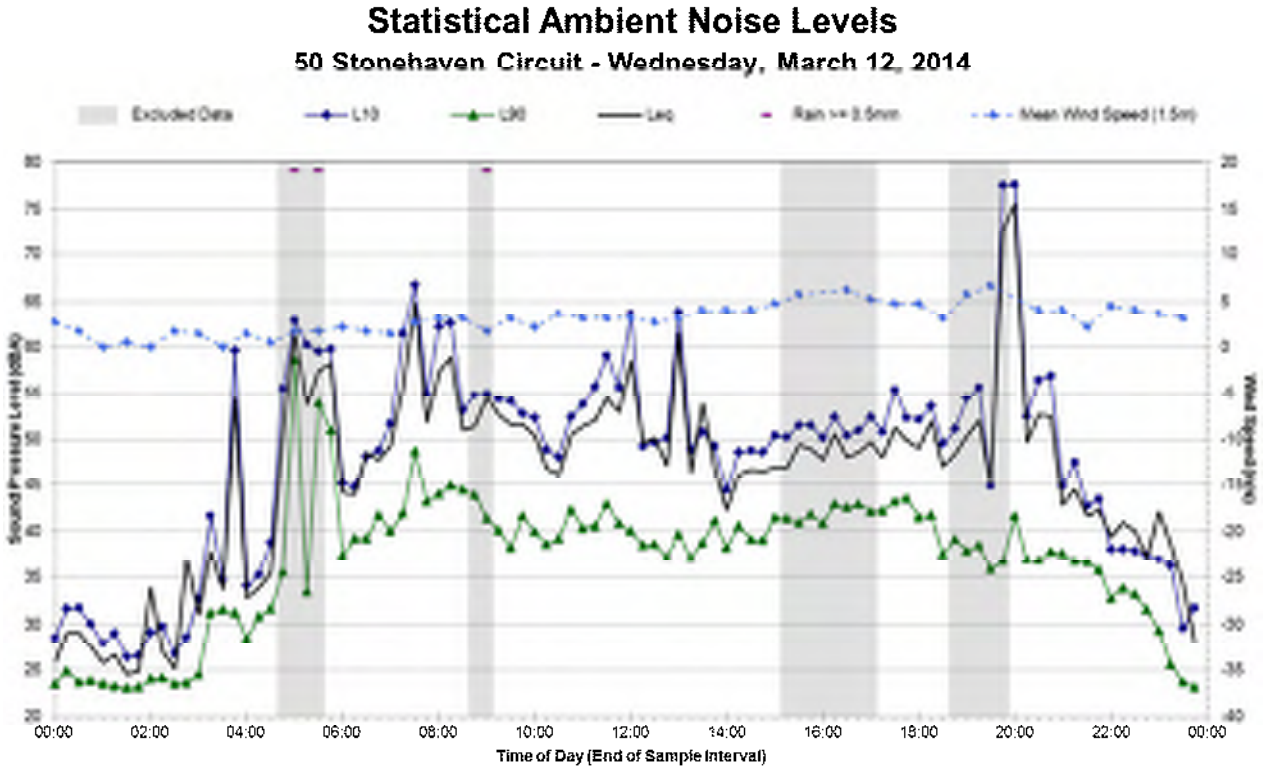


Statistical Ambient Noise Levels

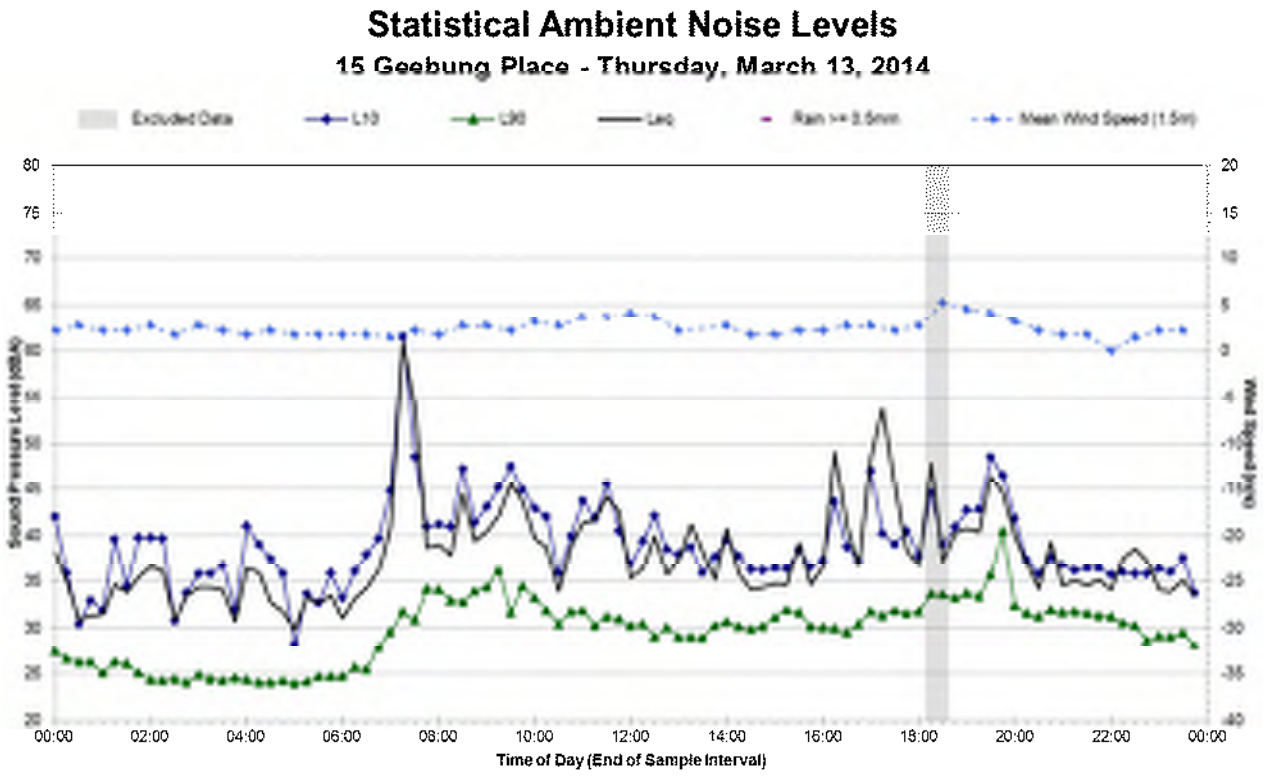
50 Stonehaven Circuit - Tuesday, March 11, 2014

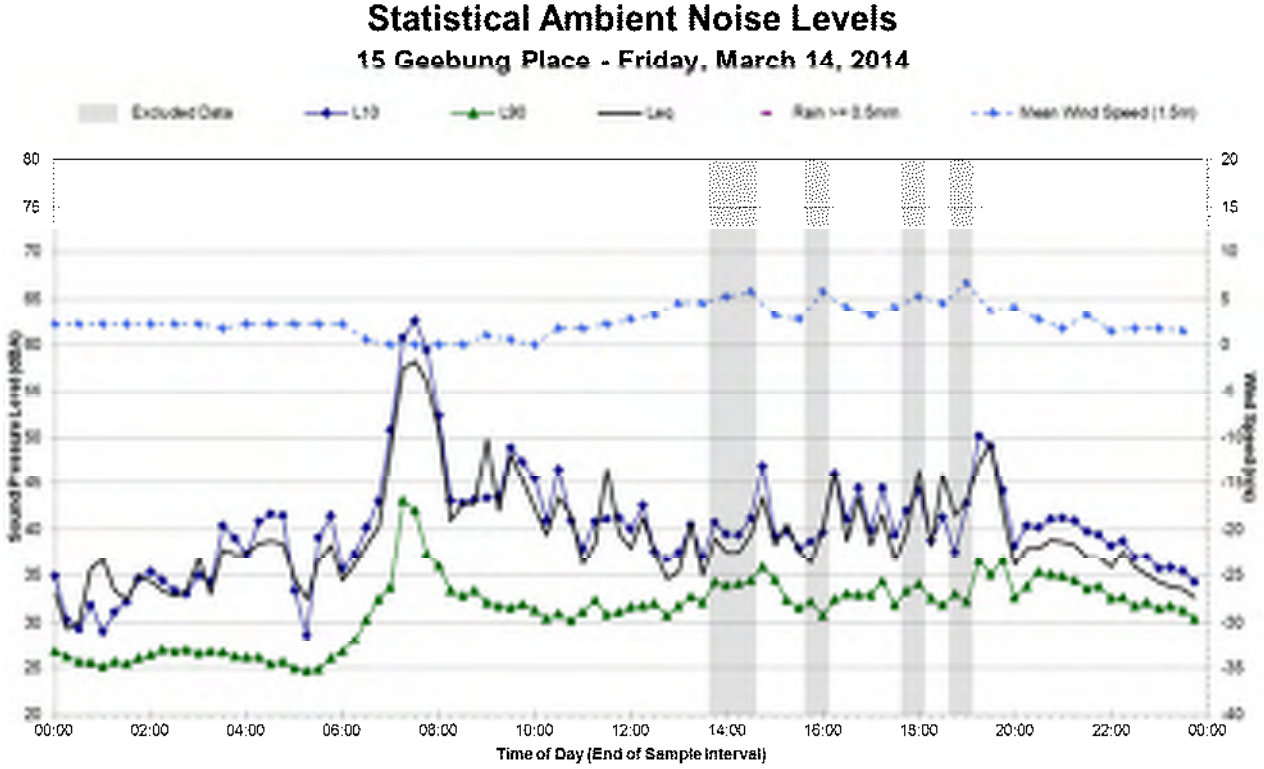


NOISE LOGGING CHARTS – 50 STONEHAVEN CIRCUIT

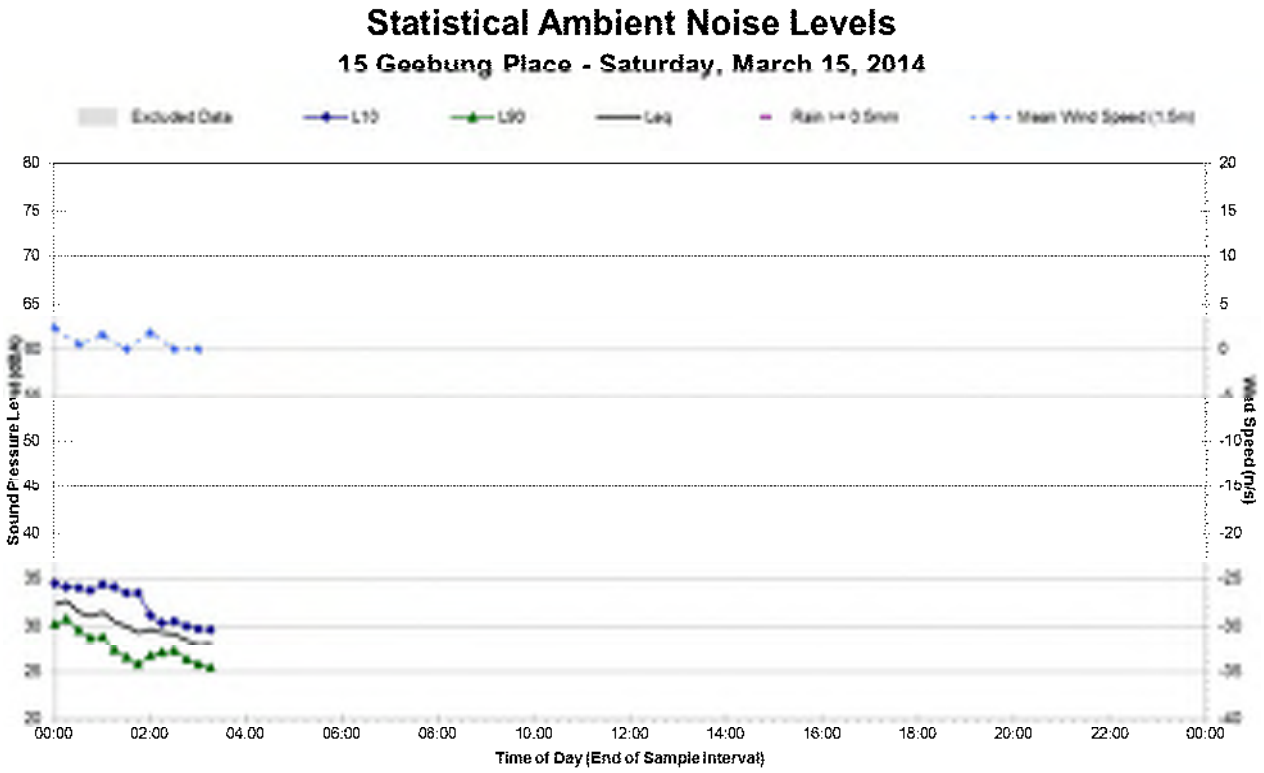


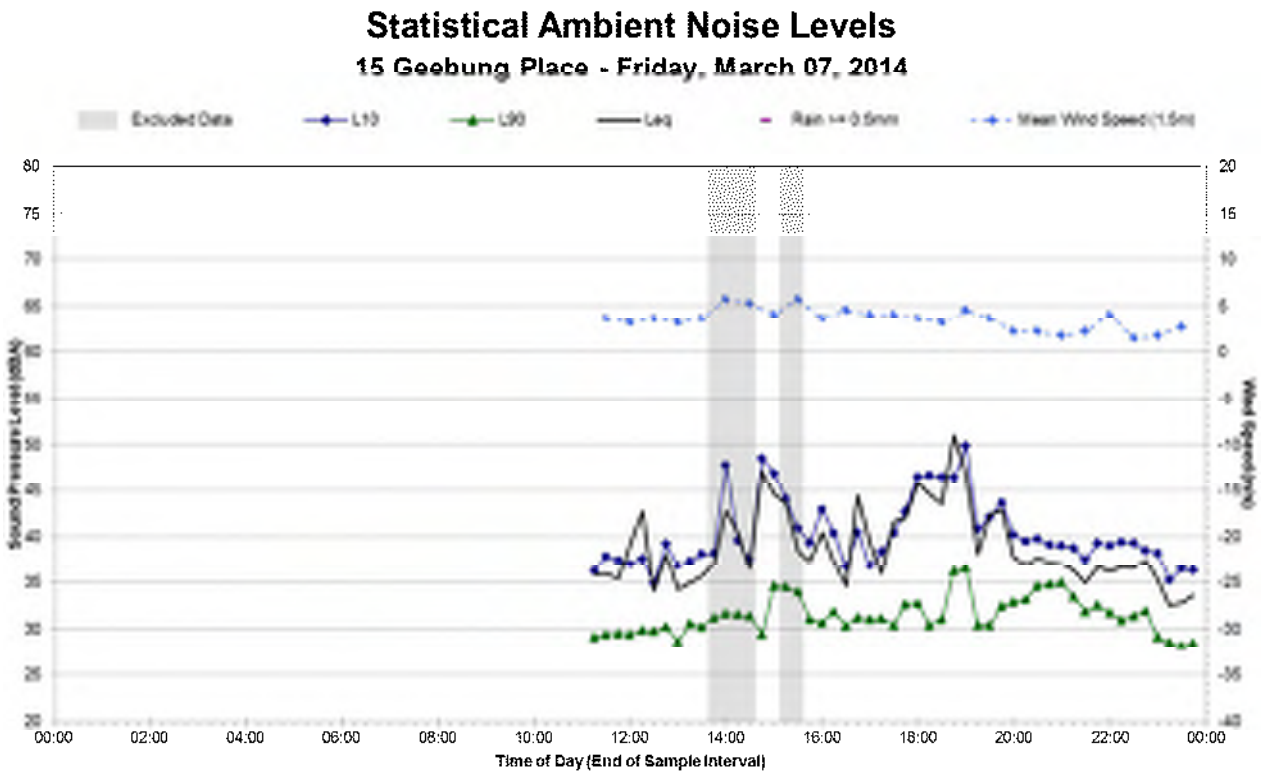
NOISE LOGGING CHARTS – 16 GEEBUNG PLACE



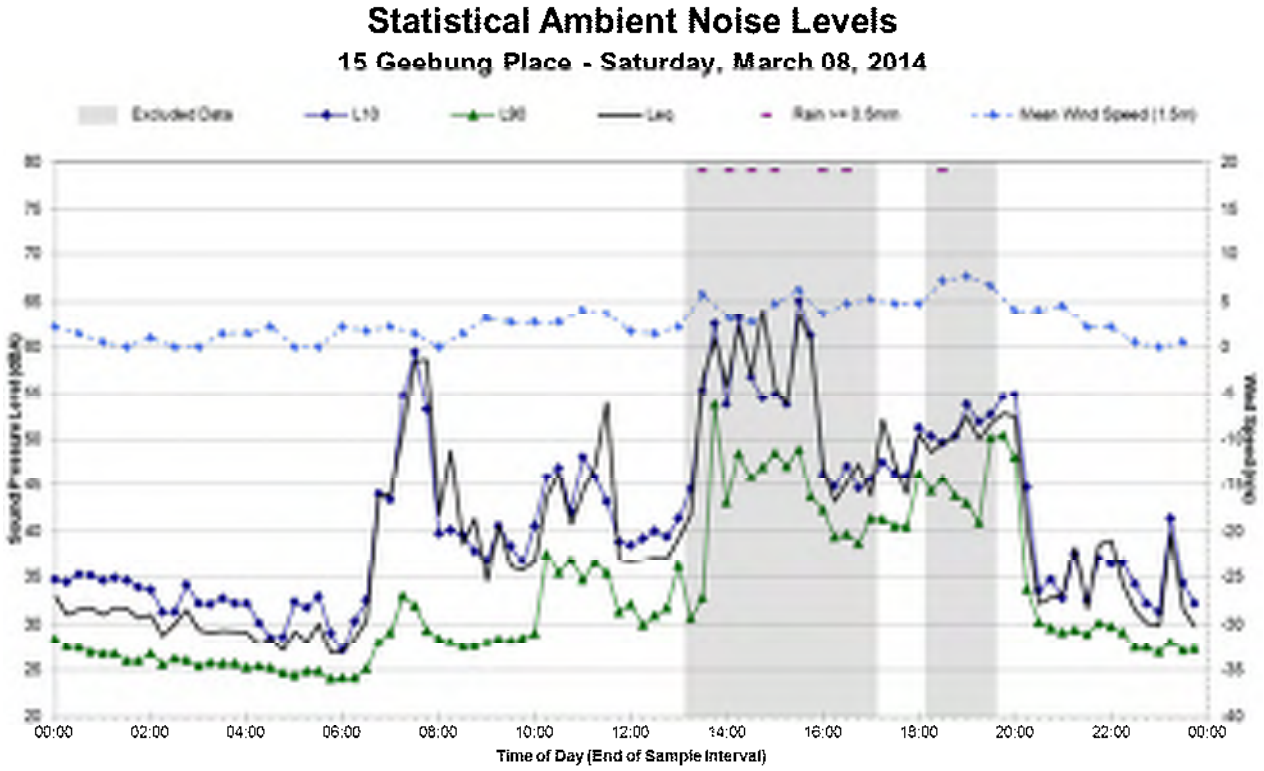


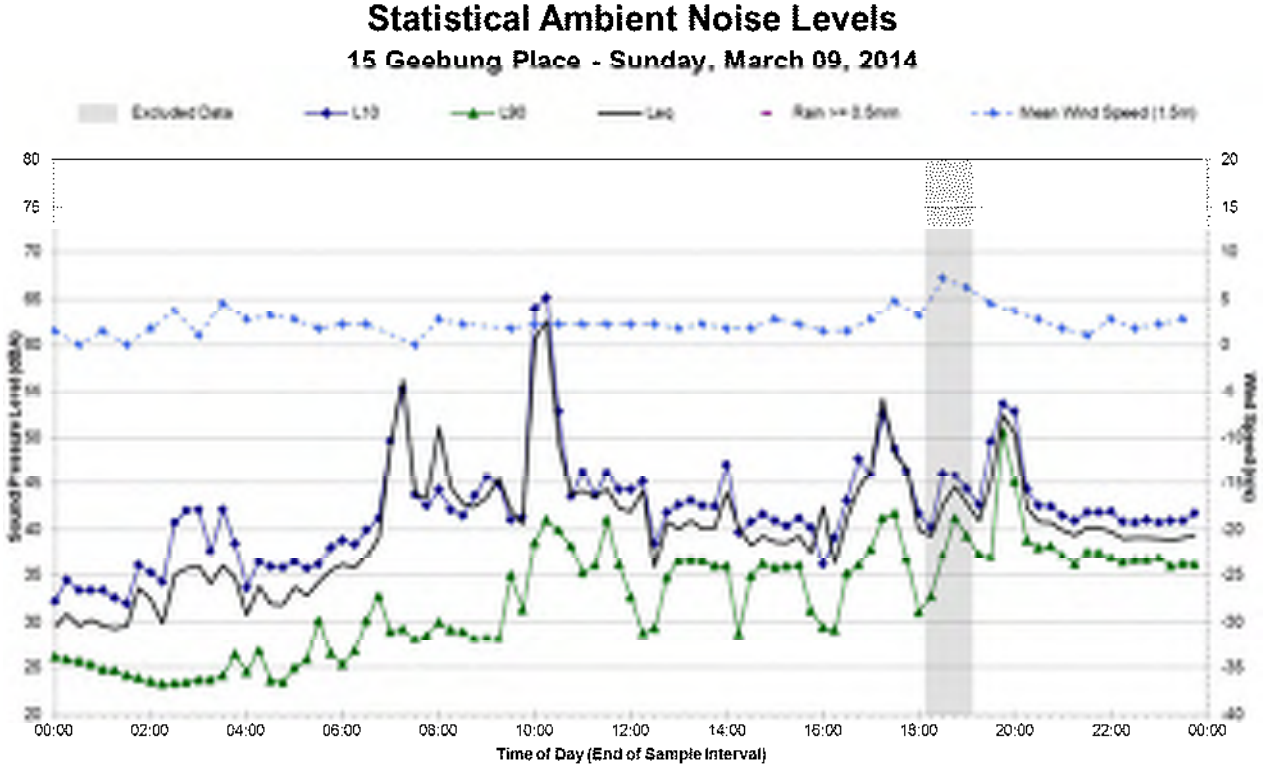
NOISE LOGGING CHARTS – 16 GEEBUNG PLACE





NOISE LOGGING CHARTS – 16 GEEBUNG PLACE

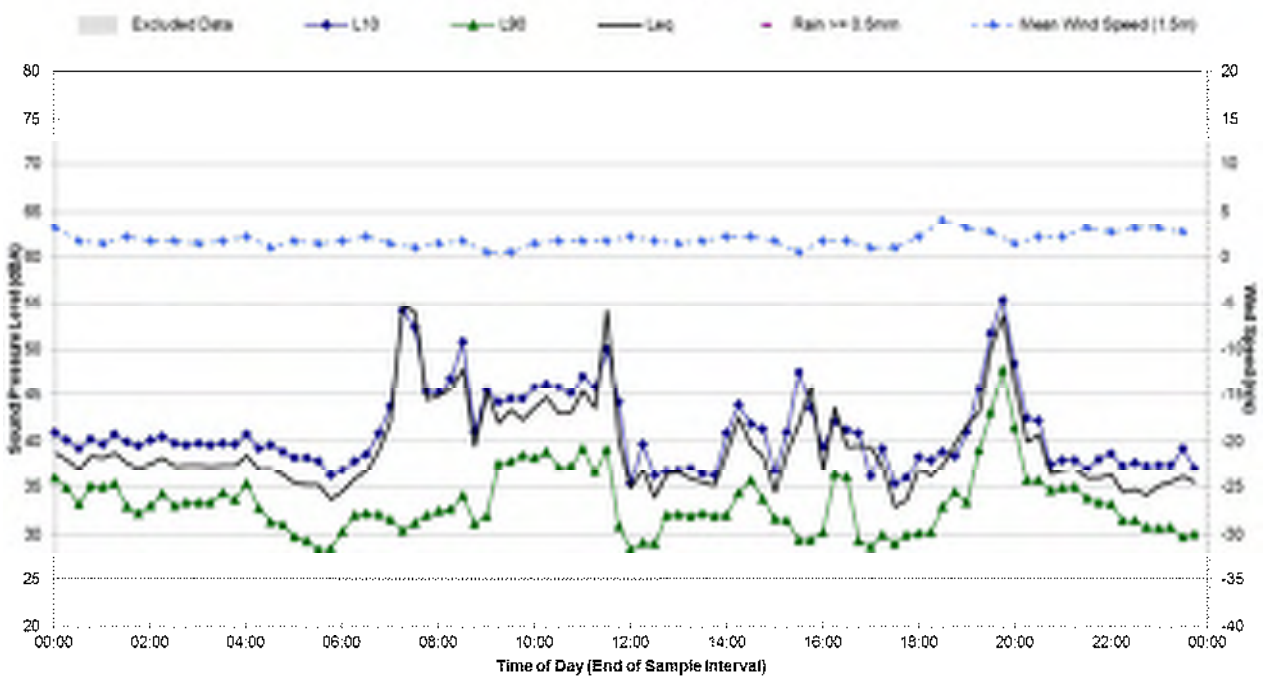




NOISE LOGGING CHARTS – 16 GEEBUNG PLACE

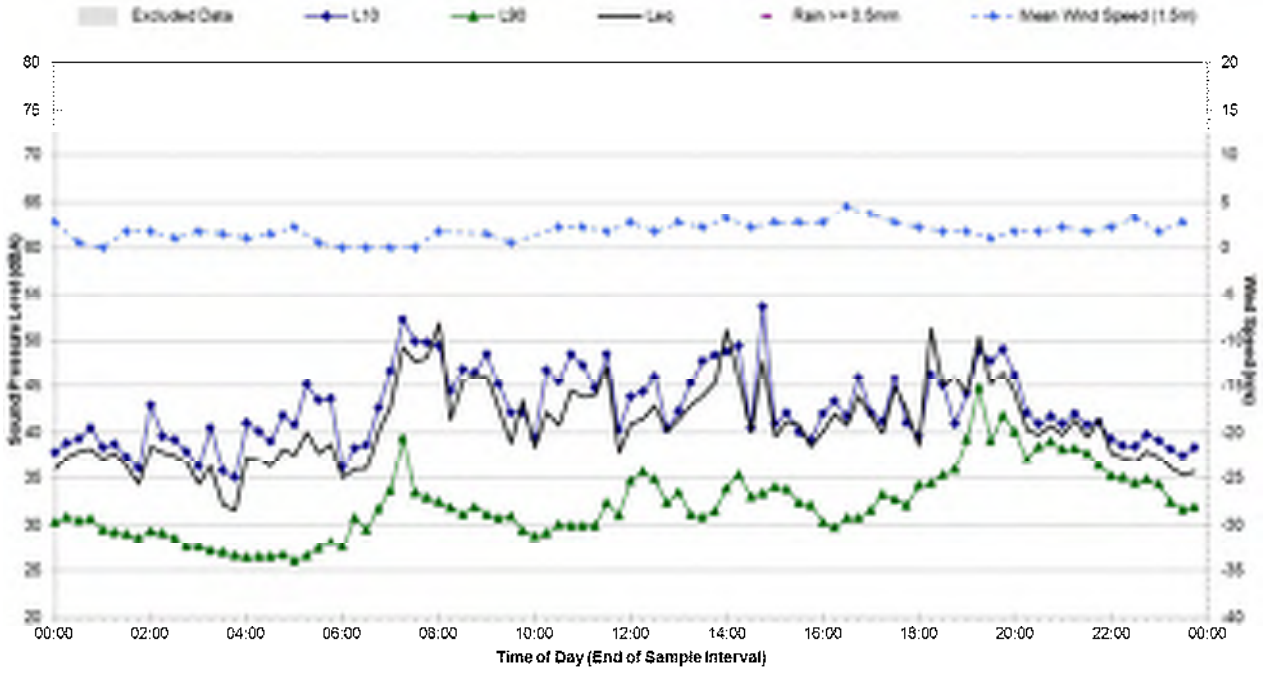
Statistical Ambient Noise Levels

15 Geebung Place - Monday, March 10, 2014

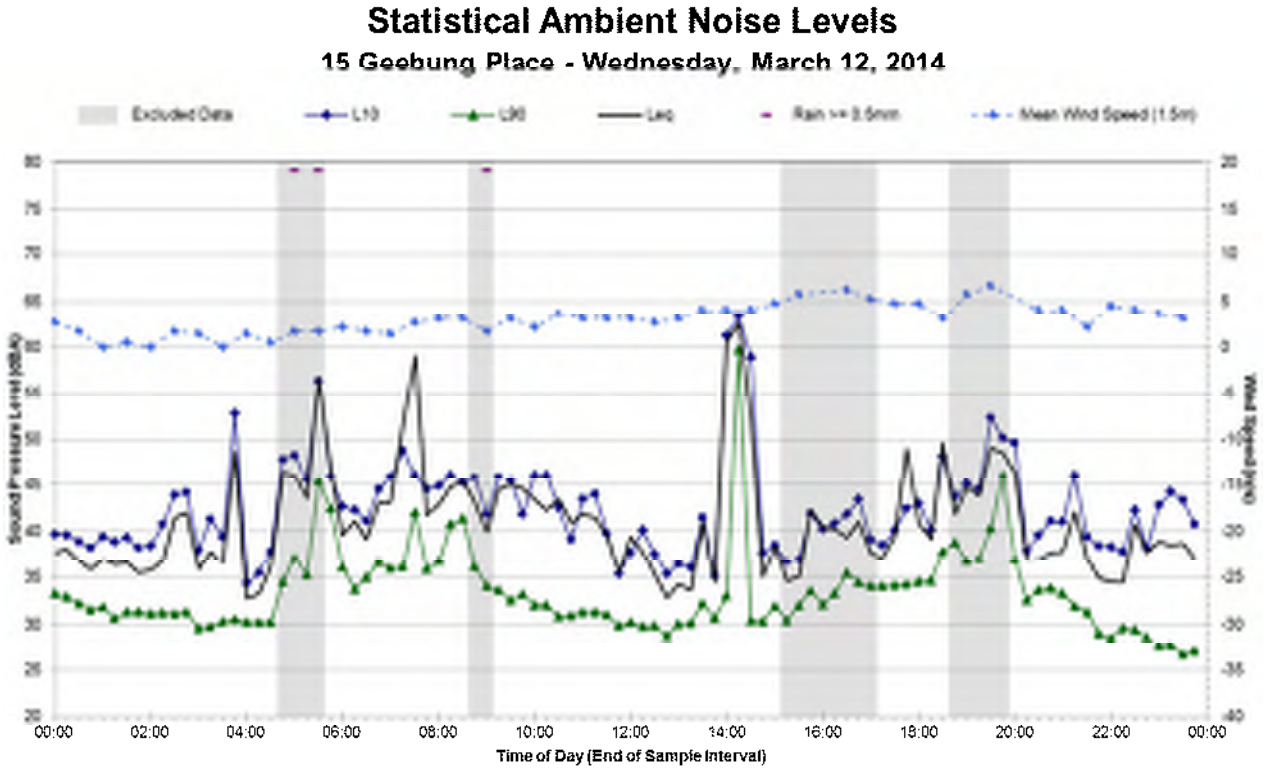


Statistical Ambient Noise Levels

15 Geebung Place - Tuesday, March 11, 2014



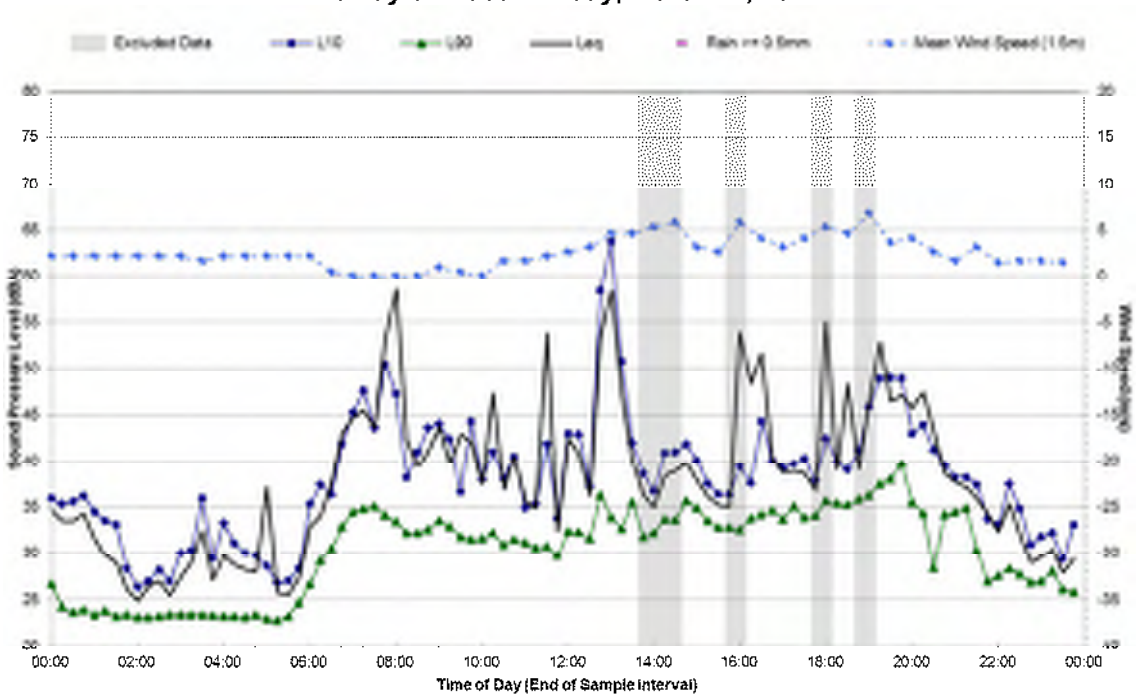
NOISE LOGGING CHARTS – 16 GEEBUNG PLACE



NOISE LOGGING CHARTS – 40 TAYLOR PLACE

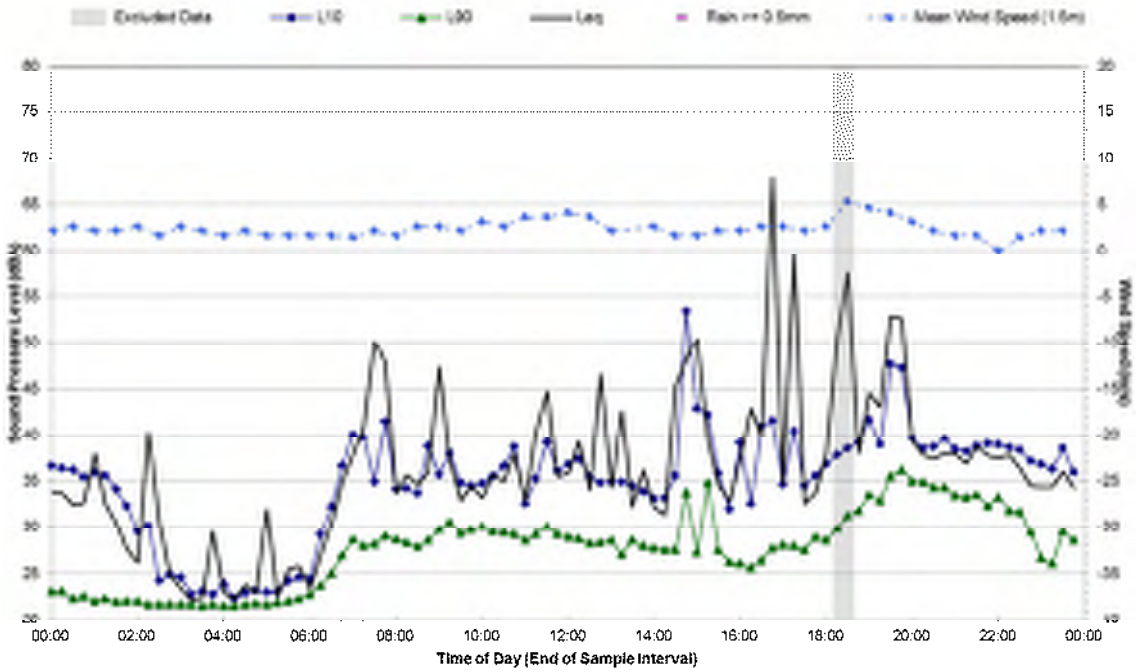
Statistical Ambient Noise Levels

40 Taylor Place - Friday, March 14, 2014



Statistical Ambient Noise Levels

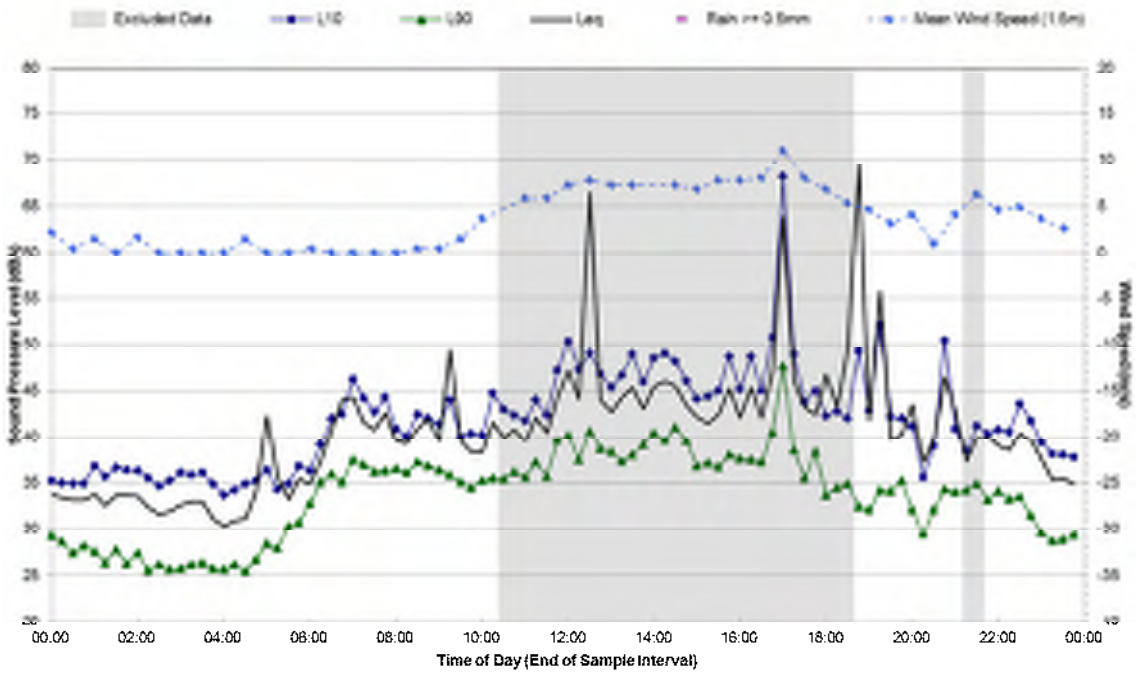
40 Taylor Place - Thursday, March 13, 2014



NOISE LOGGING CHARTS – 40 TAYLOR PLACE

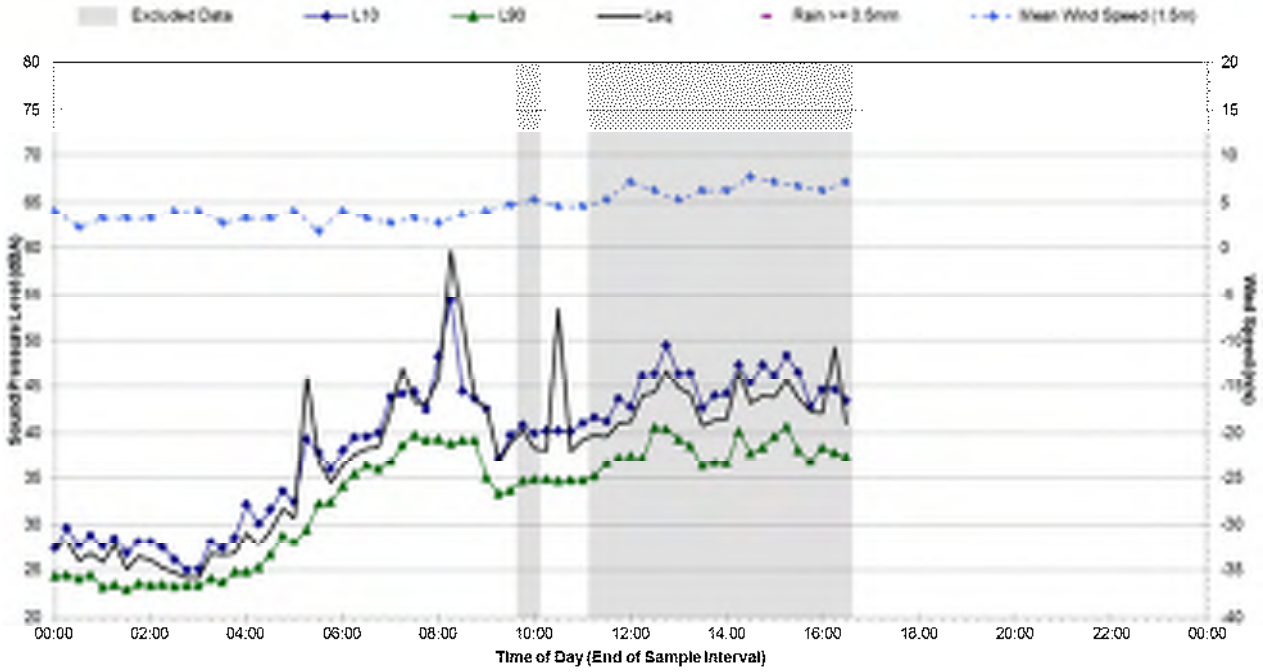
Statistical Ambient Noise Levels

40 Taylor Place - Saturday, March 15, 2014

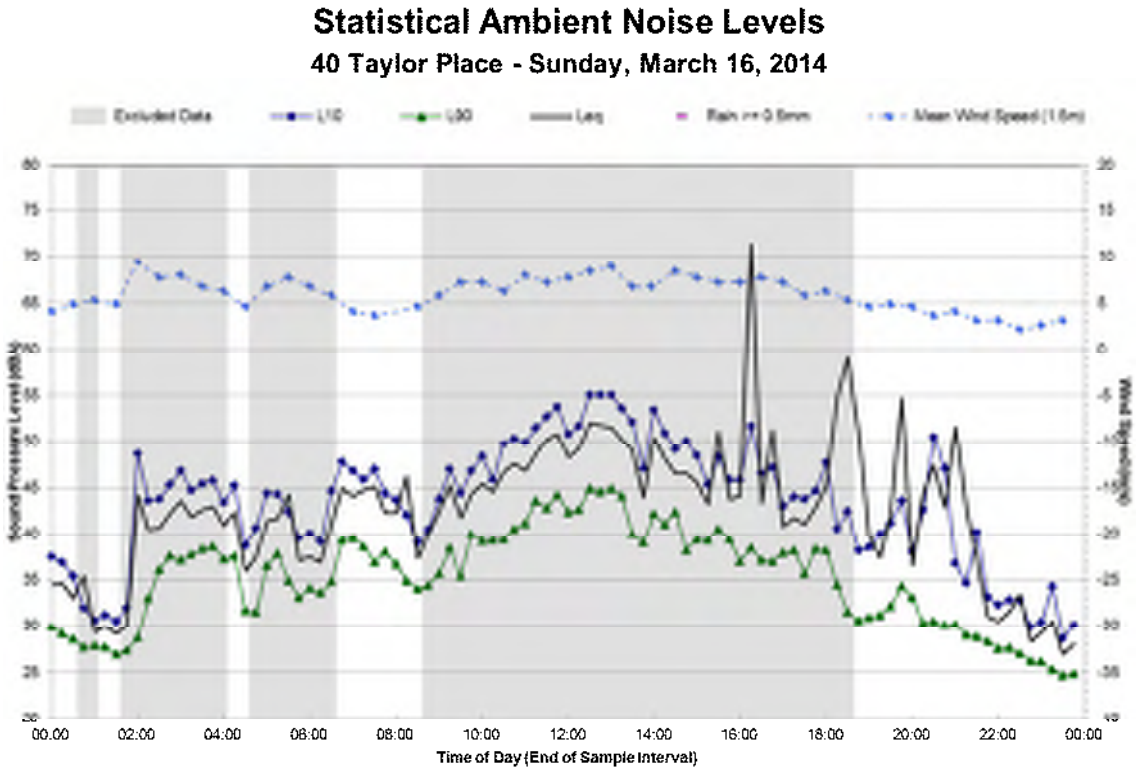


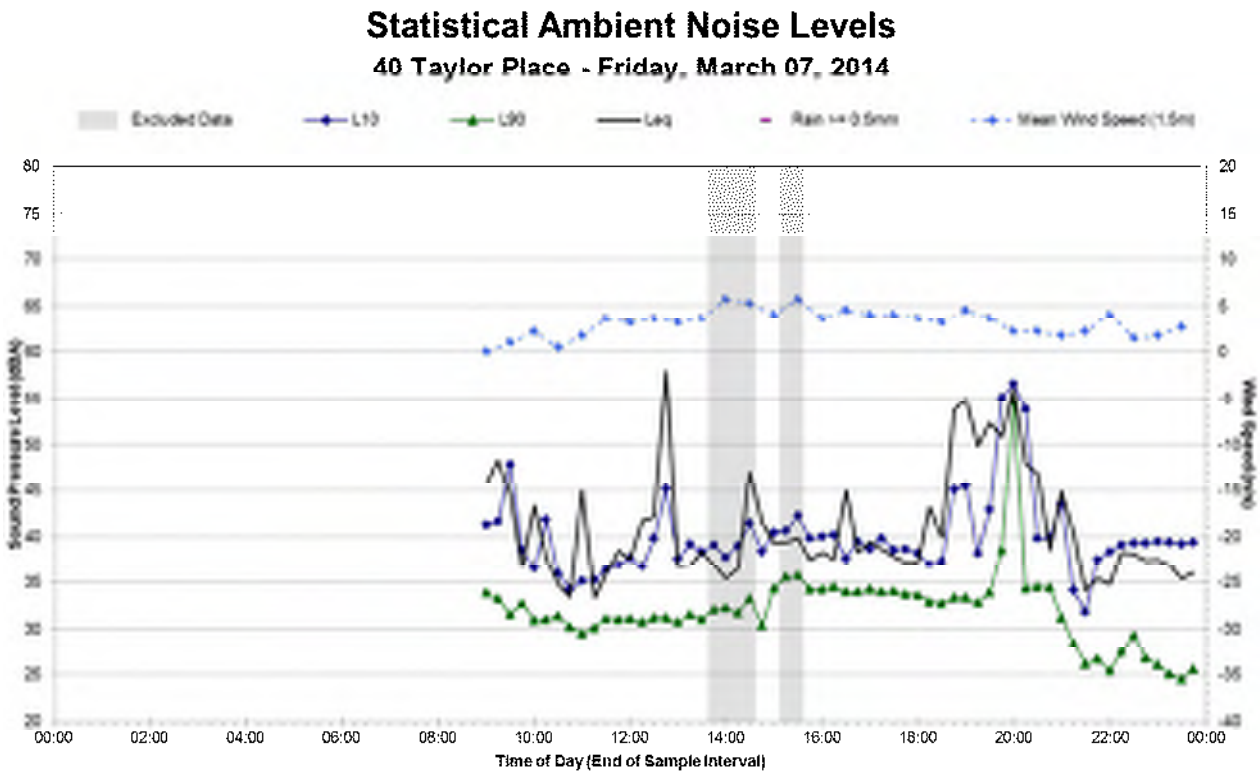
Statistical Ambient Noise Levels

40 Taylor Place - Monday, March 17, 2014



NOISE LOGGING CHARTS – 40 TAYLOR PLACE

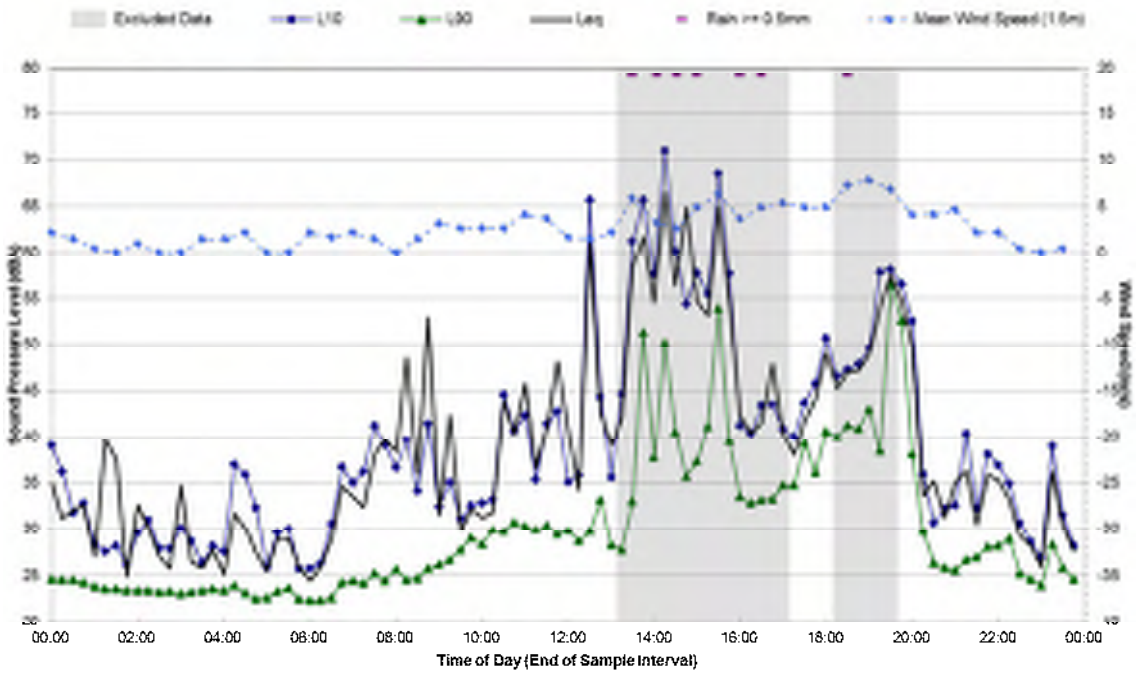




NOISE LOGGING CHARTS – 40 TAYLOR PLACE

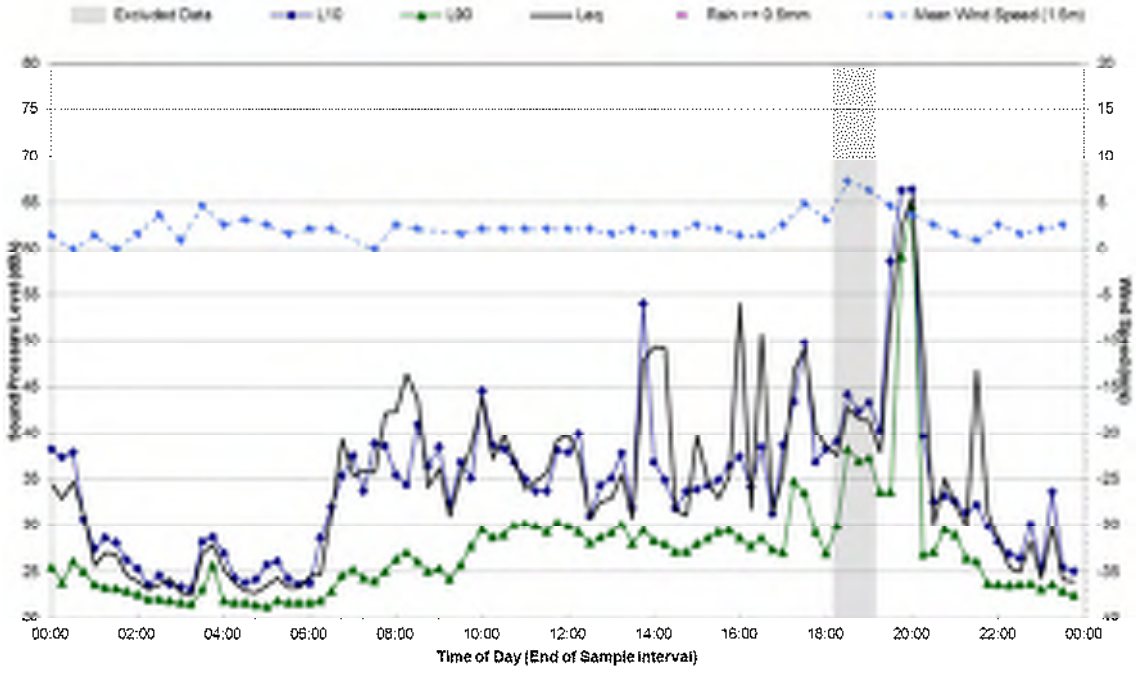
Statistical Ambient Noise Levels

40 Taylor Place - Saturday, March 08, 2014

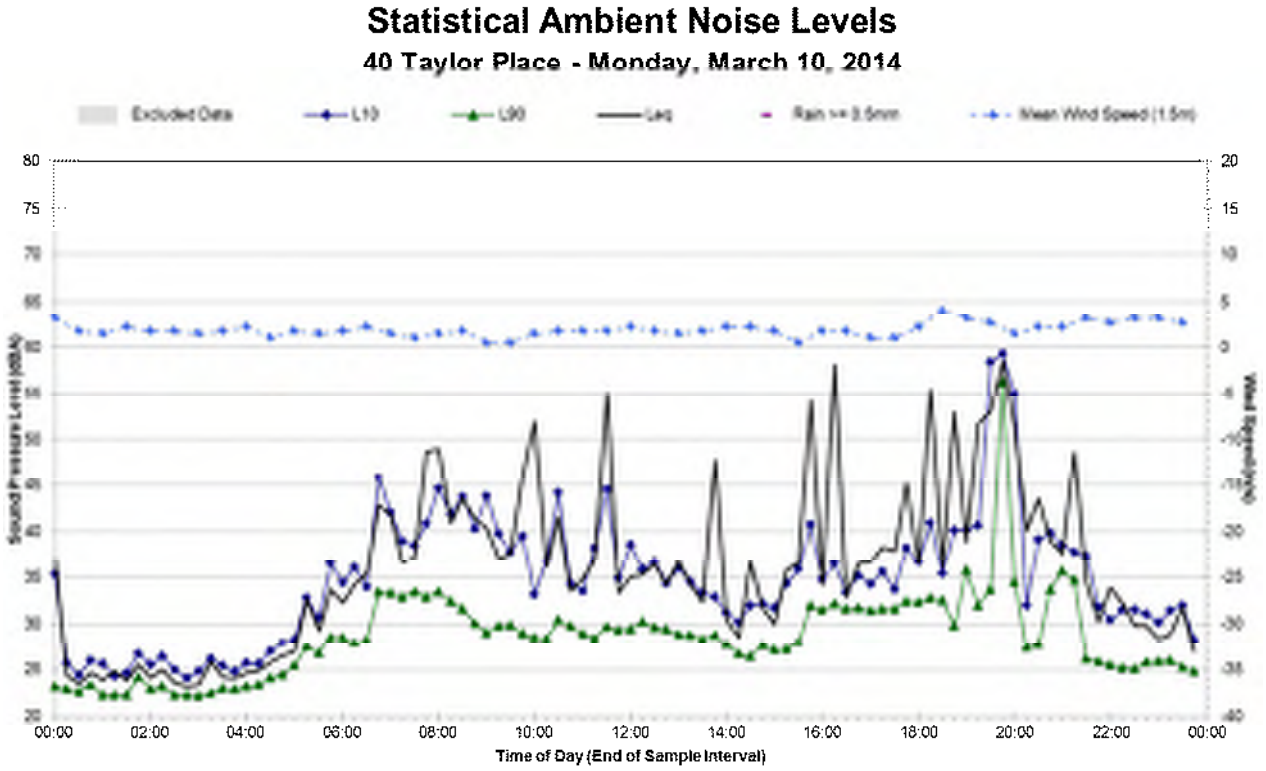


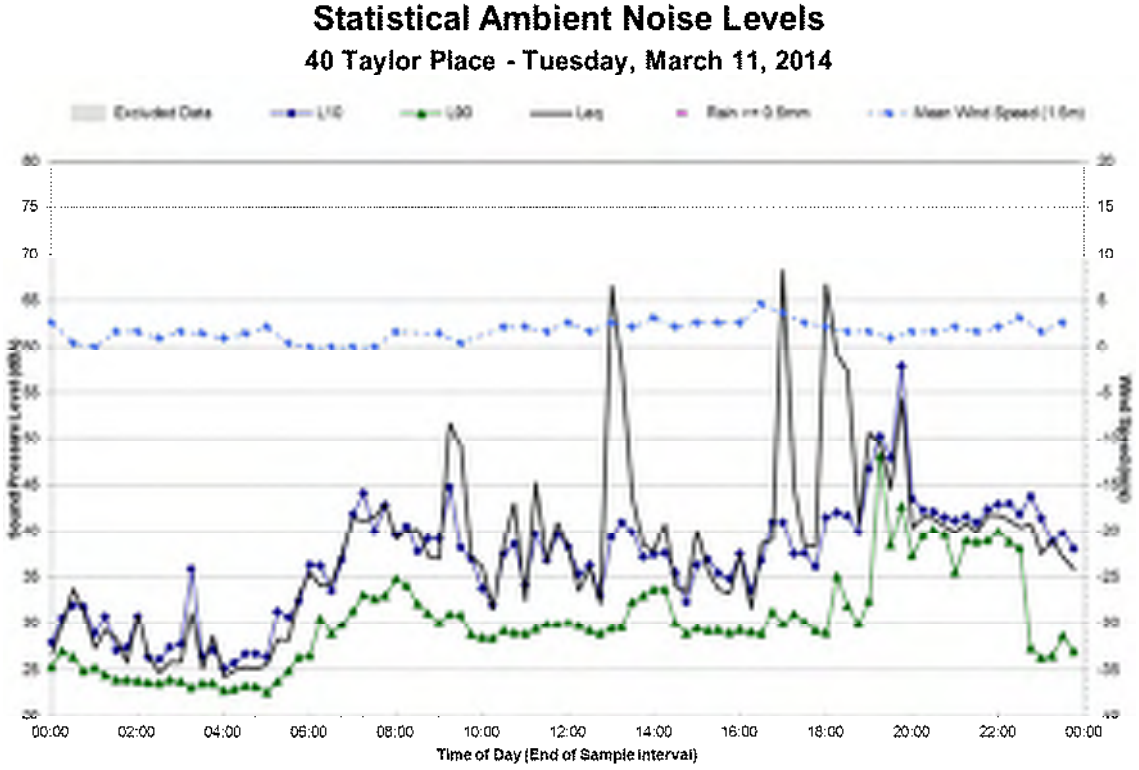
Statistical Ambient Noise Levels

40 Taylor Place - Sunday, March 09, 2014

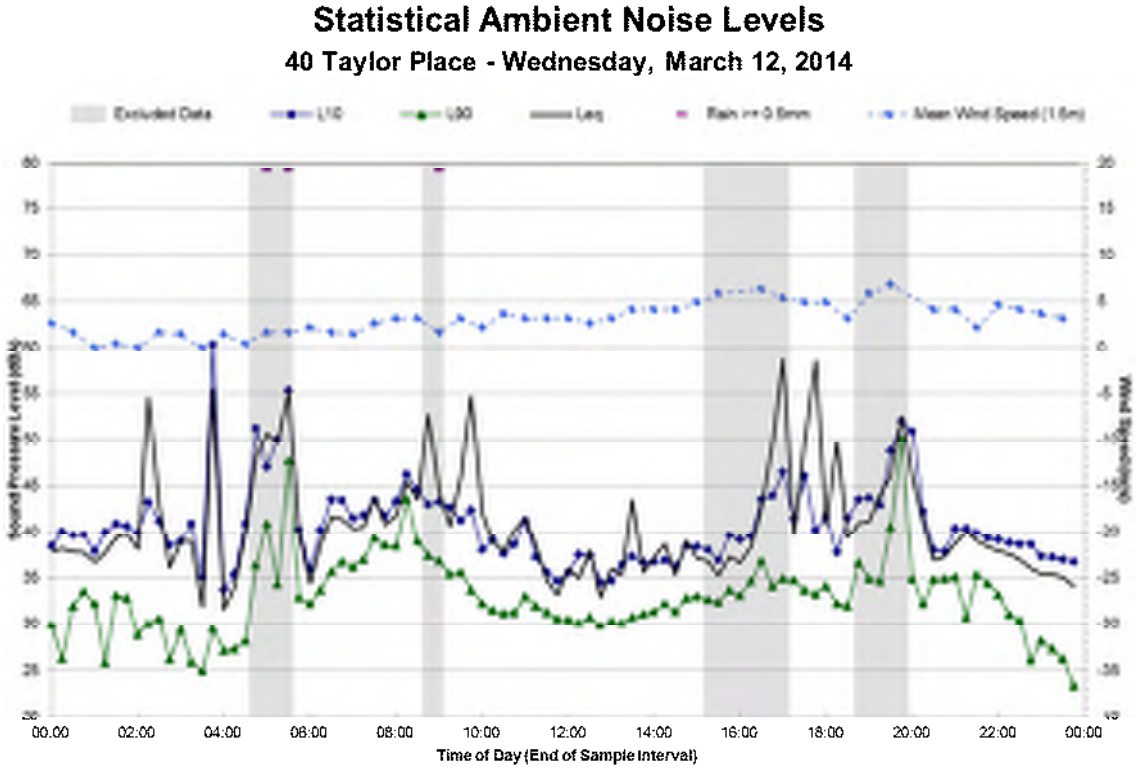


NOISE LOGGING CHARTS – 40 TAYLOR PLACE





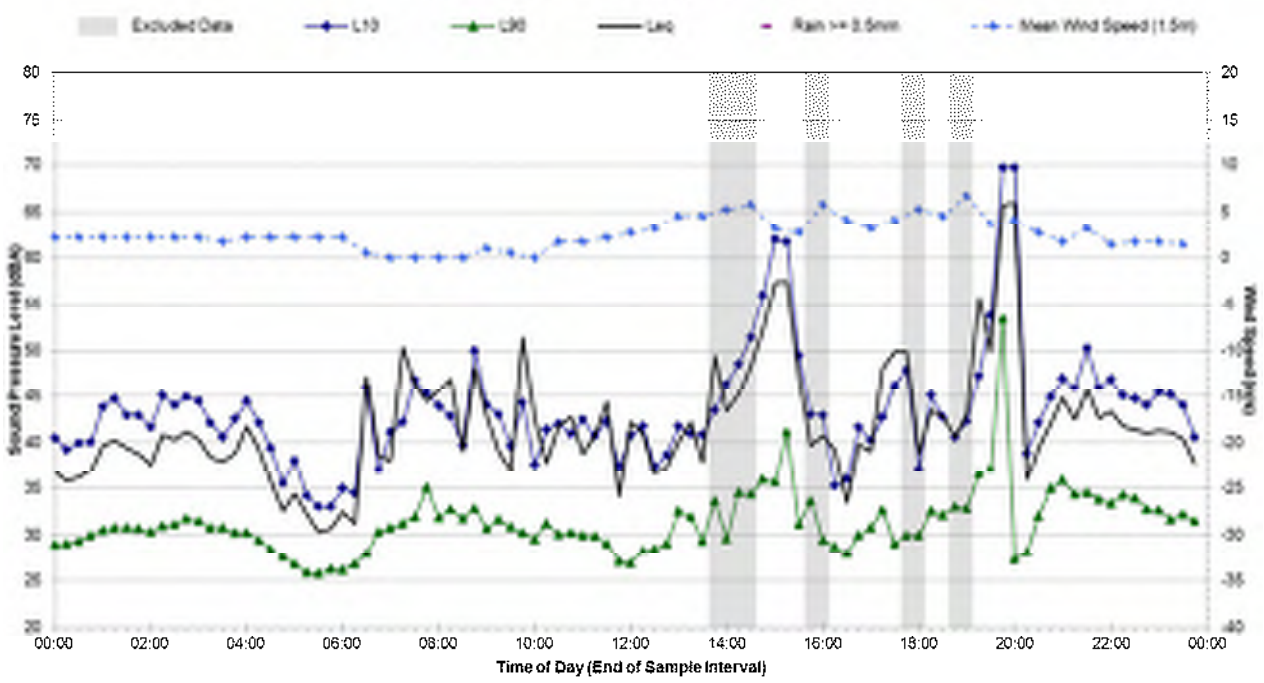
NOISE LOGGING CHARTS – 40 TAYLOR PLACE



NOISE LOGGING CHARTS – 46 SEVERNE STREET

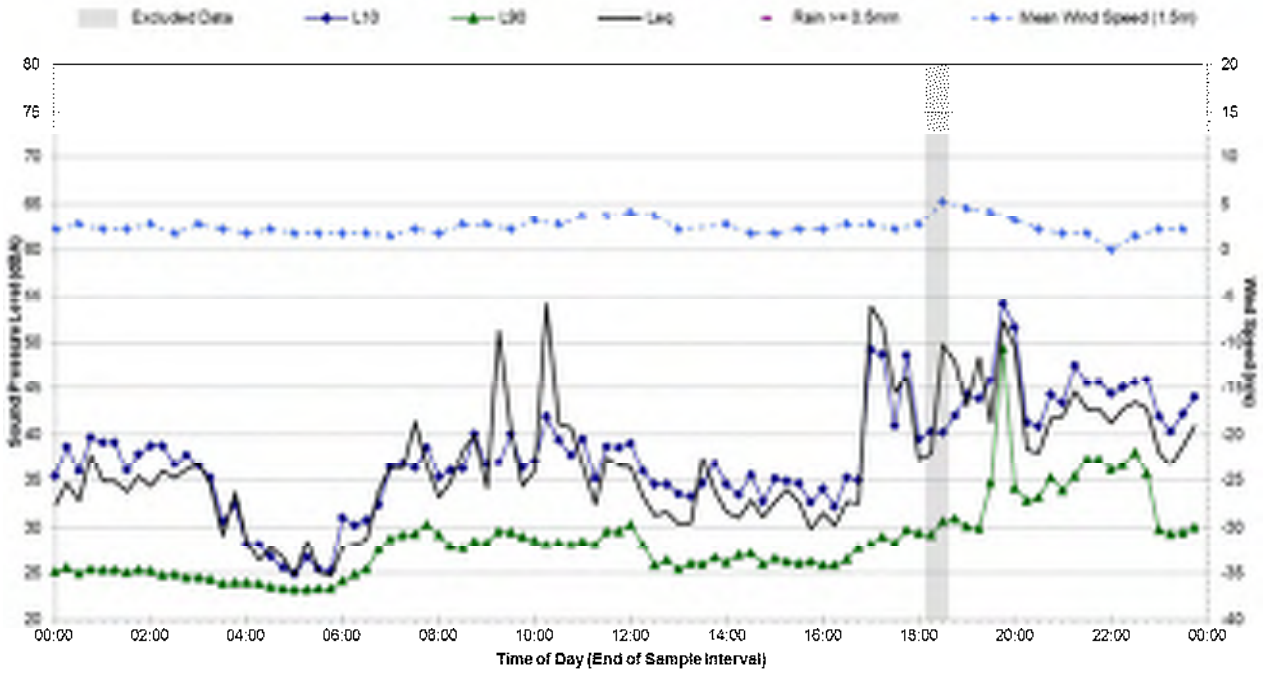
Statistical Ambient Noise Levels

46 Severne Street - Friday, March 14, 2014

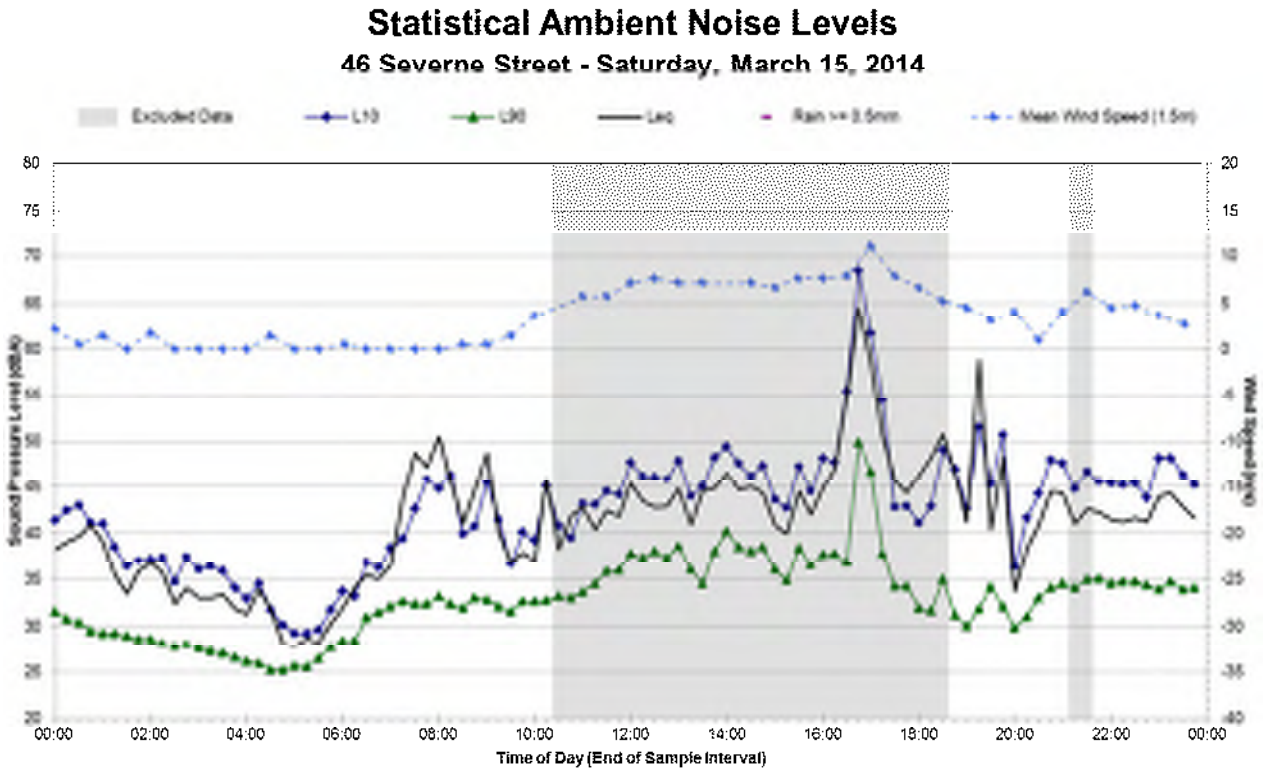


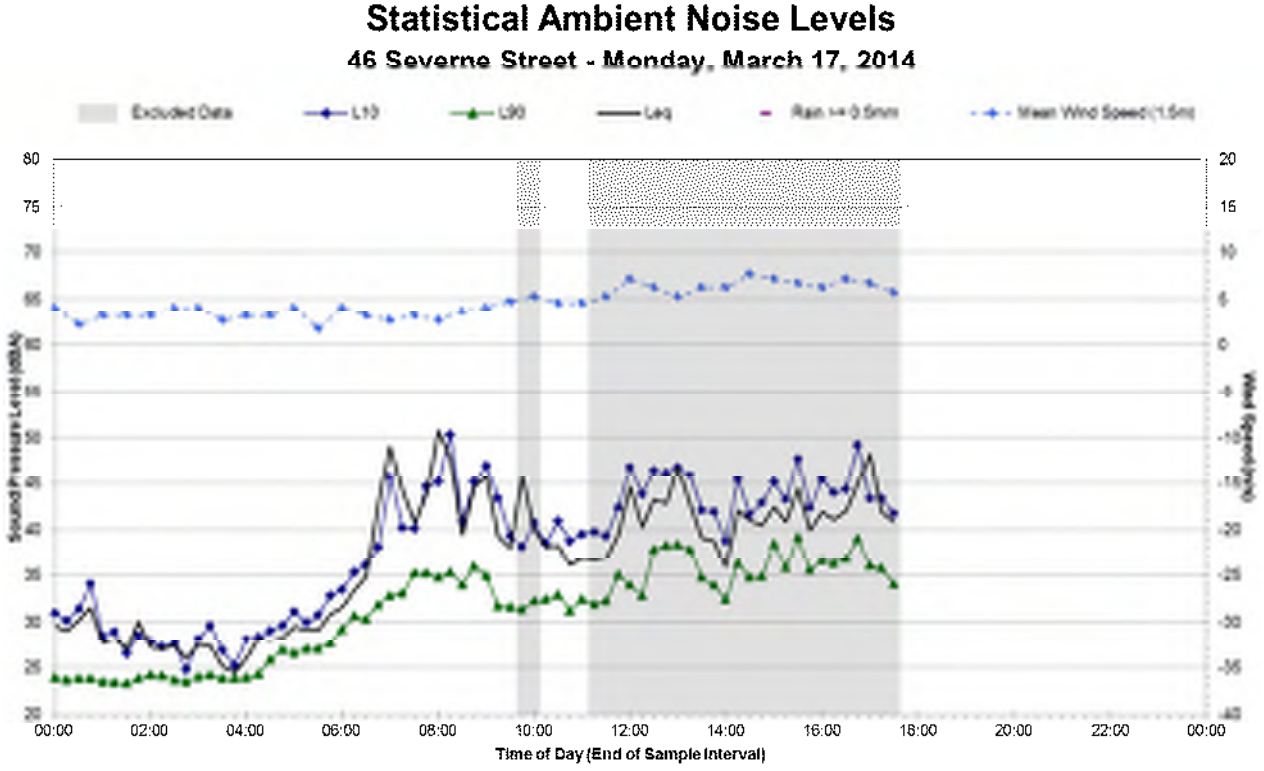
Statistical Ambient Noise Levels

46 Severne Street - Thursday, March 13, 2014

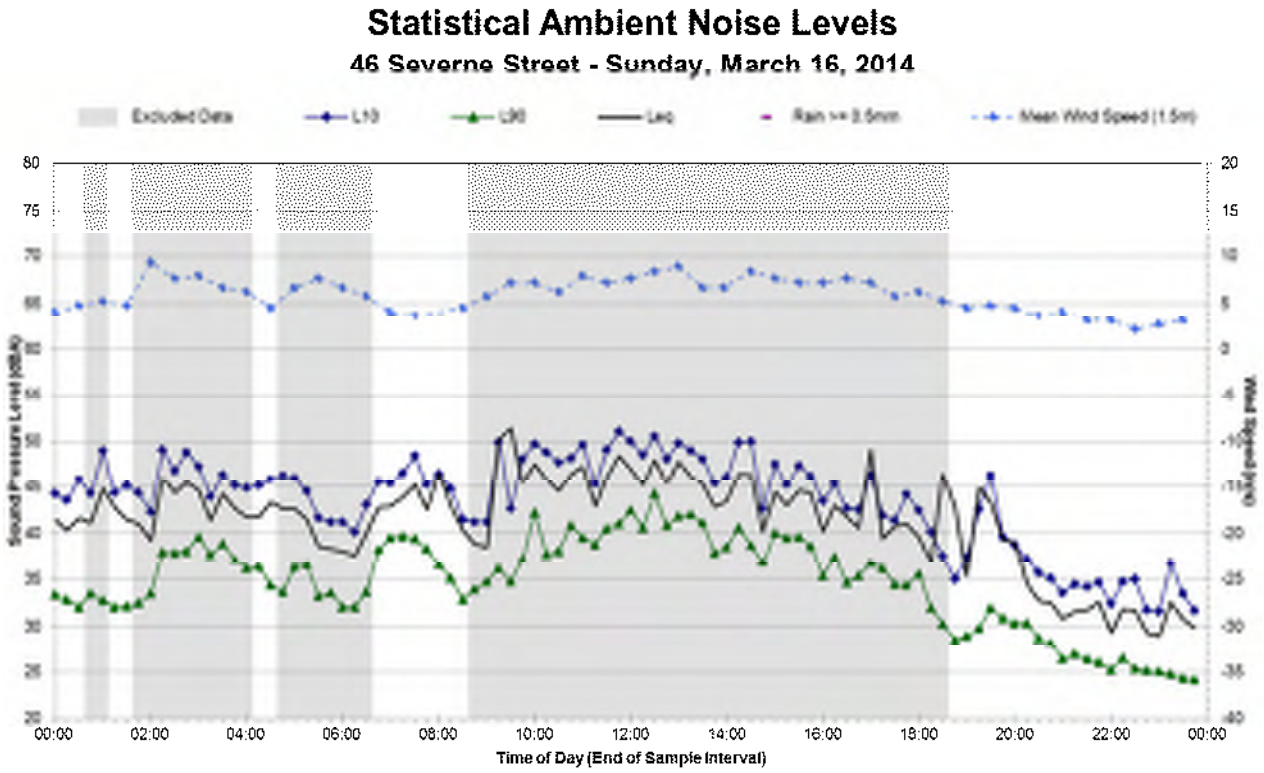


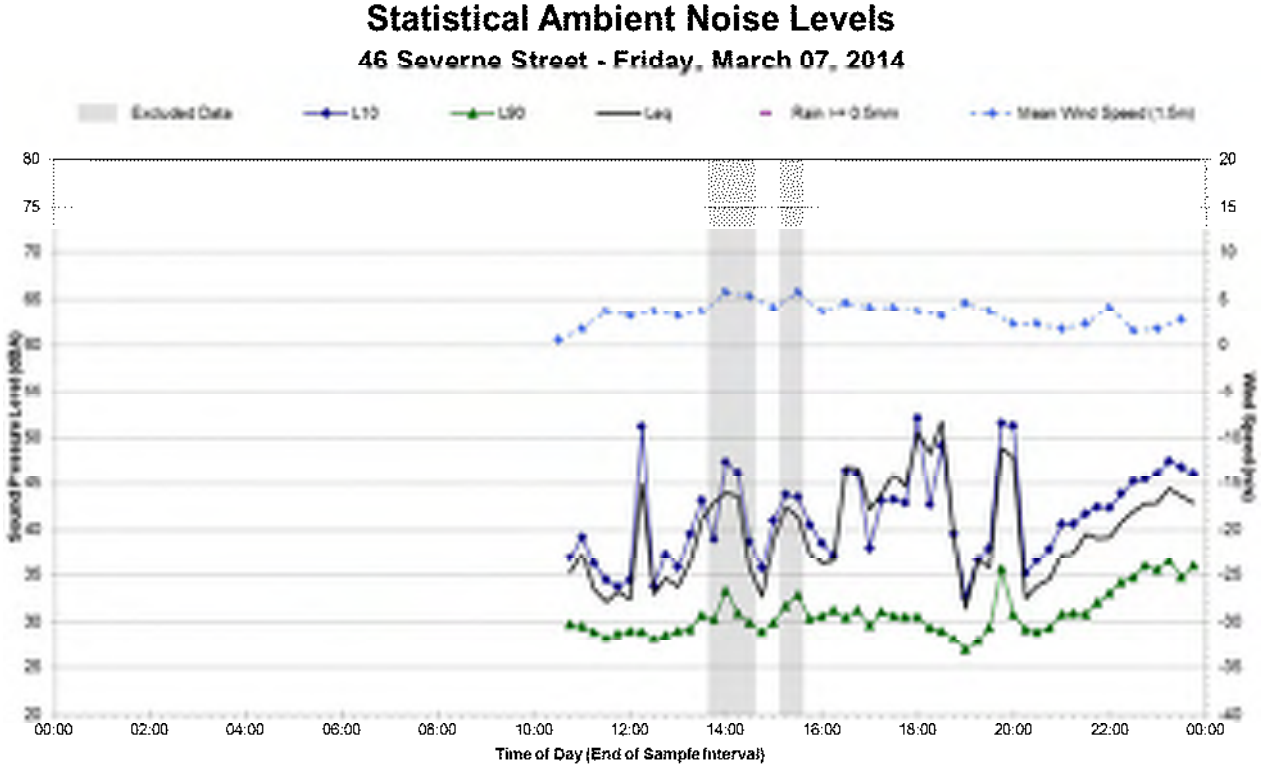
NOISE LOGGING CHARTS – 46 SEVERNE STREET



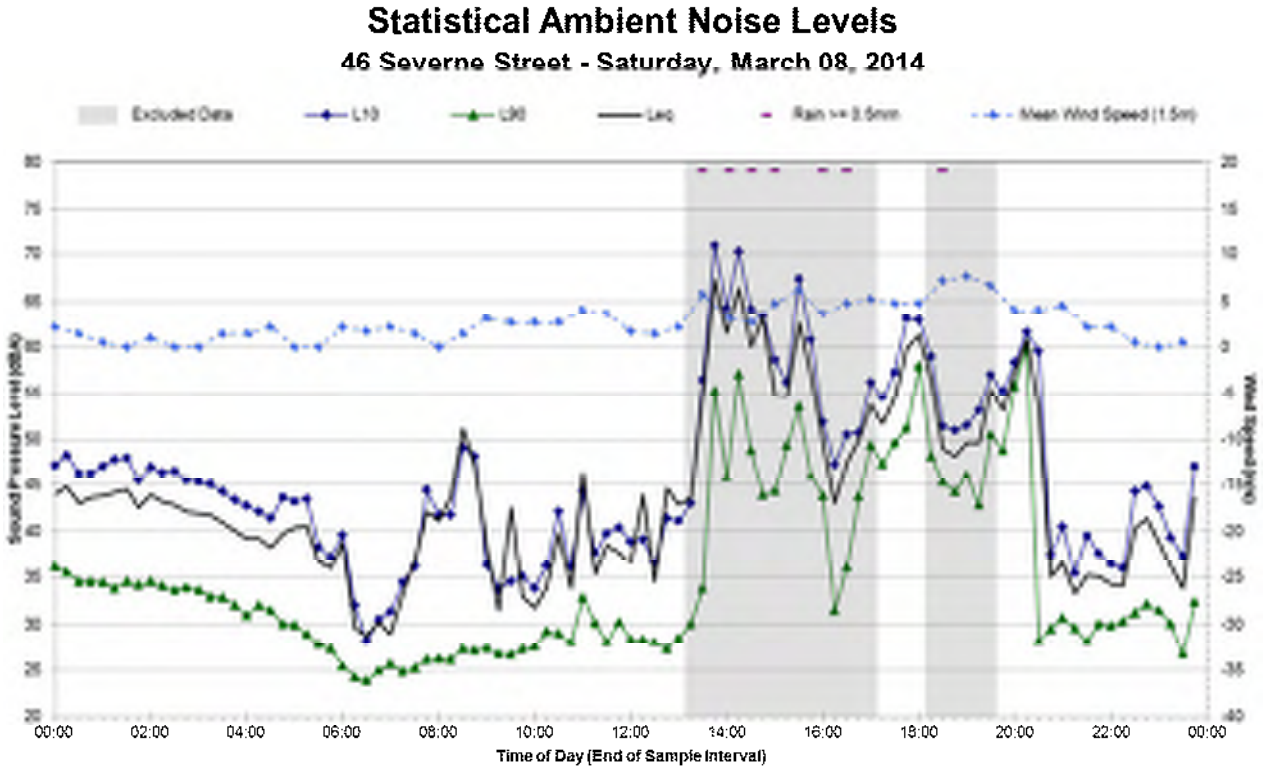


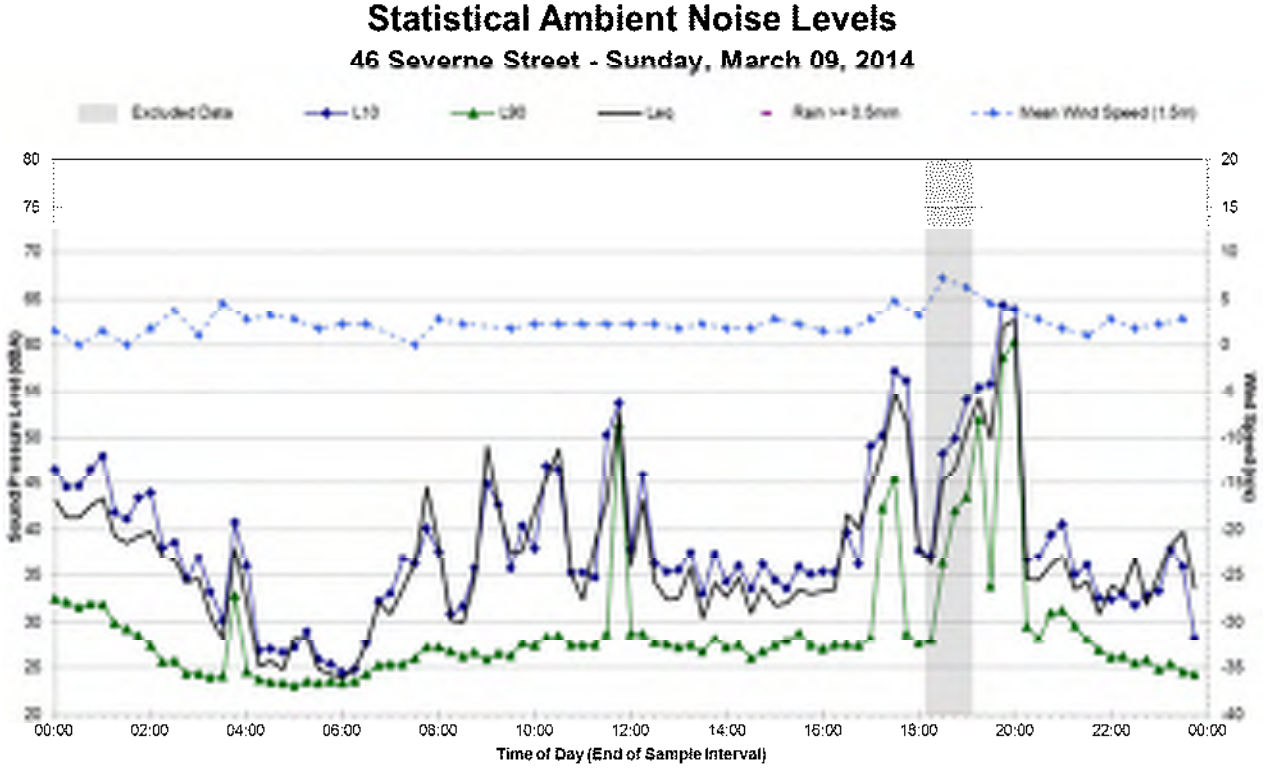
NOISE LOGGING CHARTS – 46 SEVERNE STREET



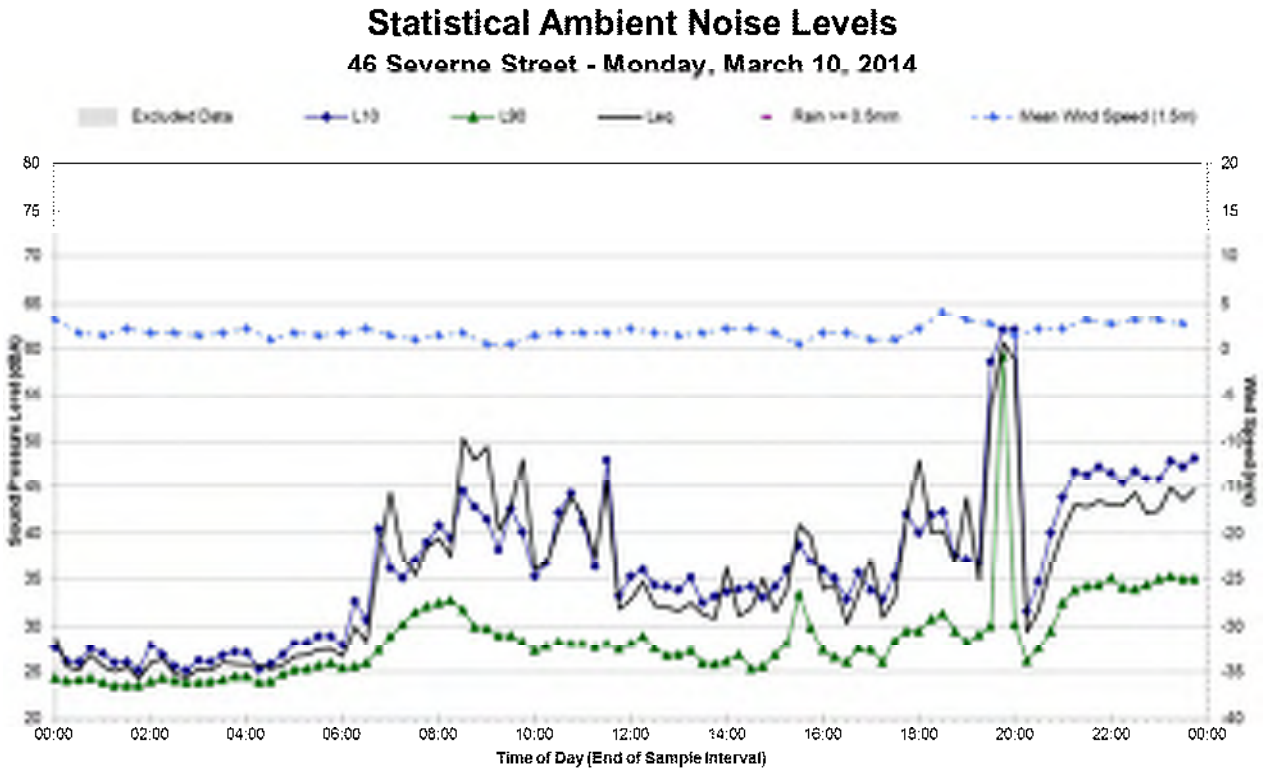


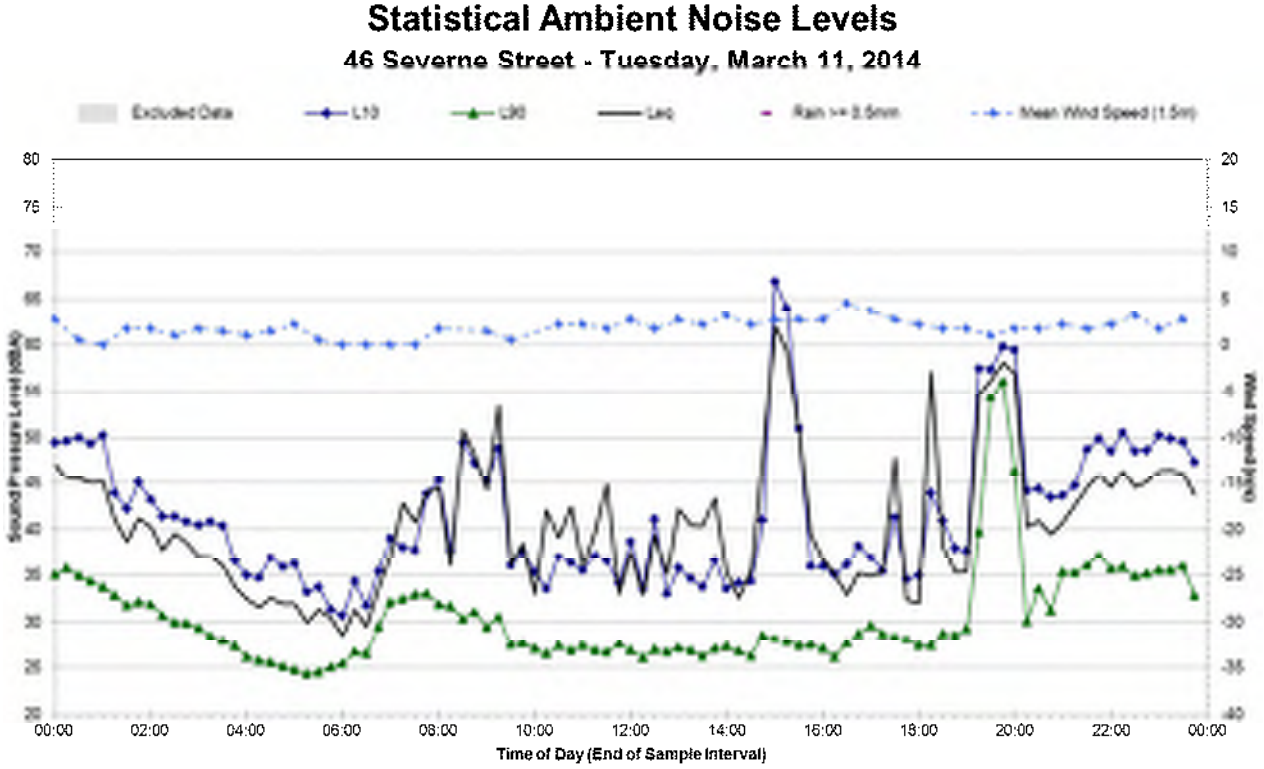
NOISE LOGGING CHARTS – 46 SEVERNE STREET



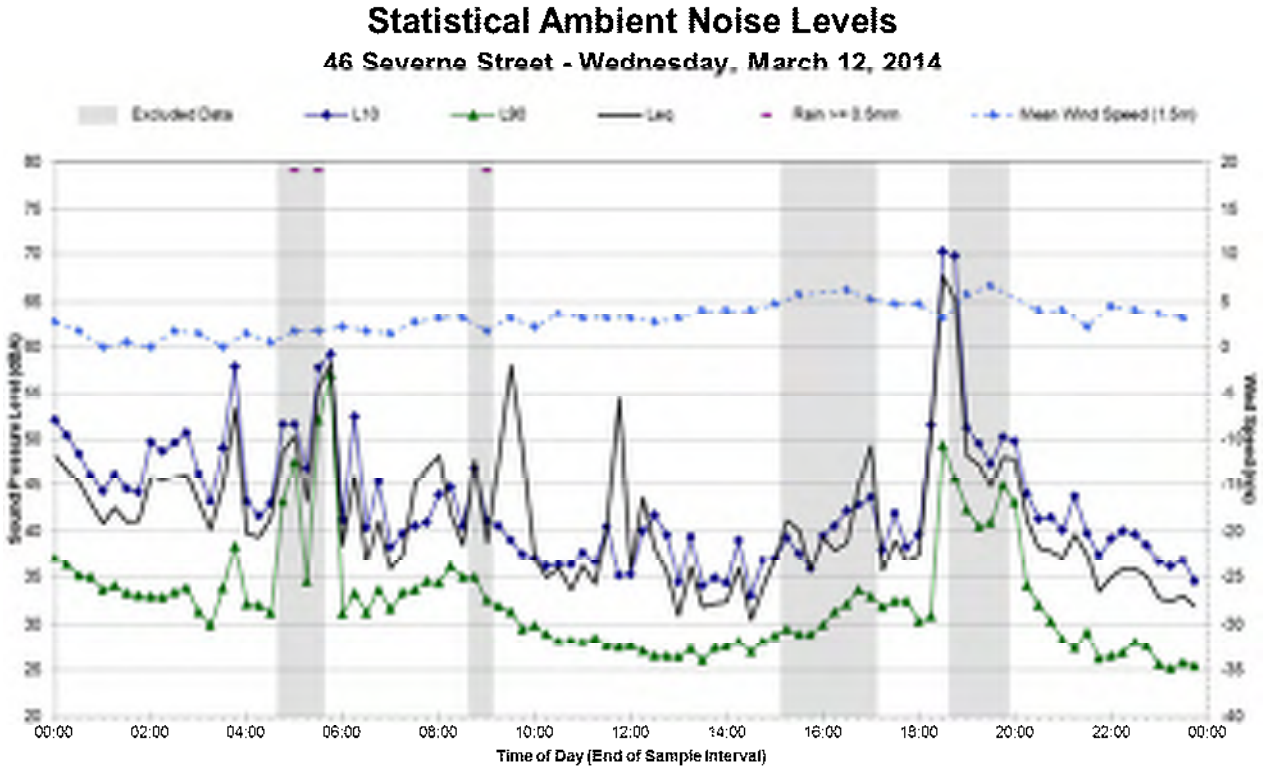


NOISE LOGGING CHARTS – 46 SEVERNE STREET

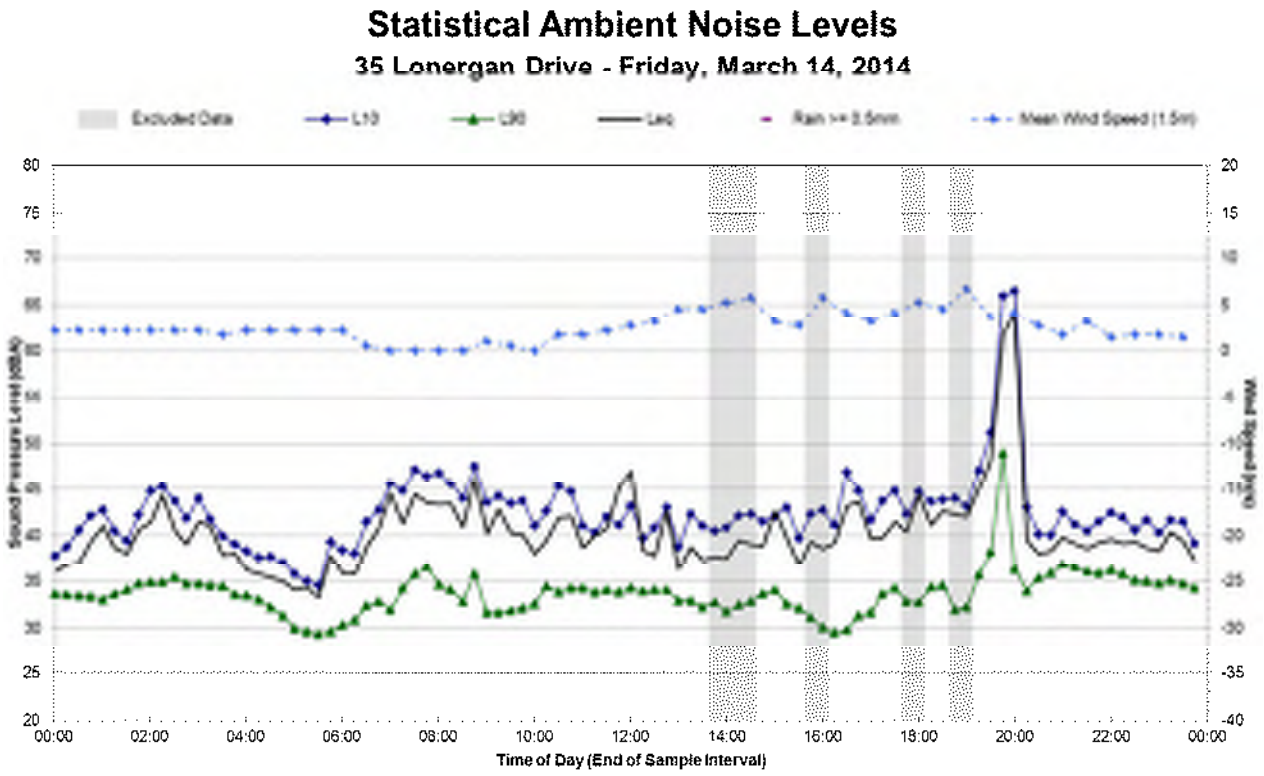


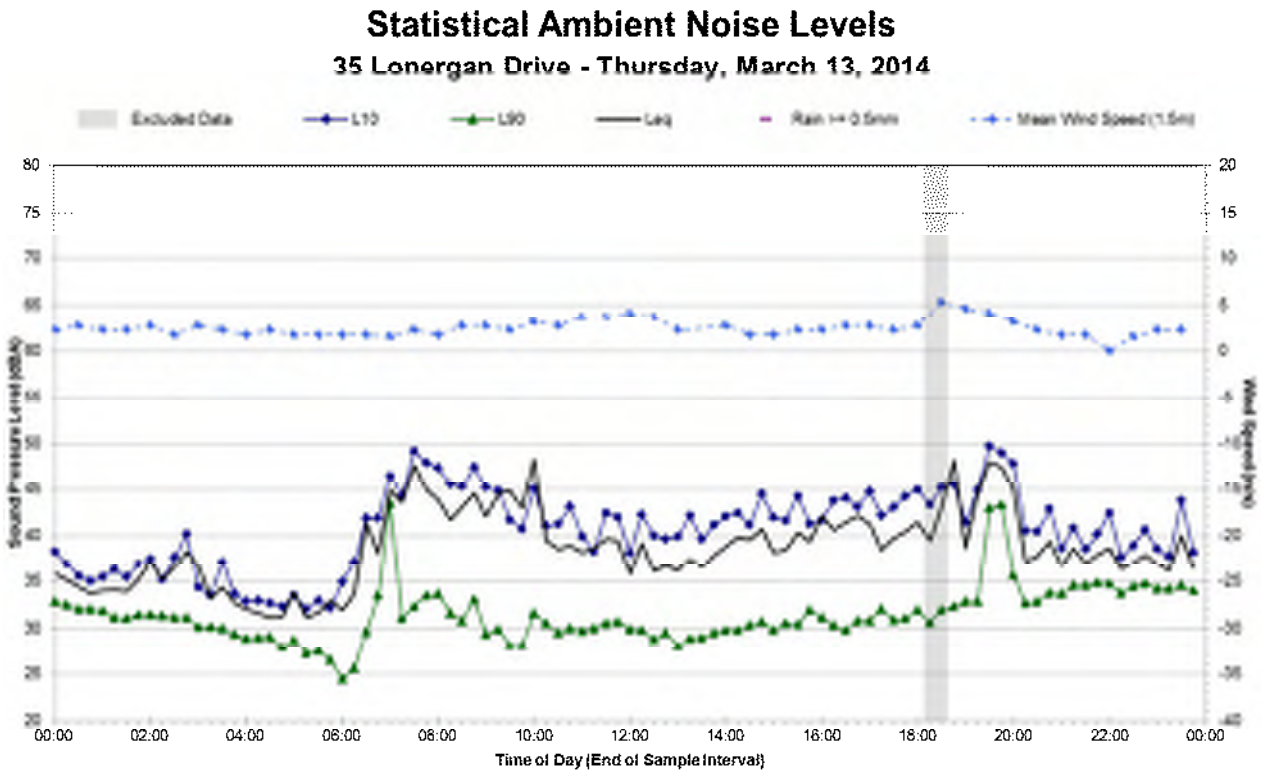


NOISE LOGGING CHARTS – 46 SEVERNE STREET

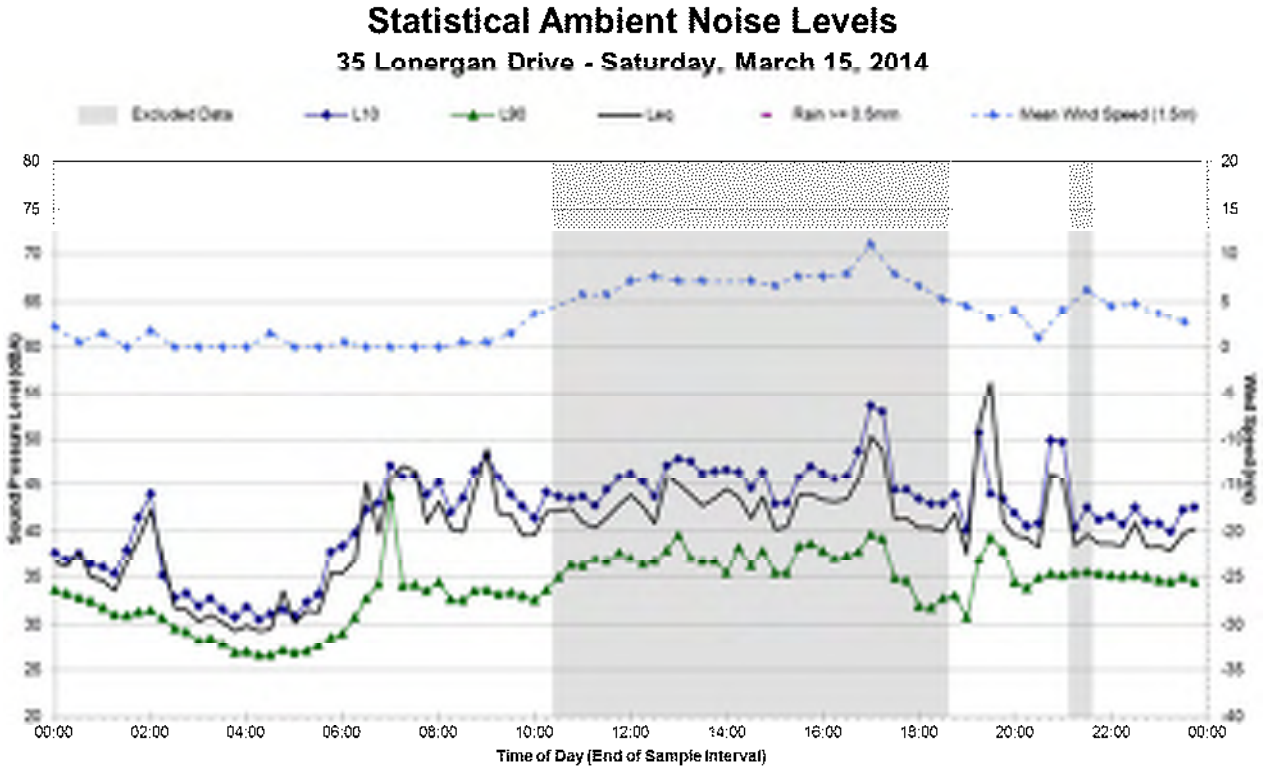


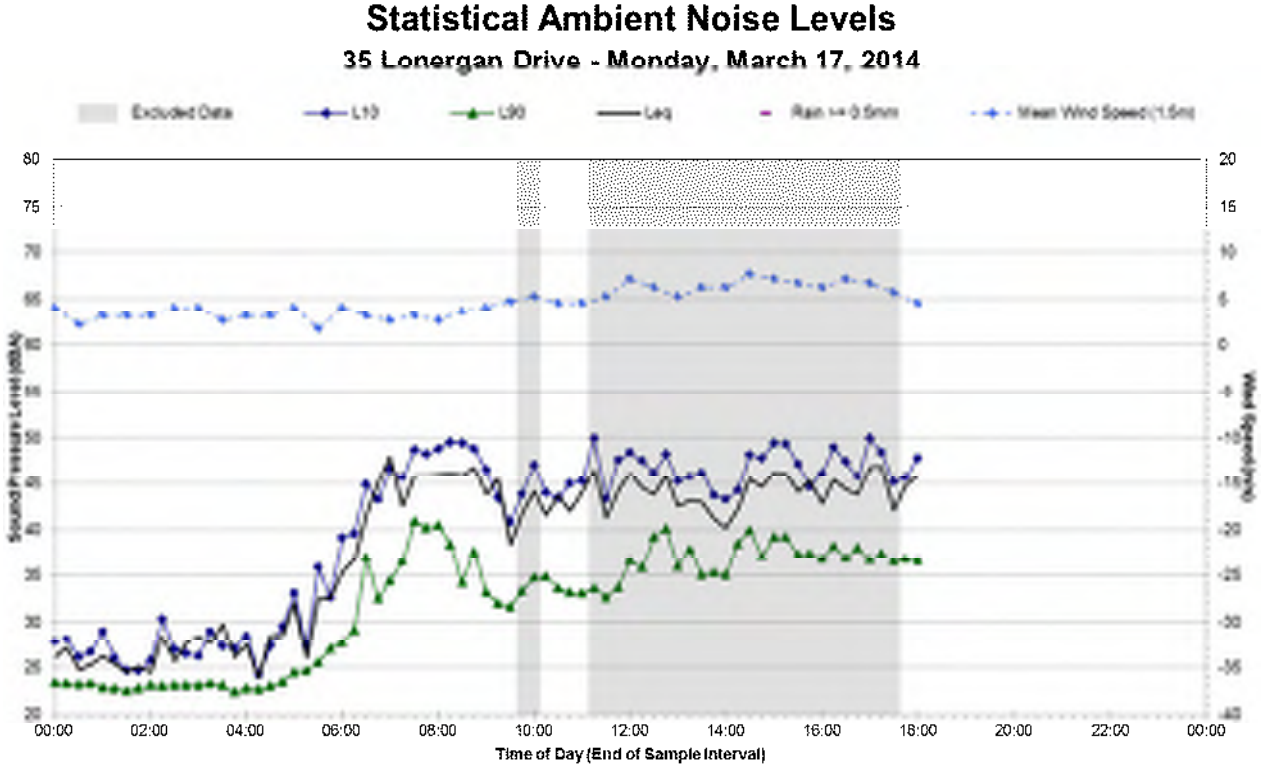
NOISE LOGGING CHARTS – 35 LONERGAN DRIVE



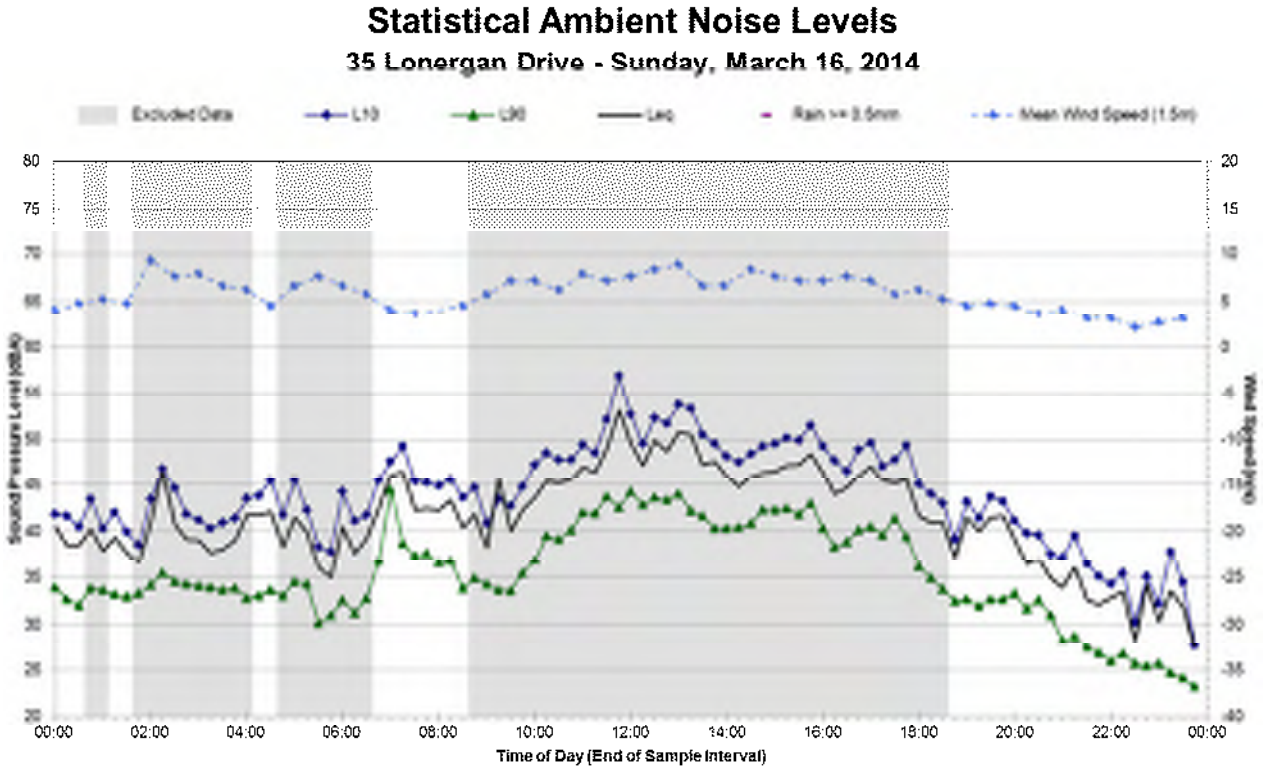


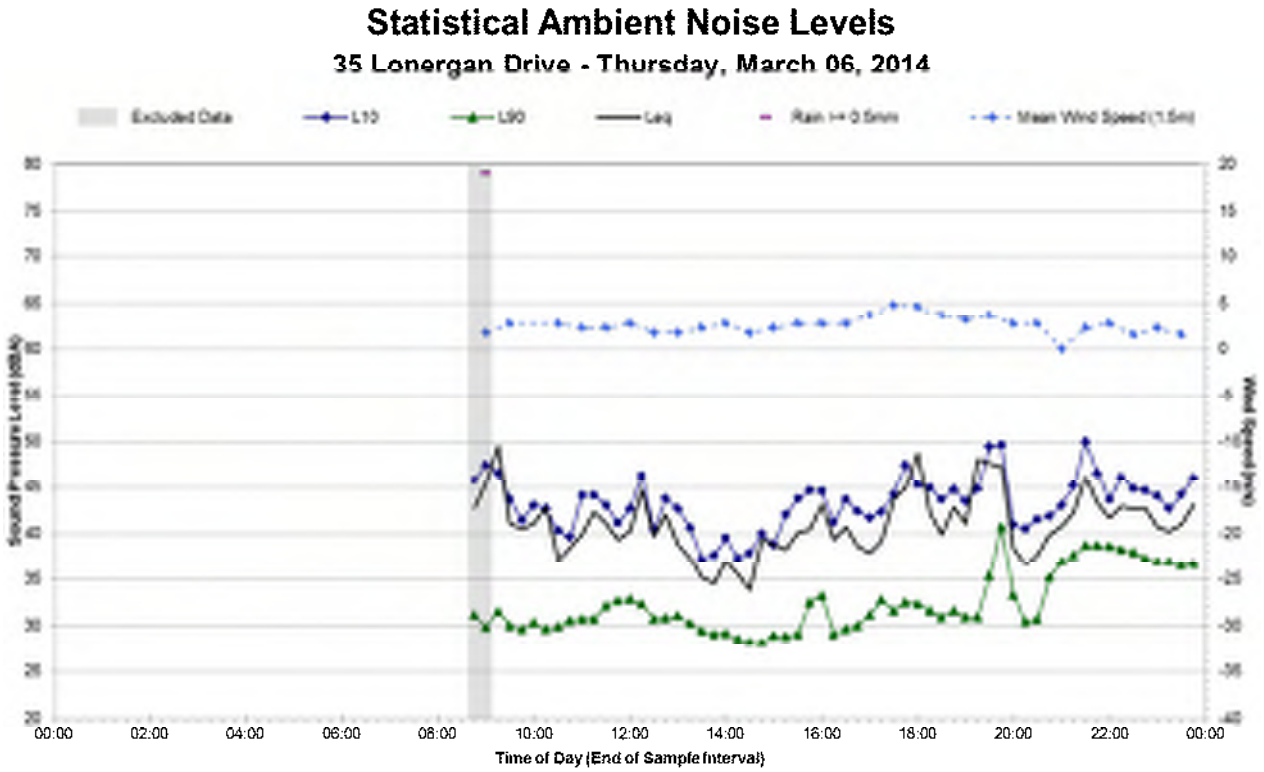
NOISE LOGGING CHARTS – 35 LONERGAN DRIVE





NOISE LOGGING CHARTS – 35 LONERGAN DRIVE

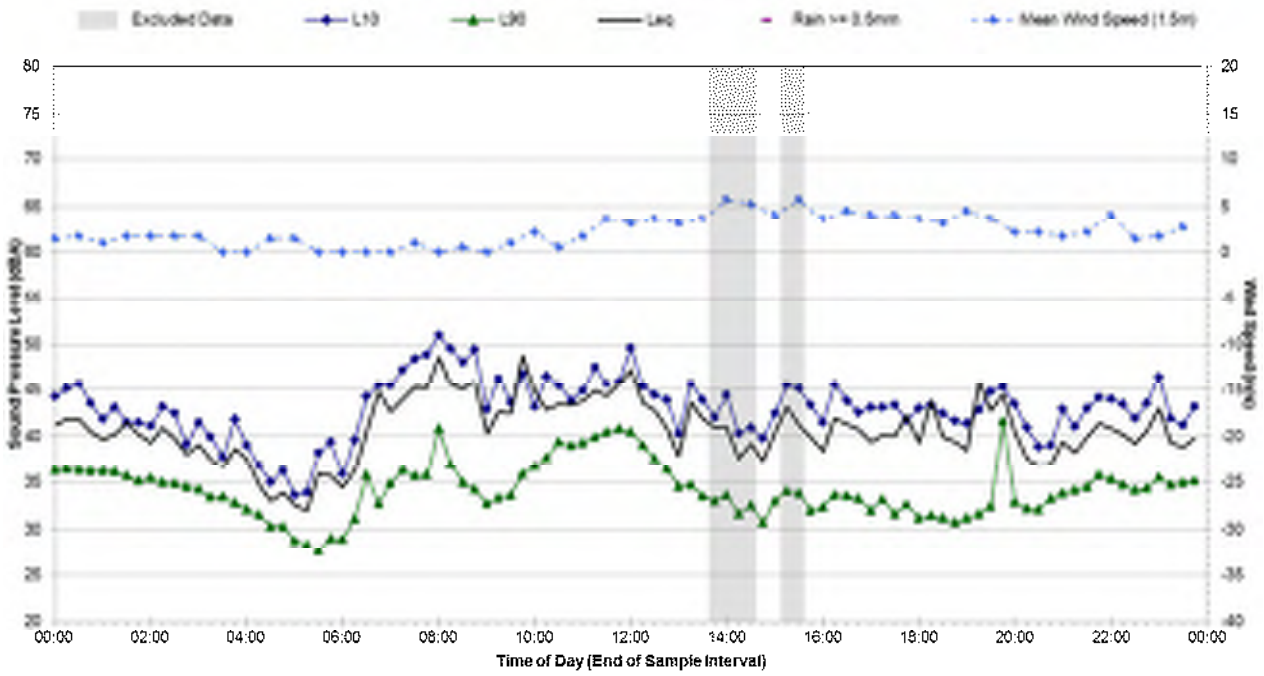




NOISE LOGGING CHARTS – 35 LONERGAN DRIVE

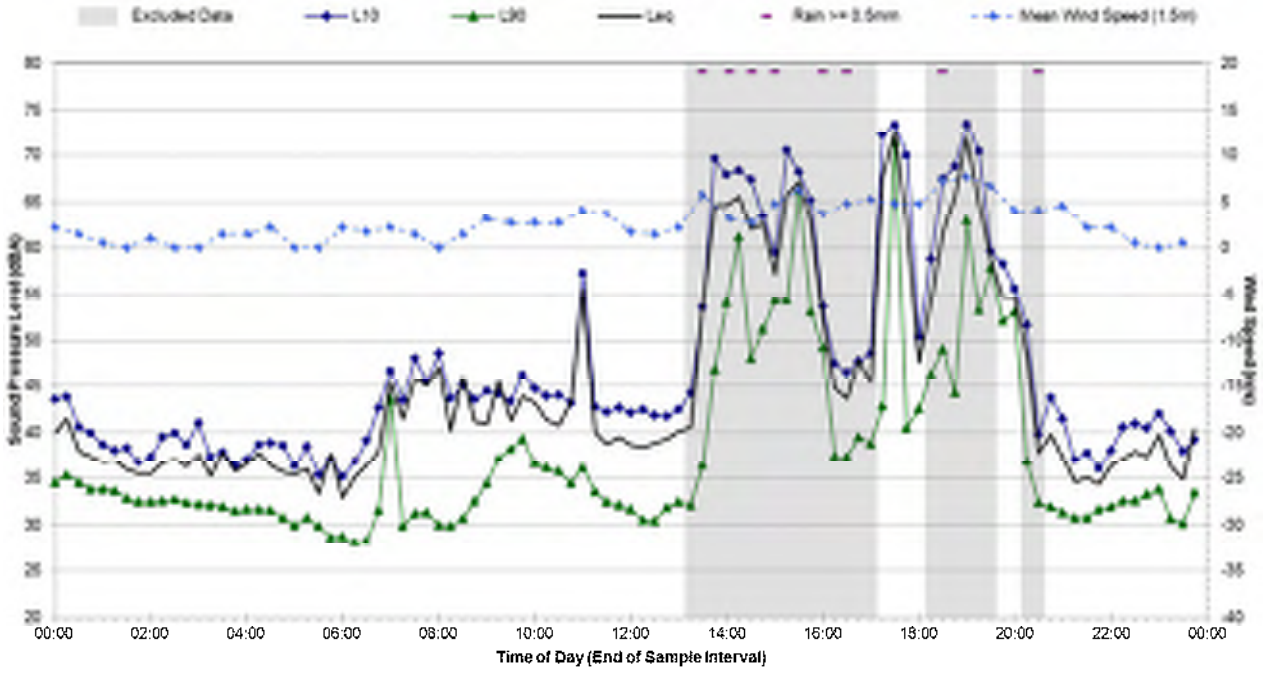
Statistical Ambient Noise Levels

35 Lonergan Drive - Friday, March 07, 2014

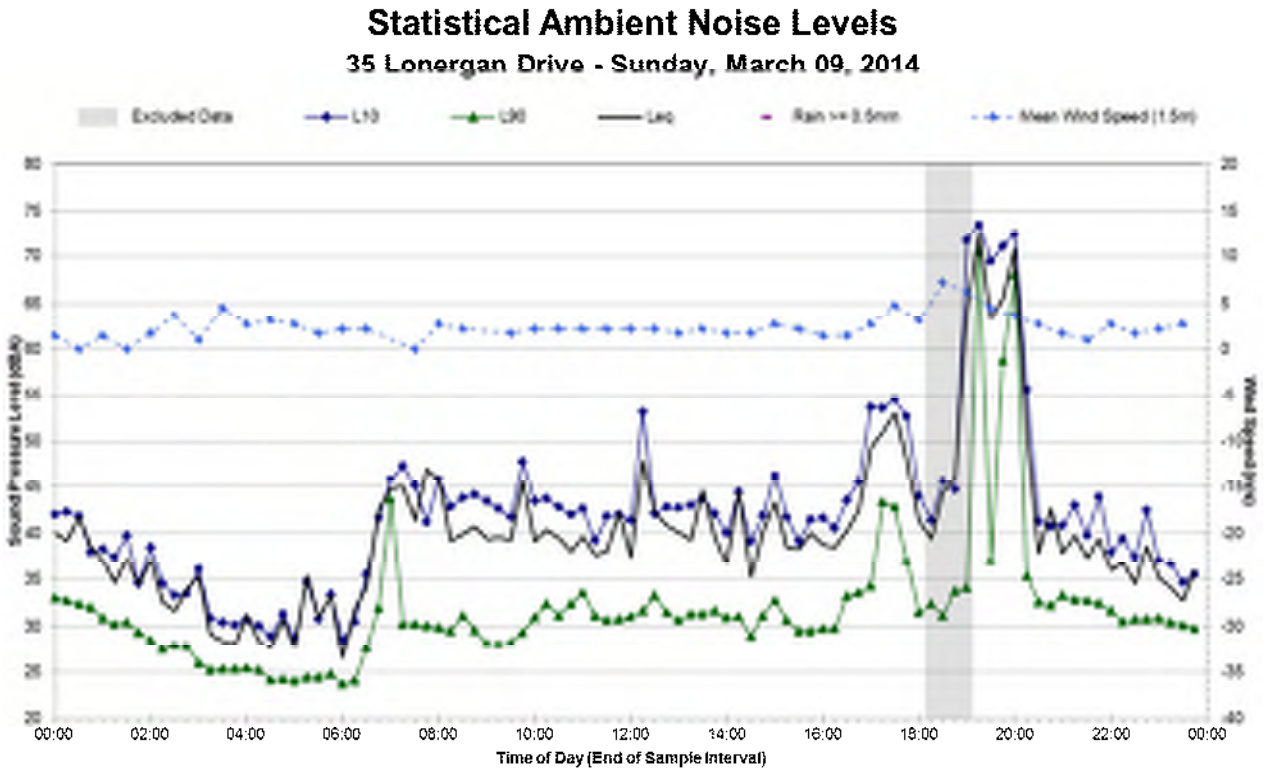


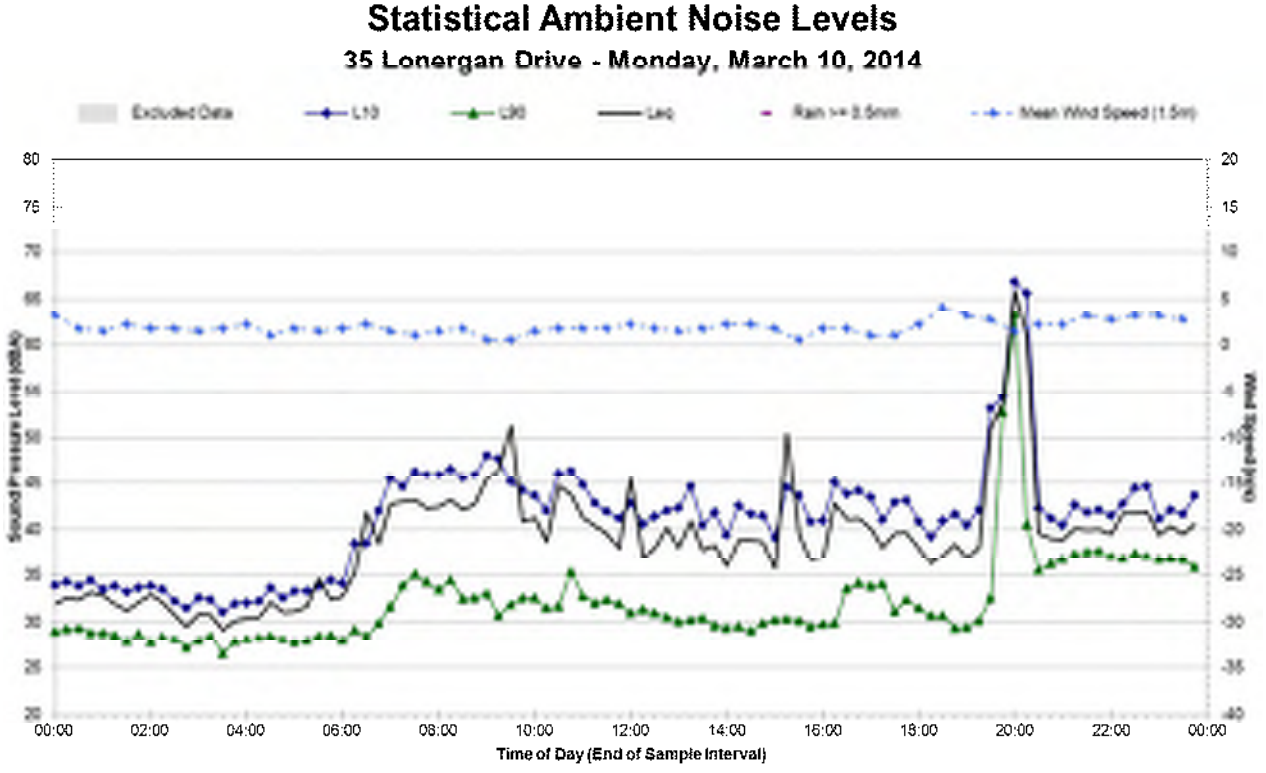
Statistical Ambient Noise Levels

35 Lonergan Drive - Saturday, March 08, 2014

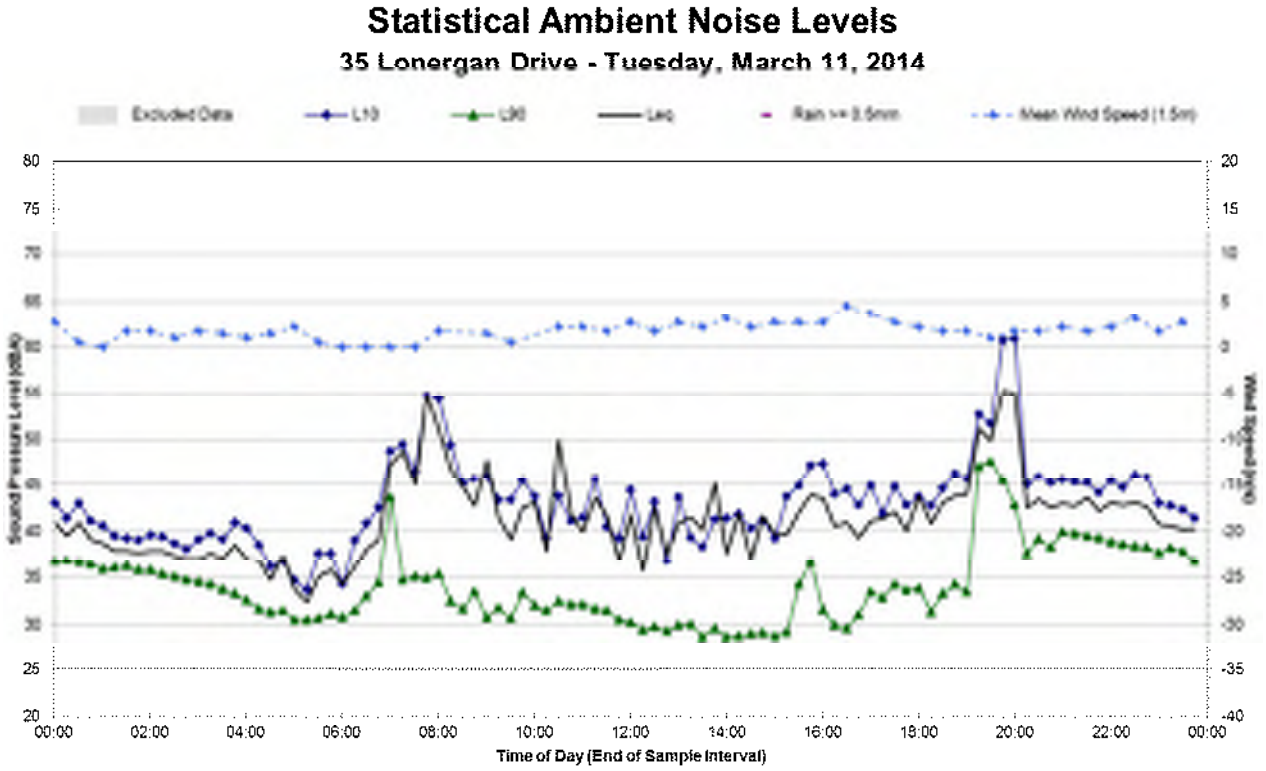


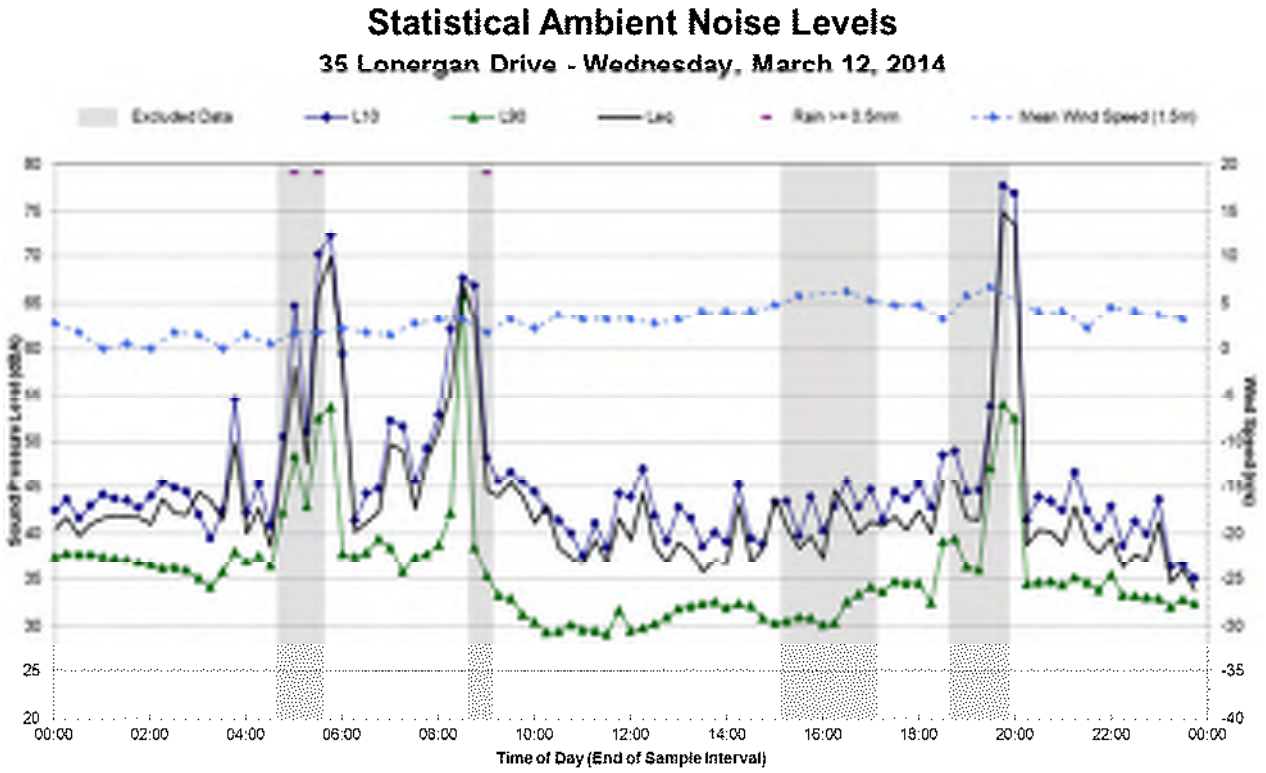
NOISE LOGGING CHARTS – 35 LONERGAN DRIVE



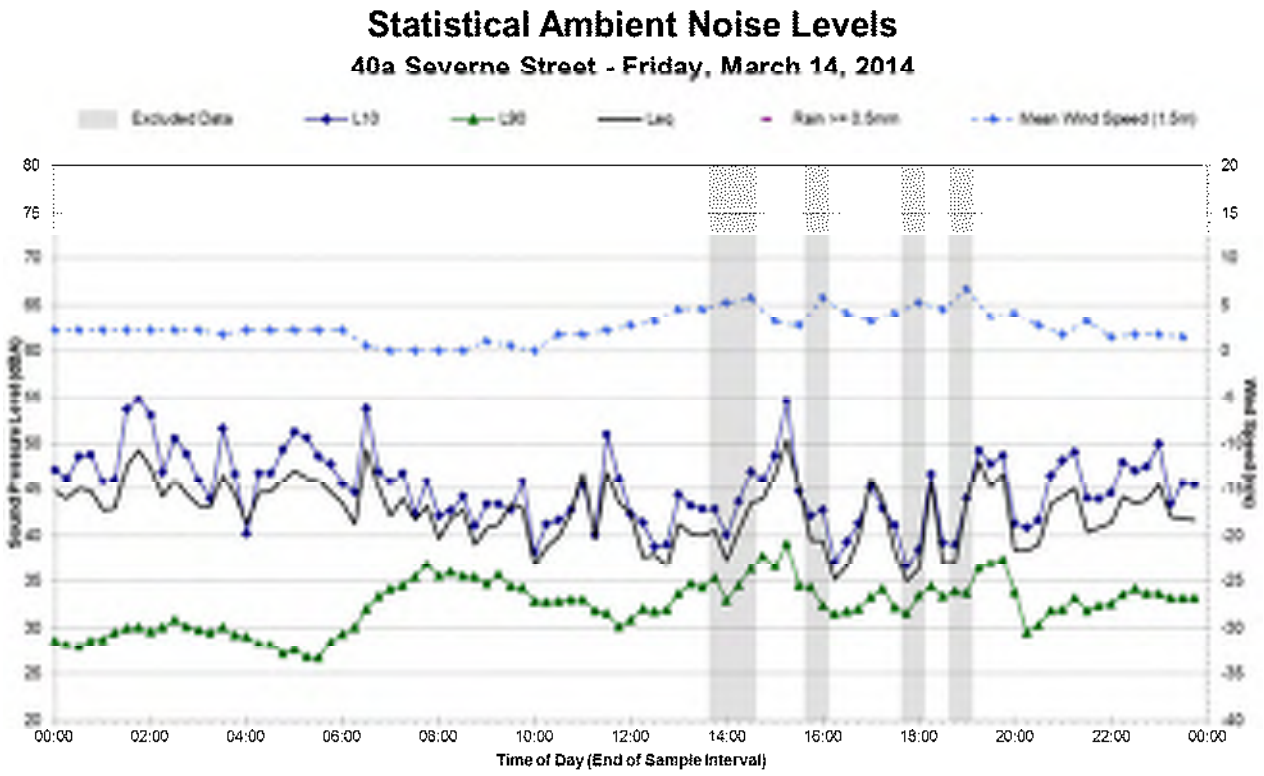


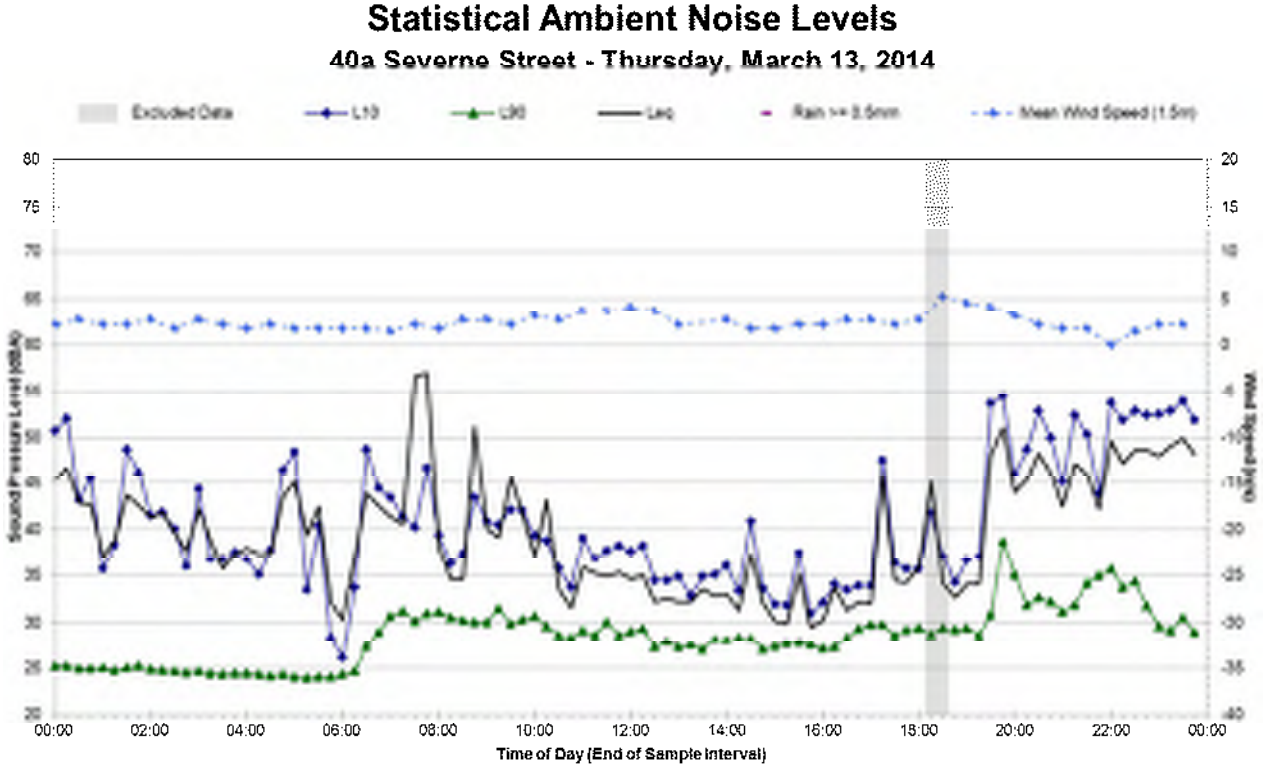
NOISE LOGGING CHARTS – 35 LONERGAN DRIVE



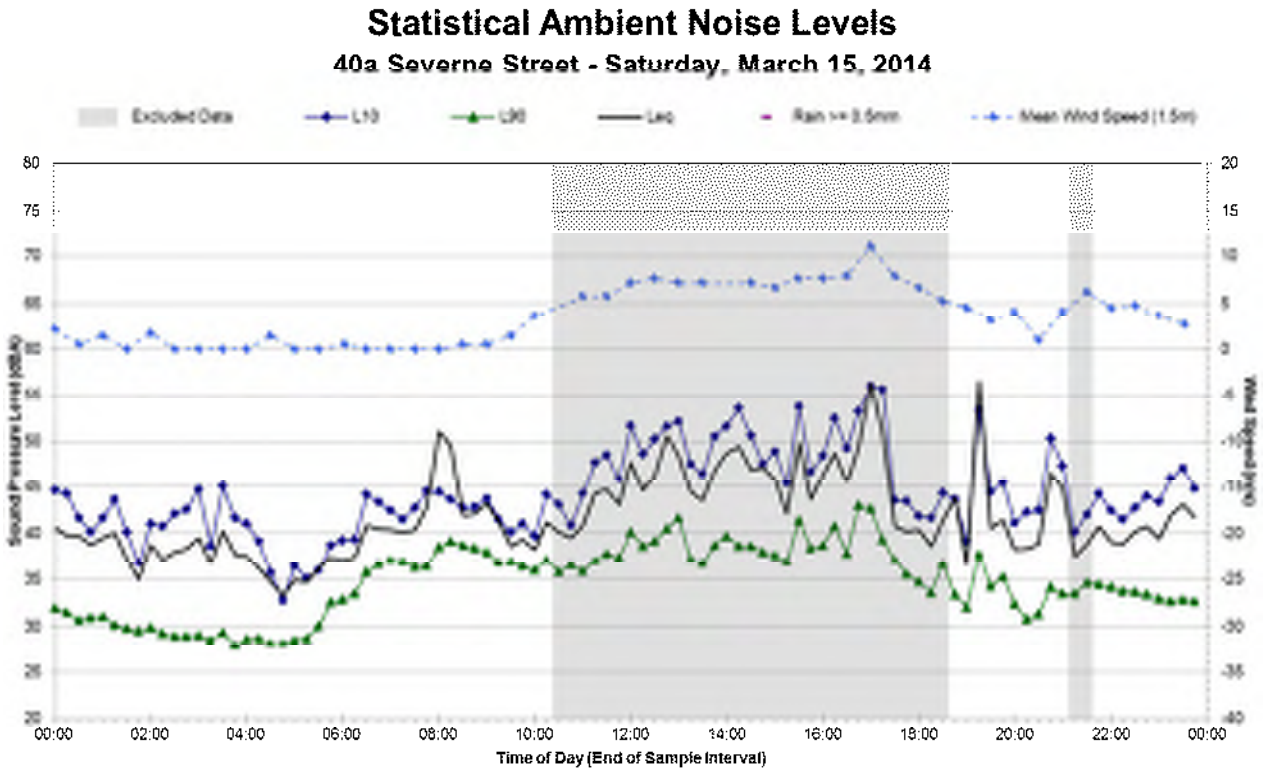


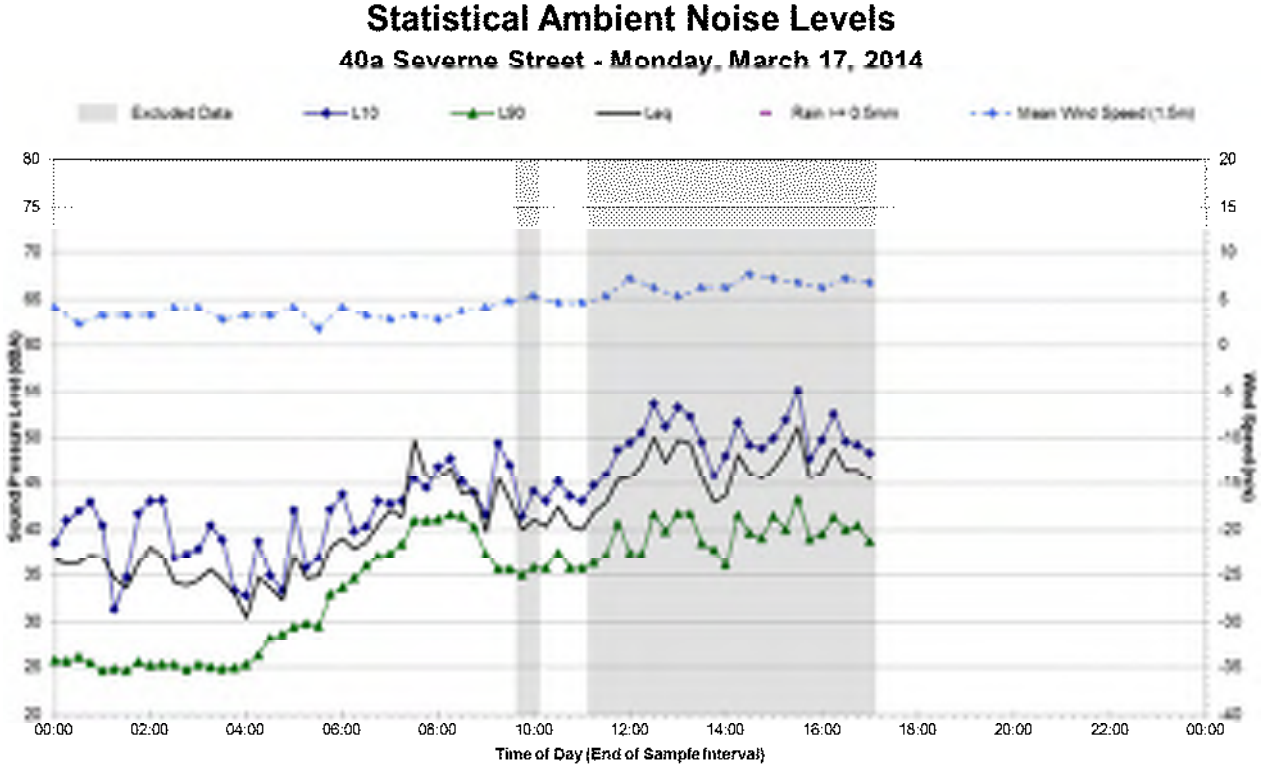
NOISE LOGGING CHARTS – 40A SEVERNE STREET



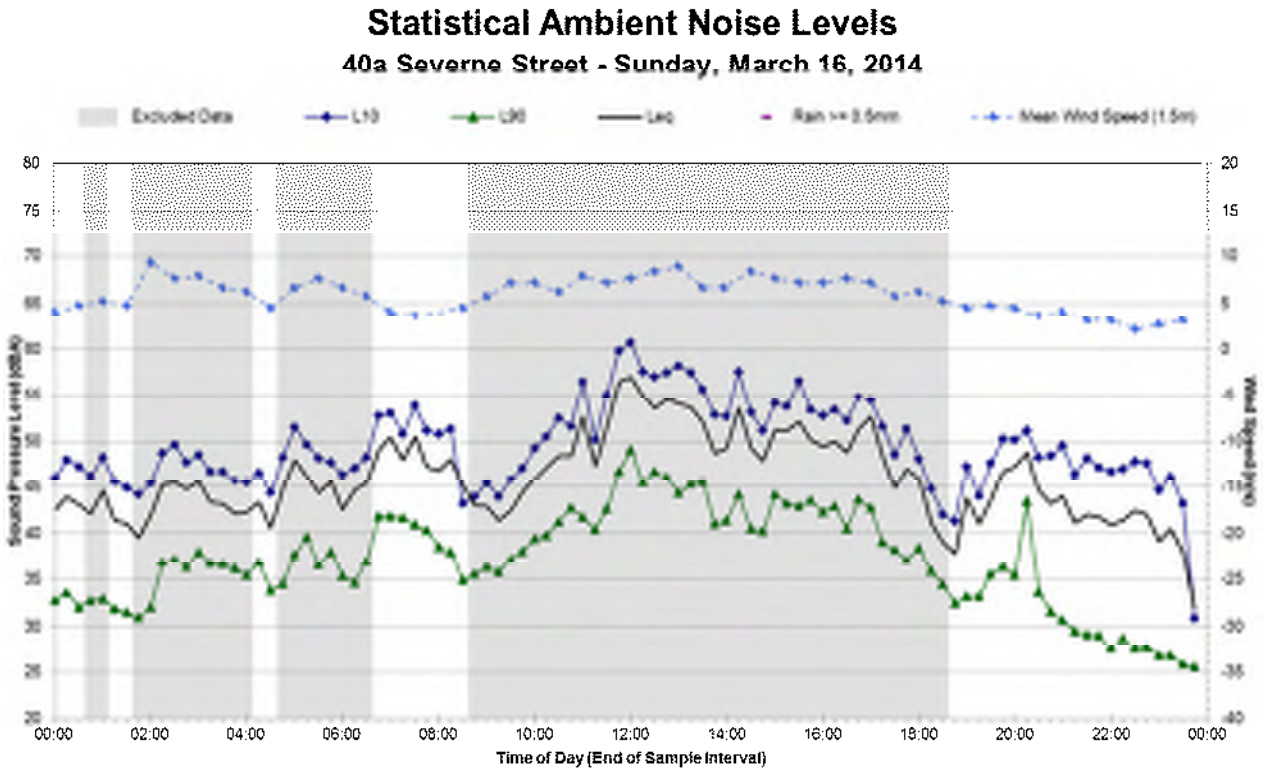


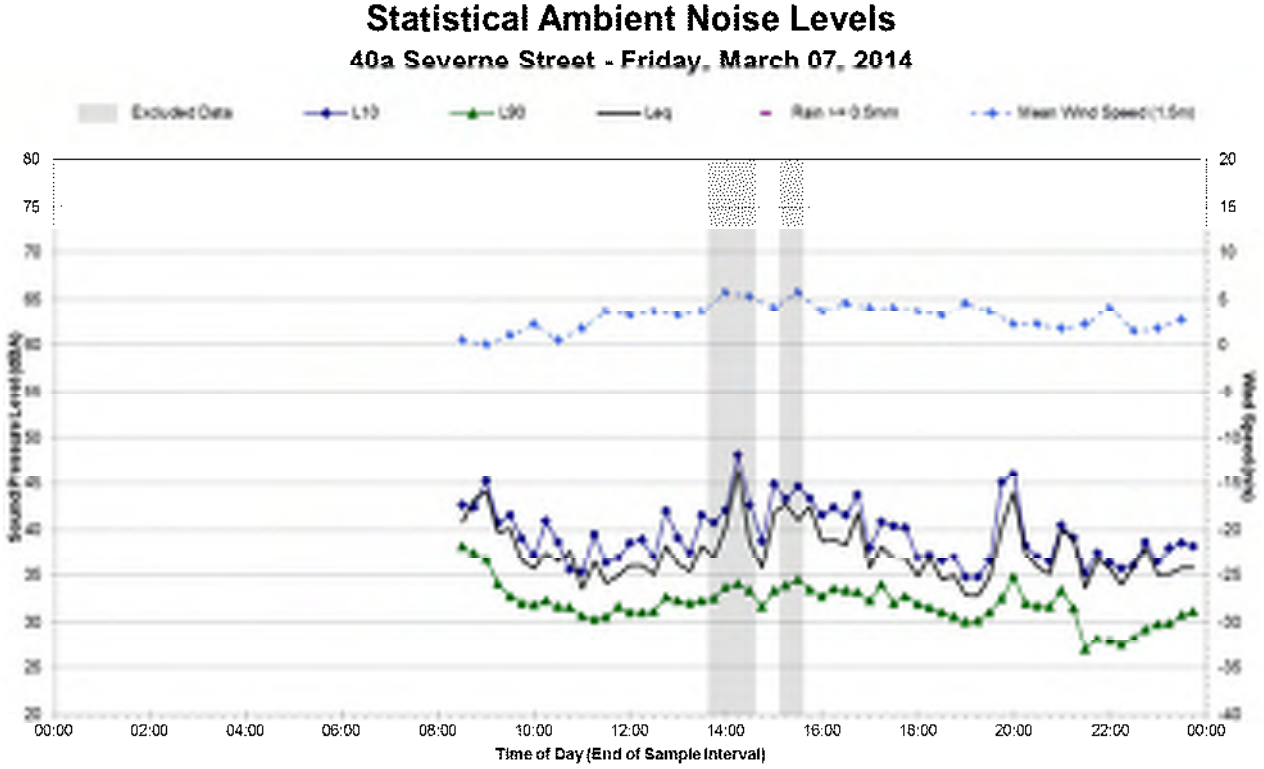
NOISE LOGGING CHARTS – 40A SEVERNE STREET



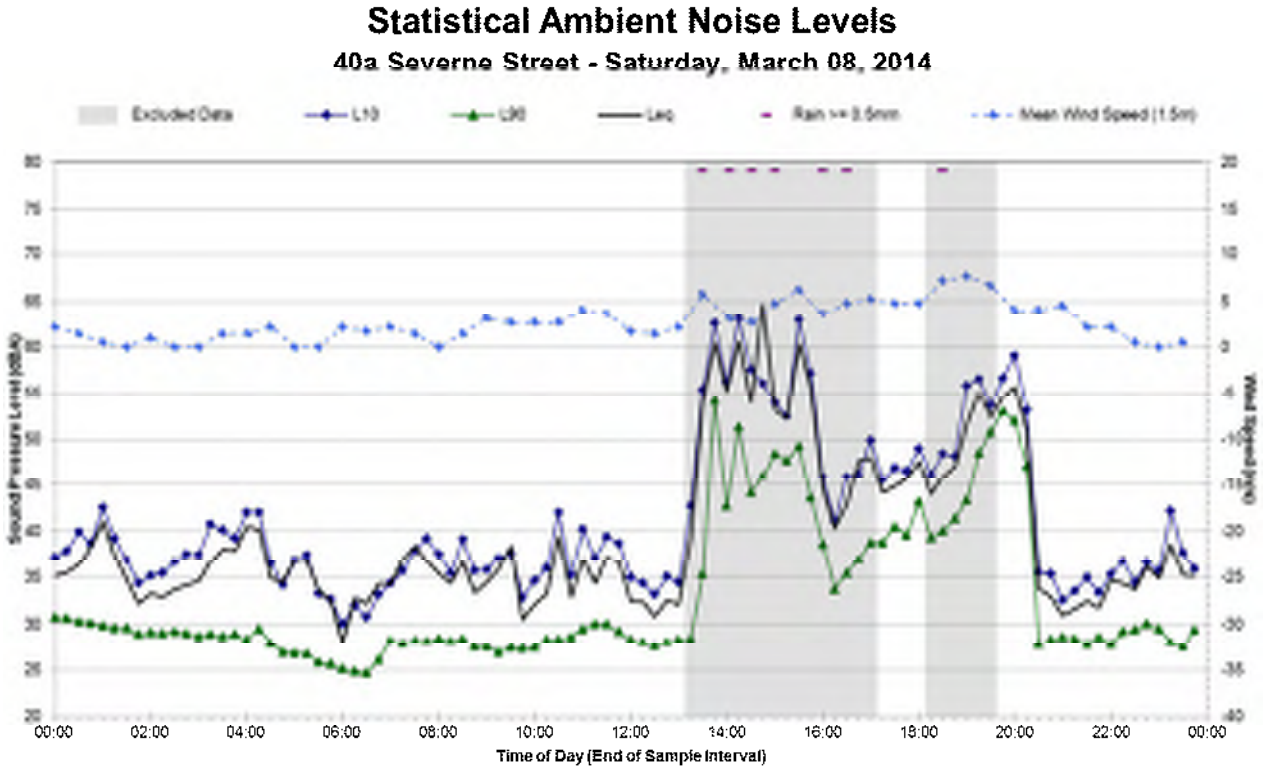


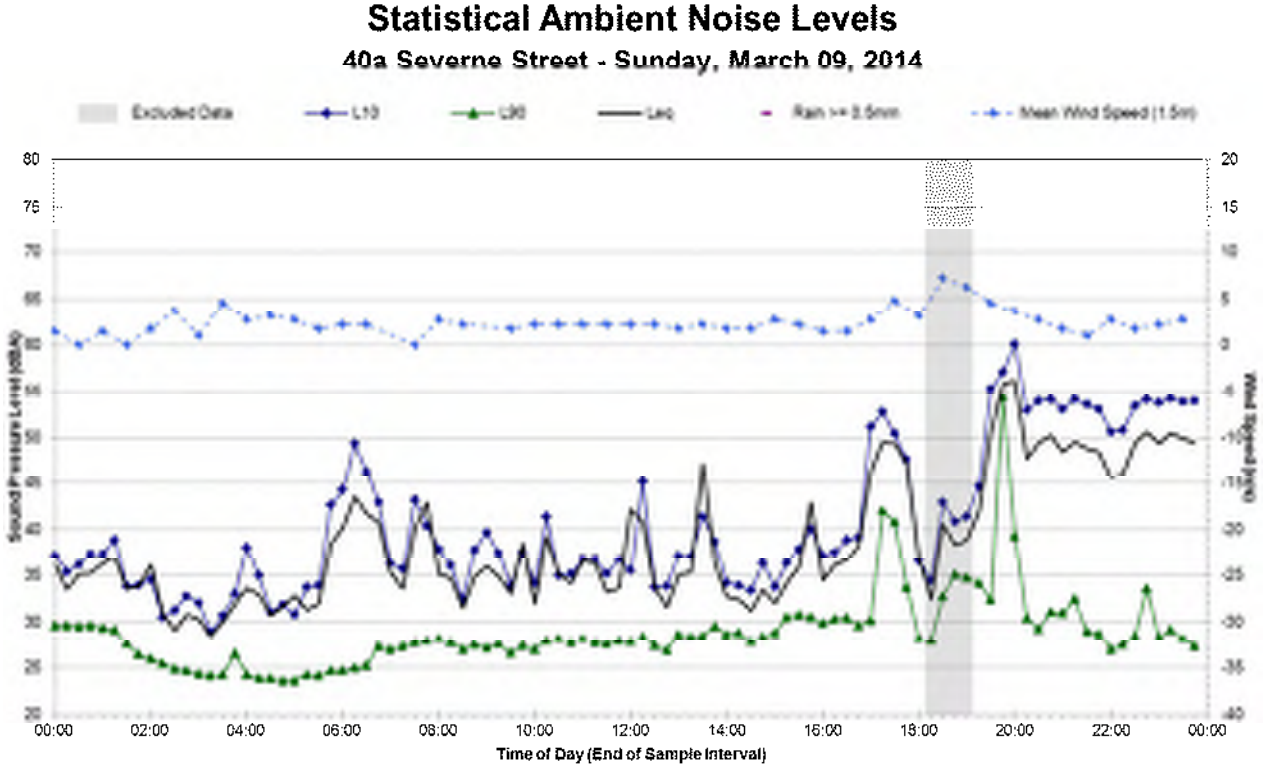
NOISE LOGGING CHARTS – 40A SEVERNE STREET



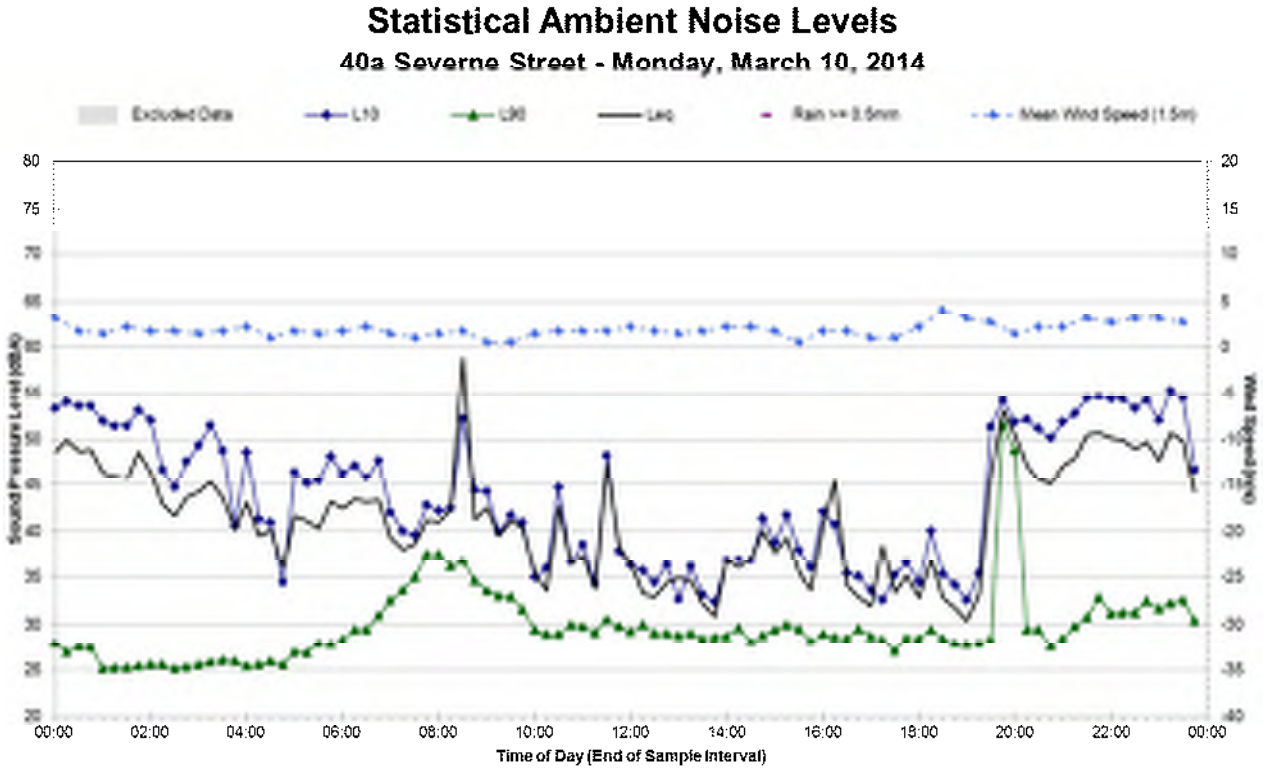


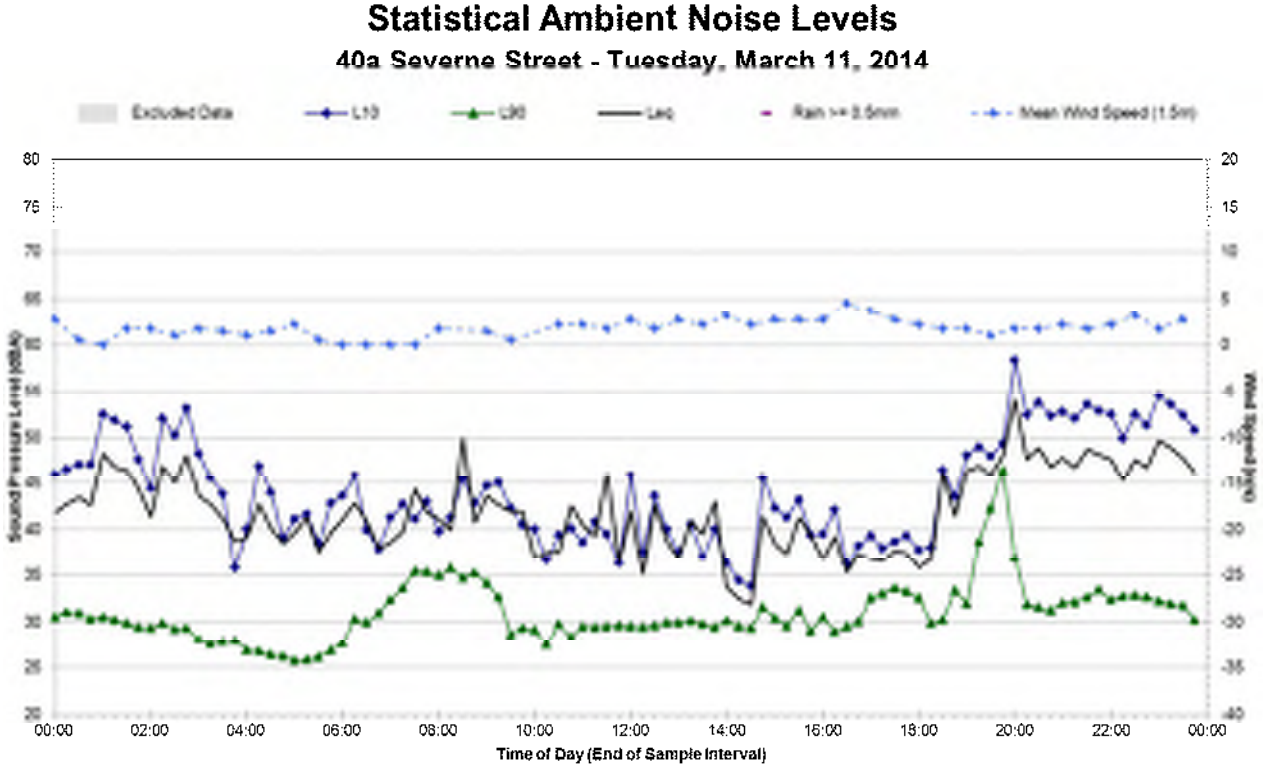
NOISE LOGGING CHARTS – 40A SEVERNE STREET



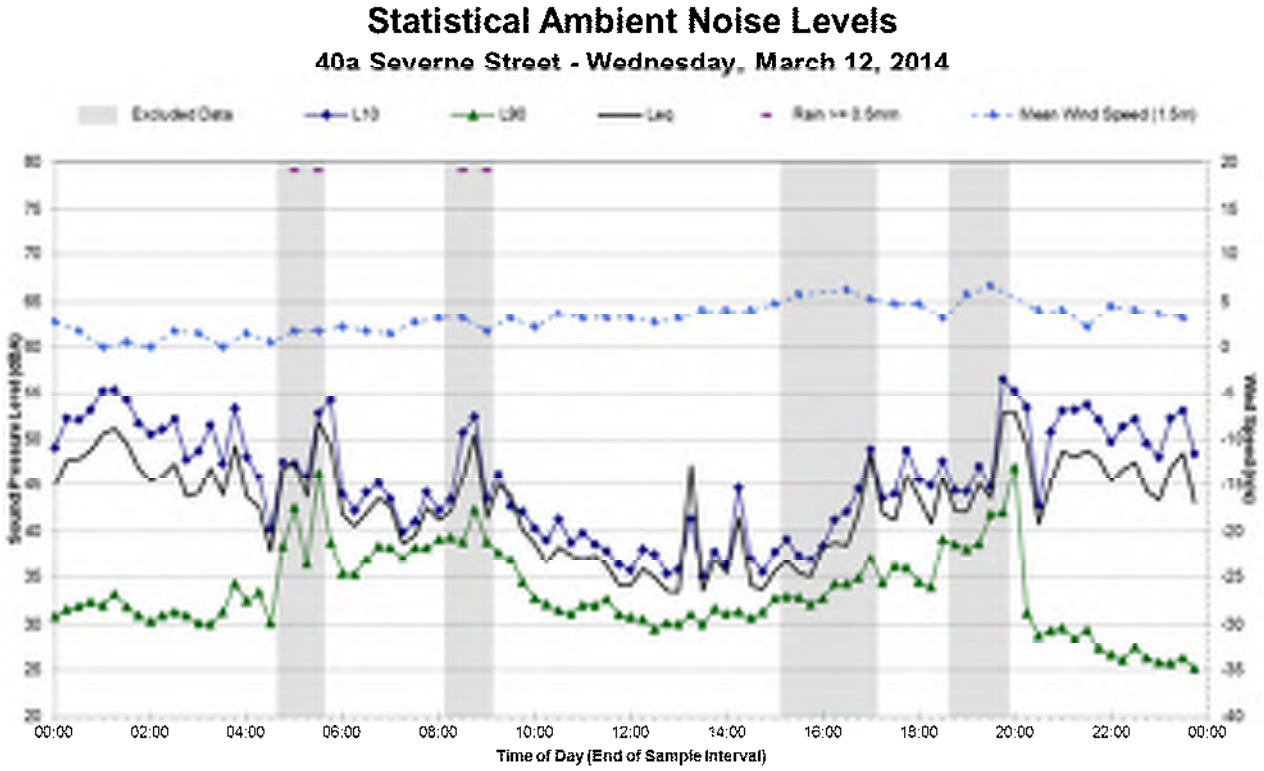


NOISE LOGGING CHARTS – 40A SEVERNE STREET





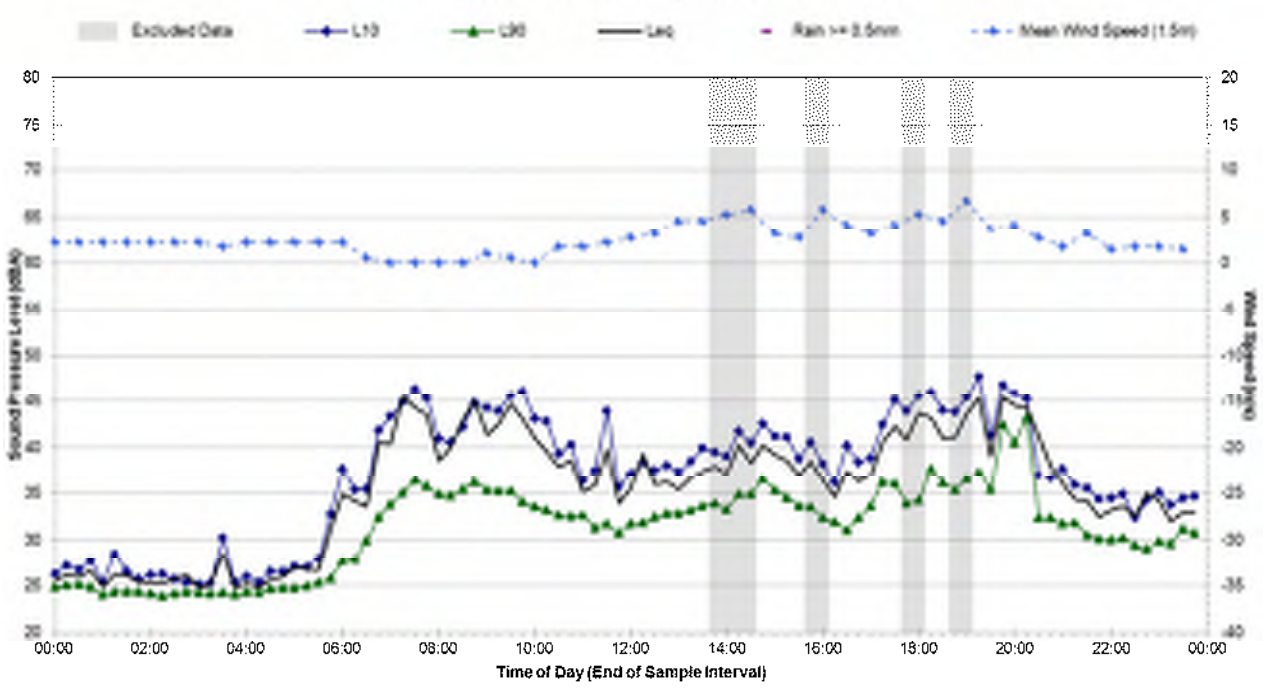
NOISE LOGGING CHARTS – 40A SEVERNE STREET



NOISE LOGGING CHARTS – 26 DOEBERL PLACE

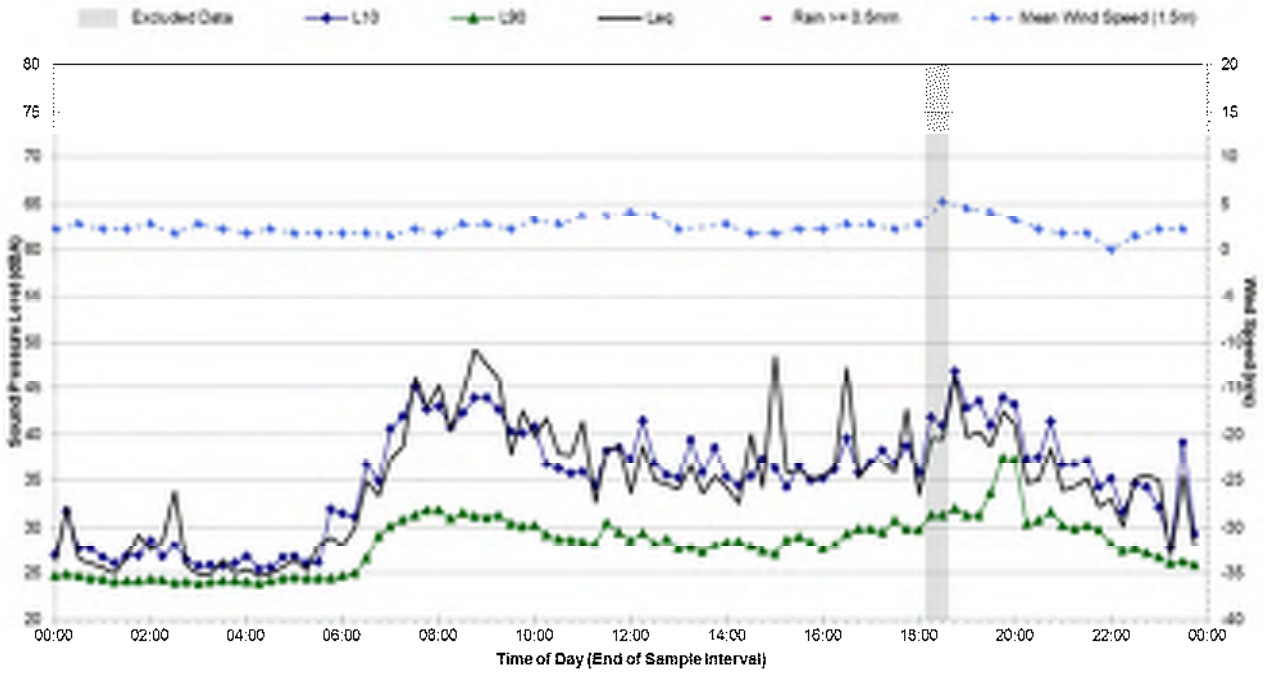
Statistical Ambient Noise Levels

26 Doeberl Place - Friday, March 14, 2014



Statistical Ambient Noise Levels

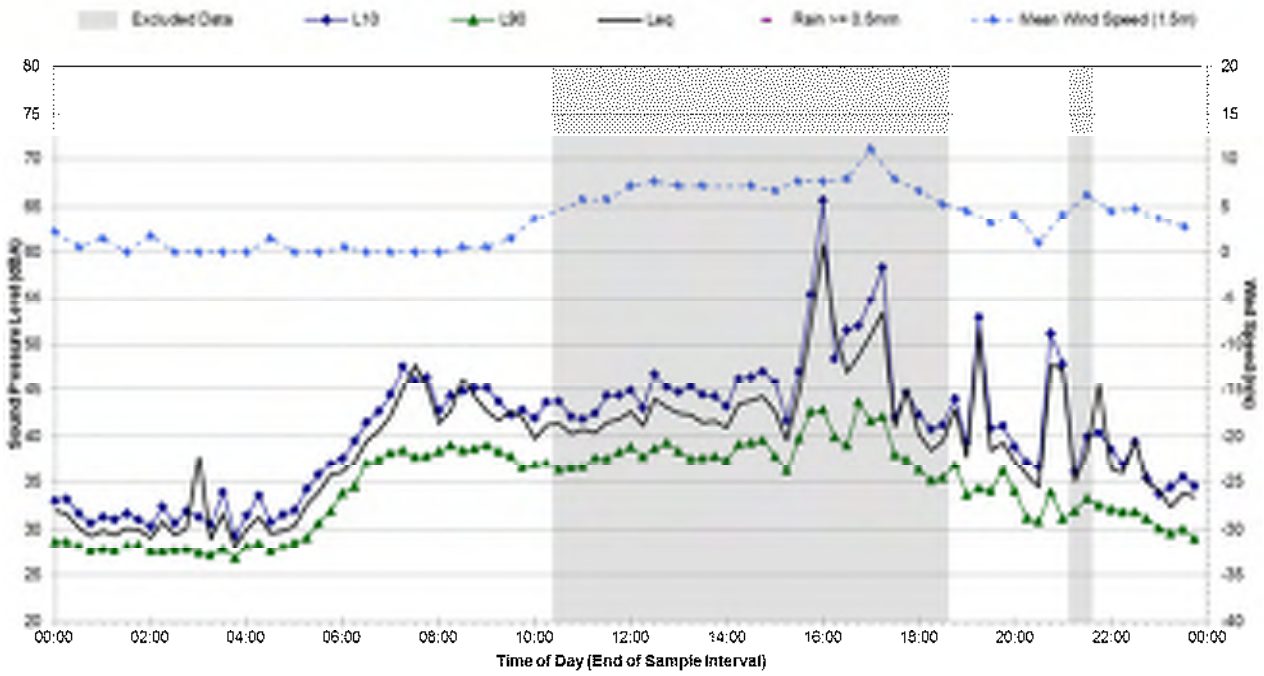
26 Doeberl Place - Thursday, March 13, 2014



NOISE LOGGING CHARTS – 26 DOEBERL PLACE

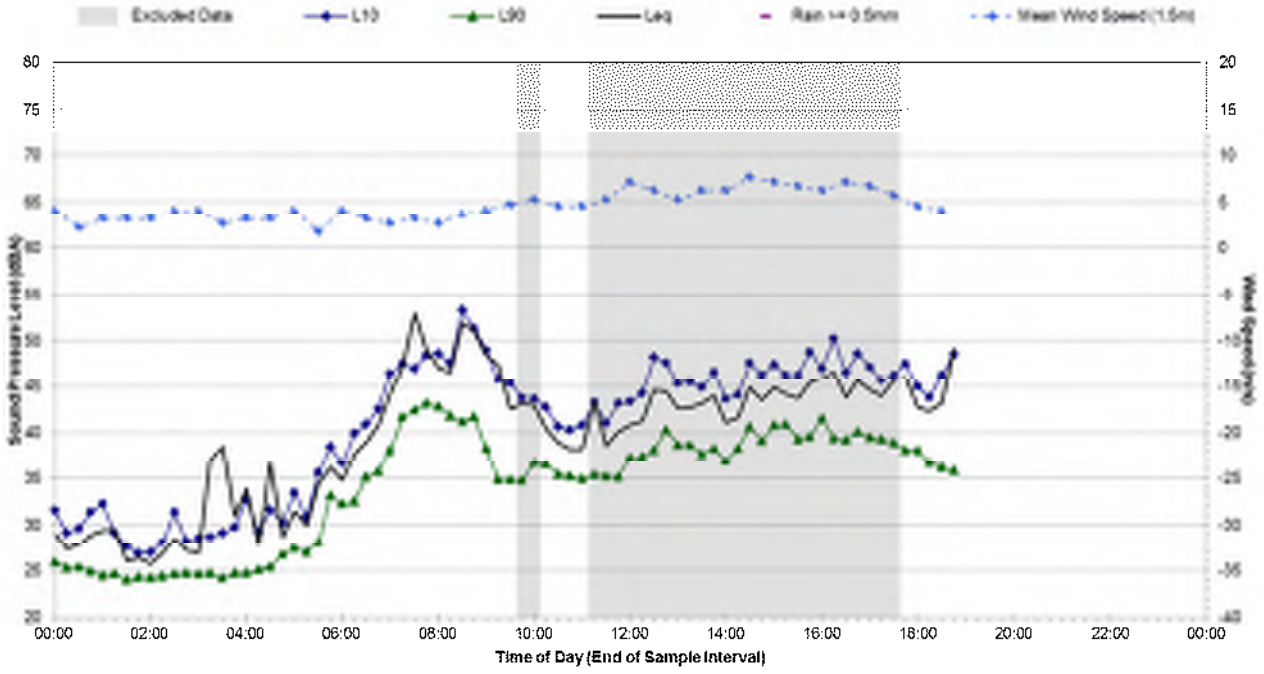
Statistical Ambient Noise Levels

26 Doeberl Place - Saturday, March 15, 2014

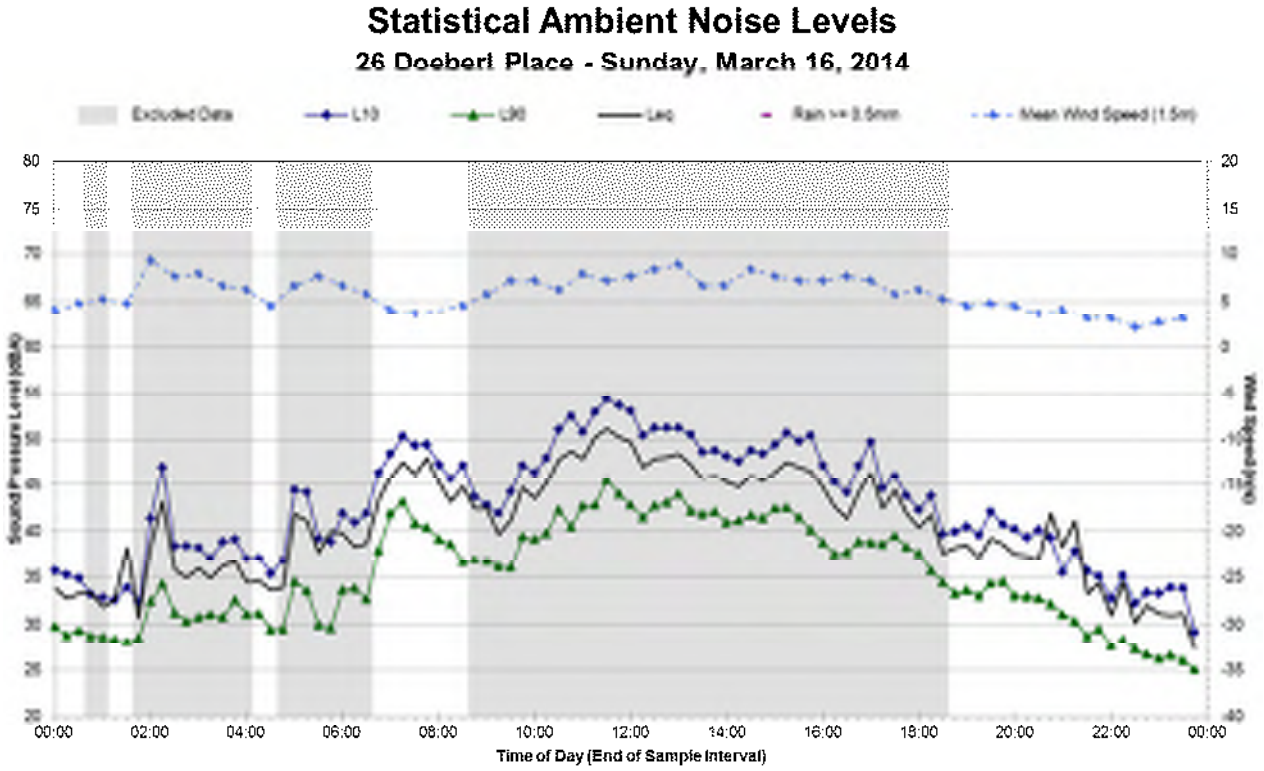


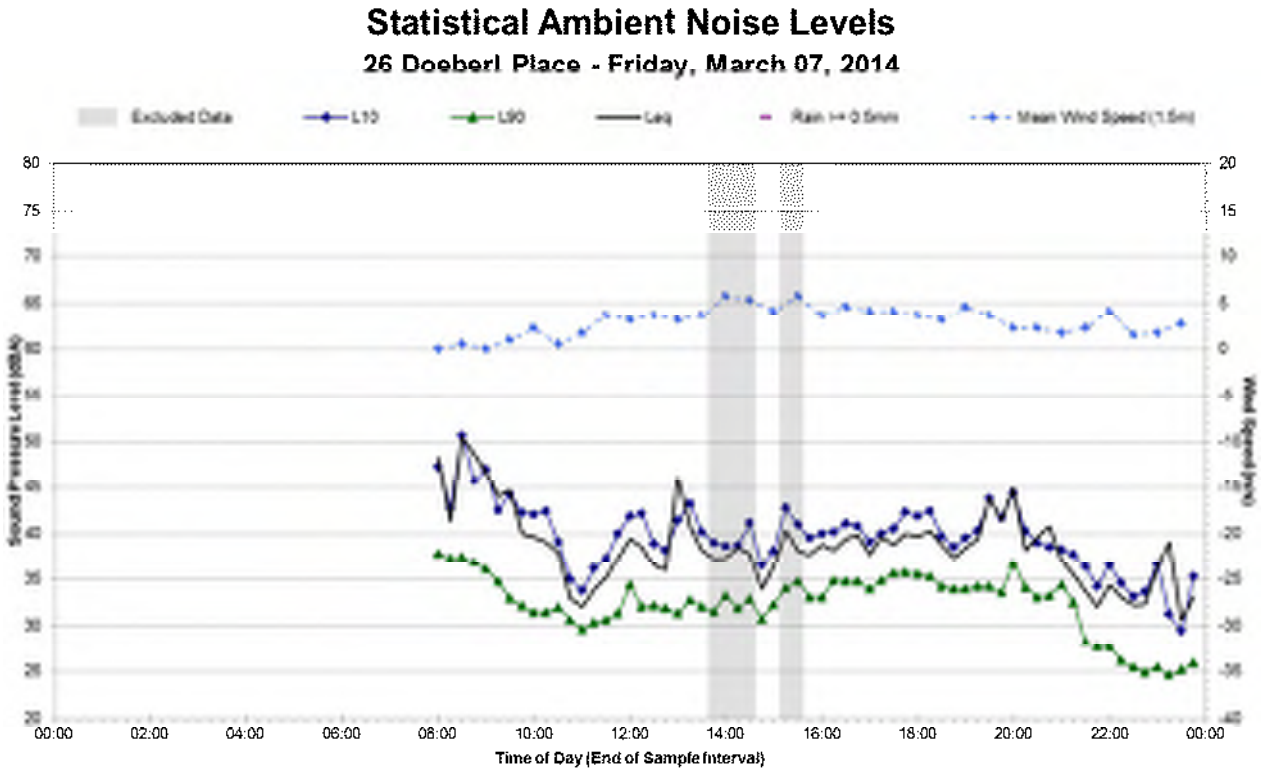
Statistical Ambient Noise Levels

26 Doeberl Place - Monday, March 17, 2014

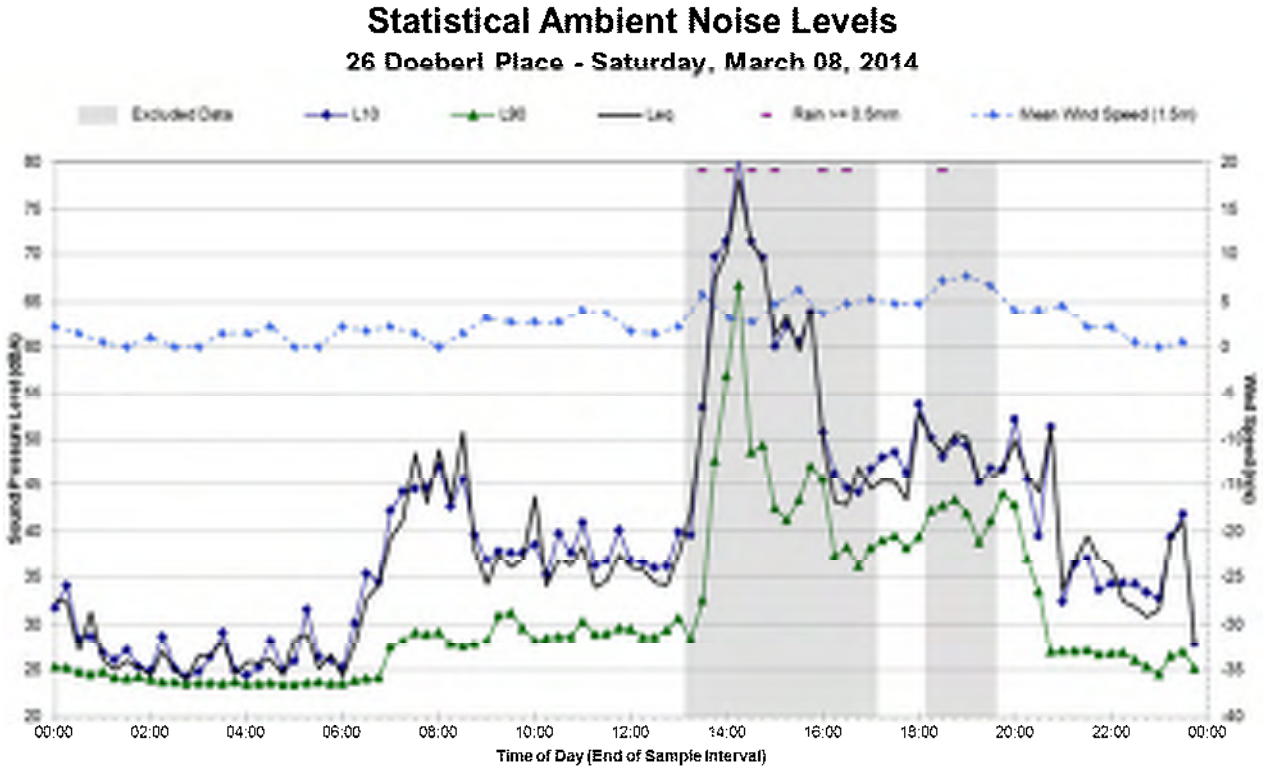


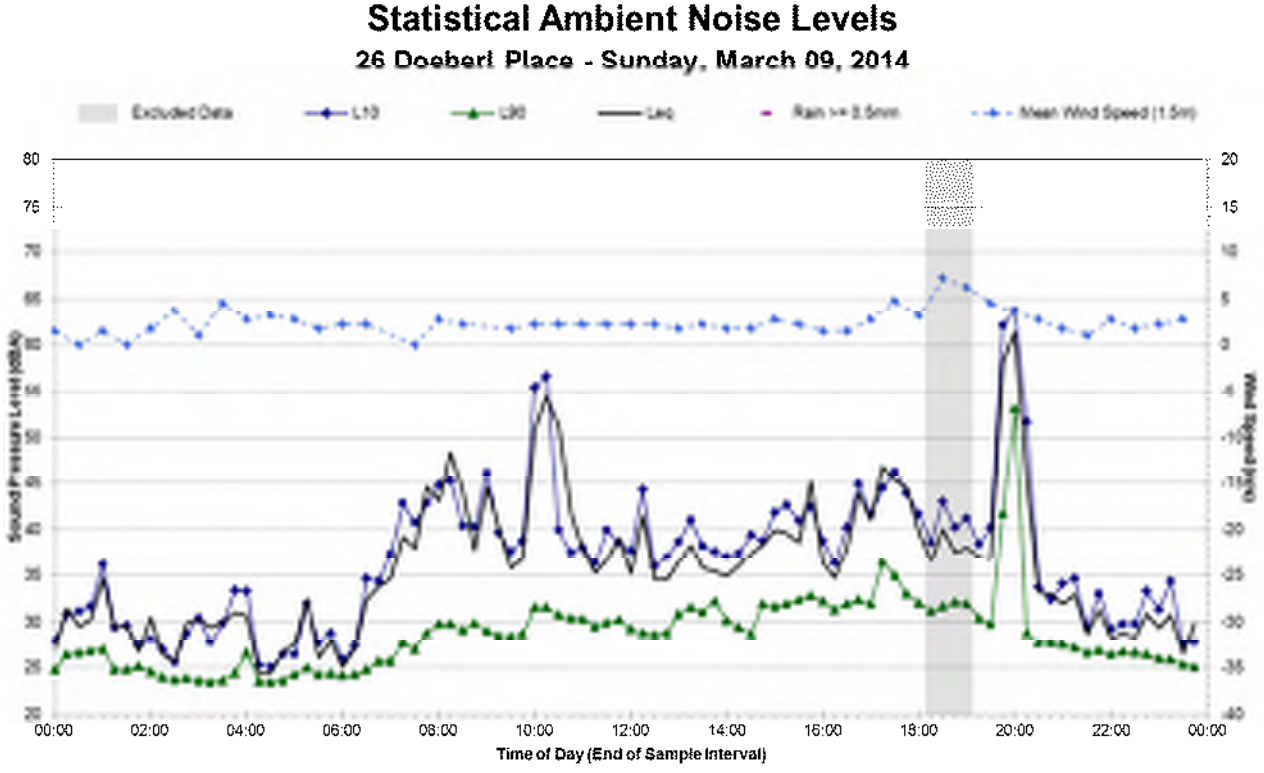
NOISE LOGGING CHARTS – 26 DOEBERL PLACE



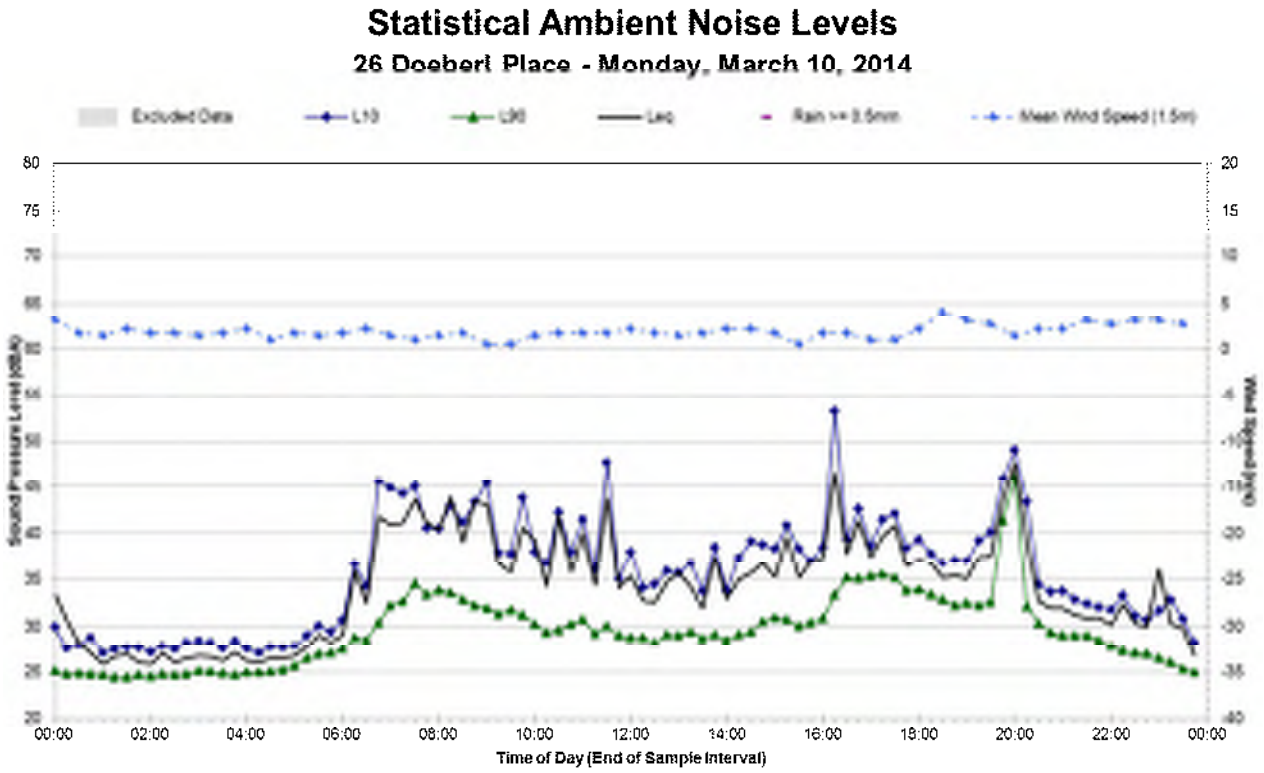


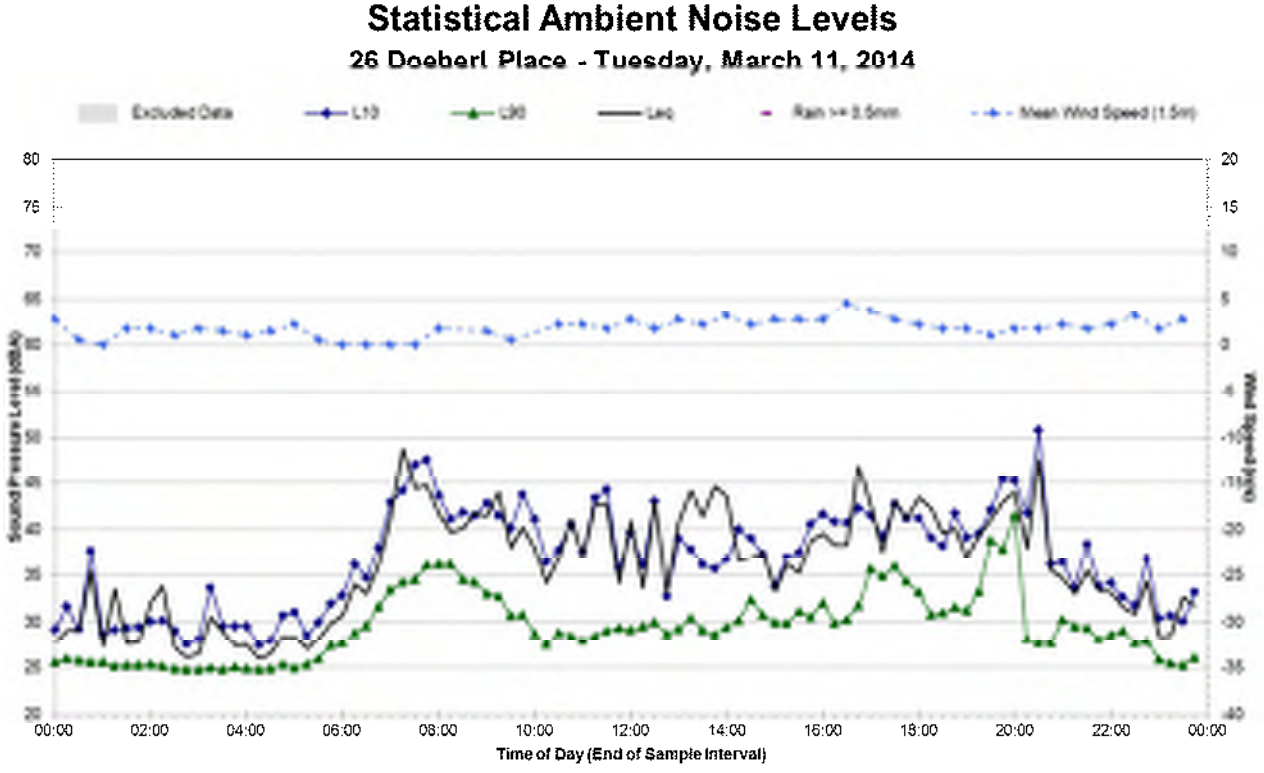
NOISE LOGGING CHARTS – 26 DOEBERL PLACE



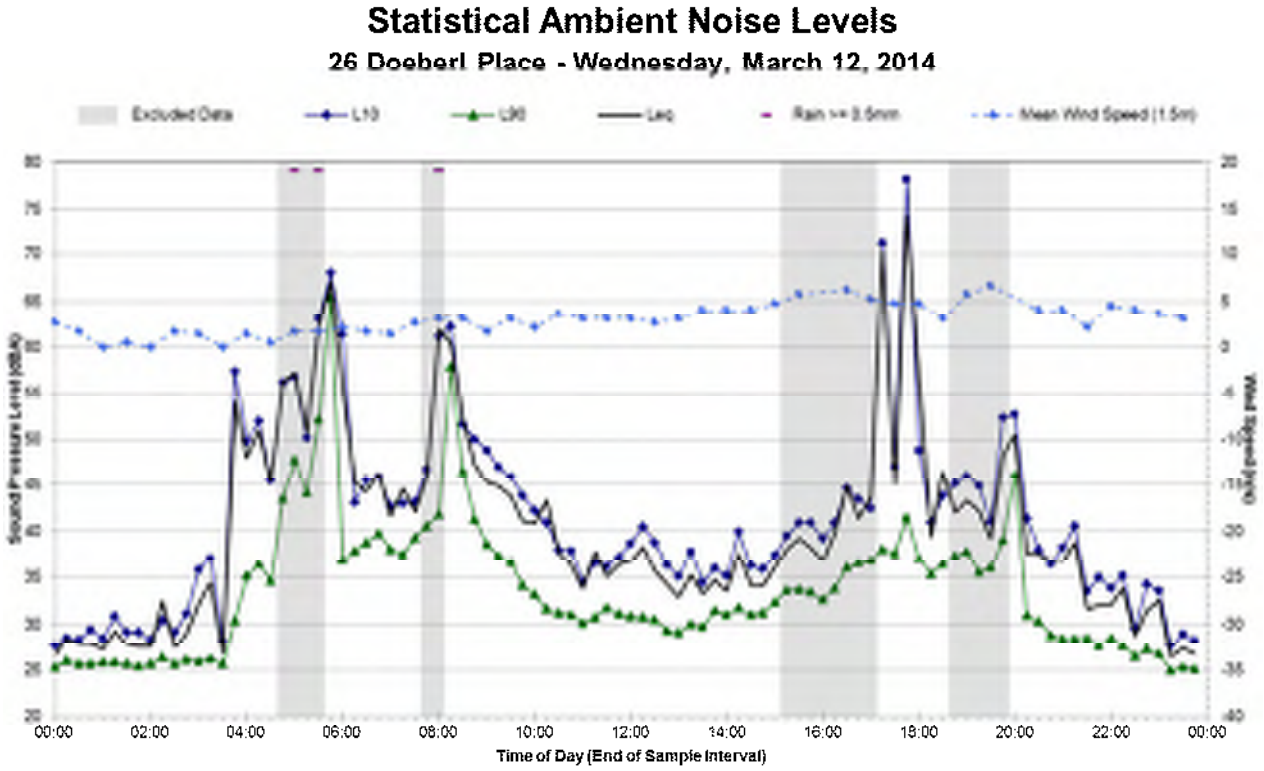


NOISE LOGGING CHARTS – 26 DOEBERL PLACE





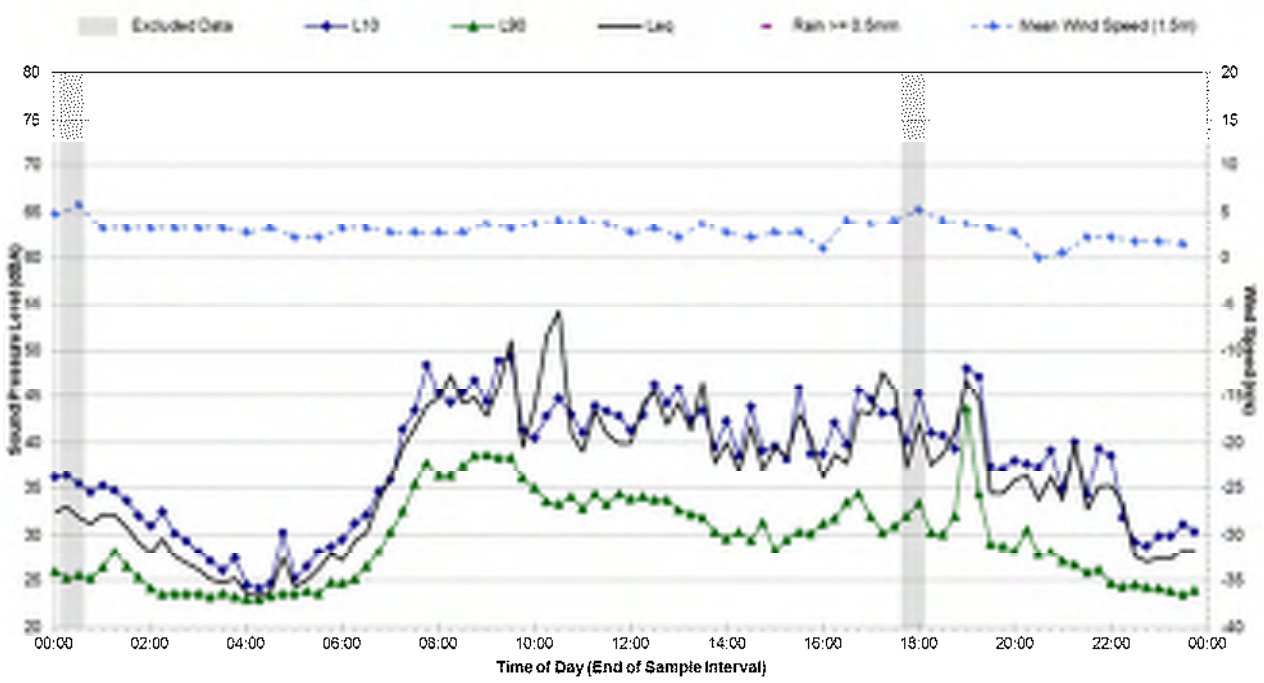
NOISE LOGGING CHARTS – 26 DOEBERL PLACE



NOISE LOGGING CHARTS – 78 BARRACKS FLAT DRIVE

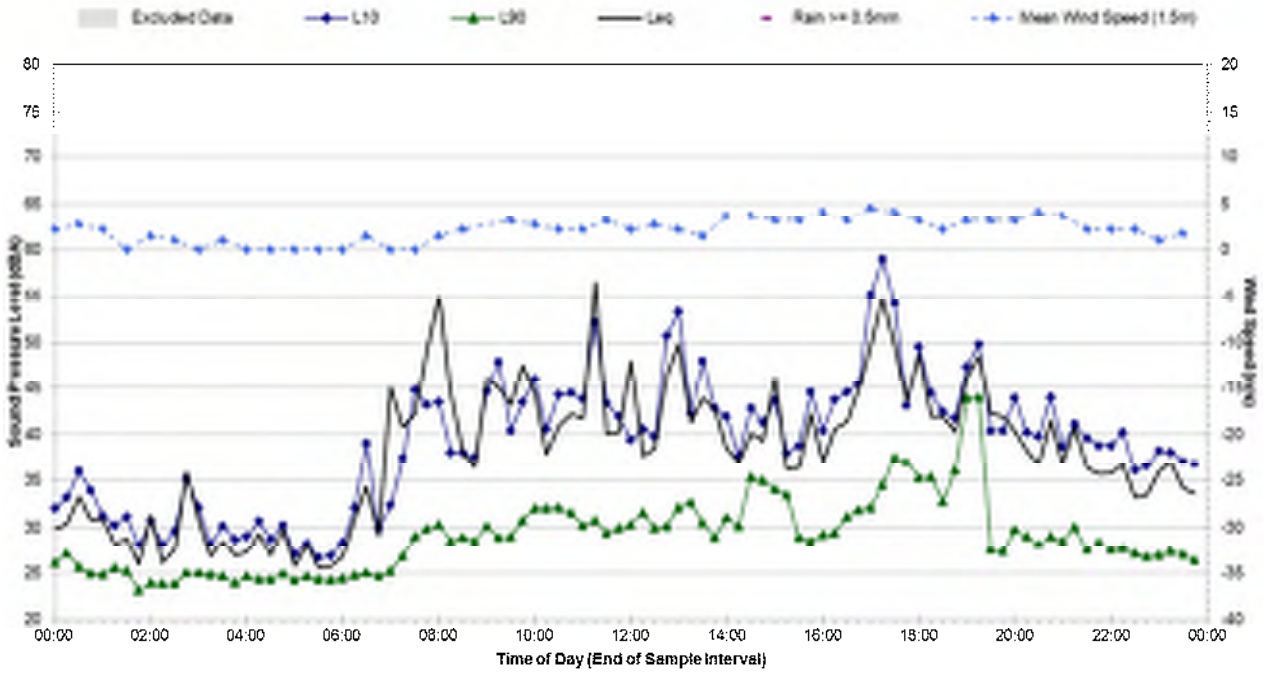
Statistical Ambient Noise Levels

78 Barracks Flat Drive - Monday, April 14, 2014

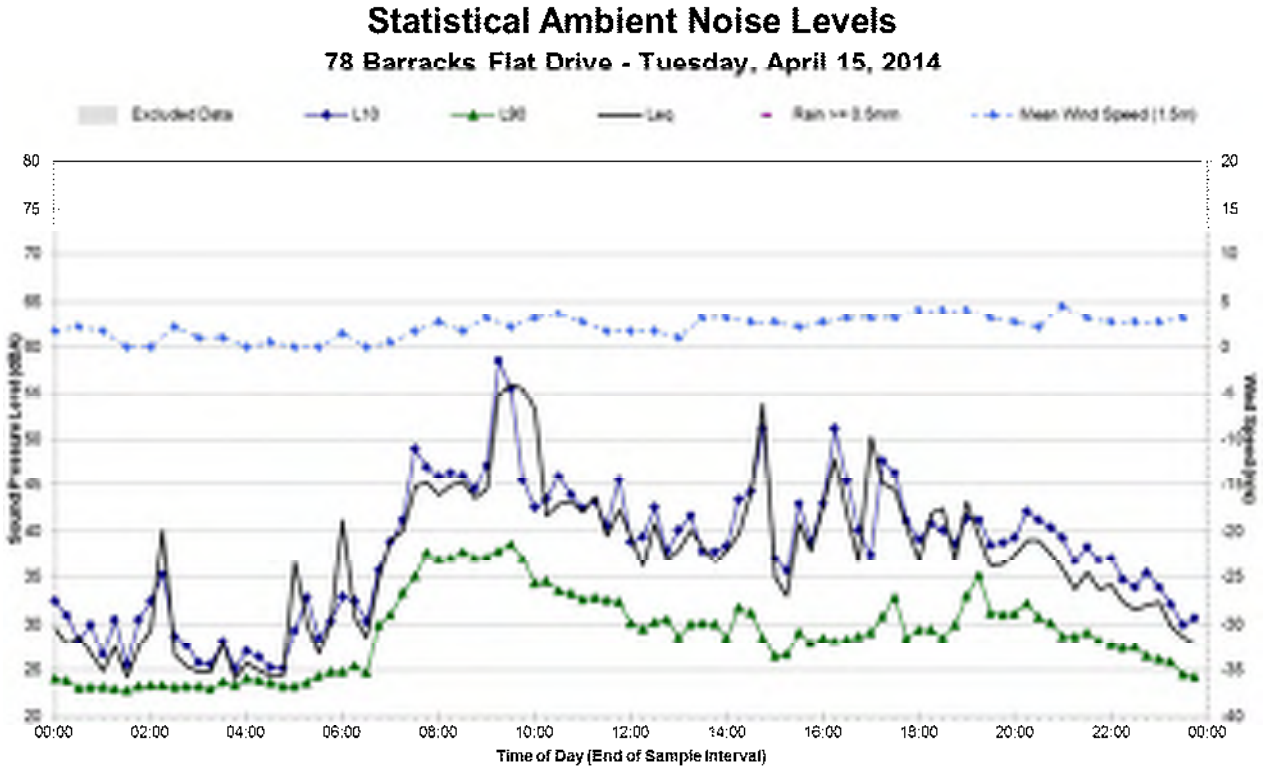


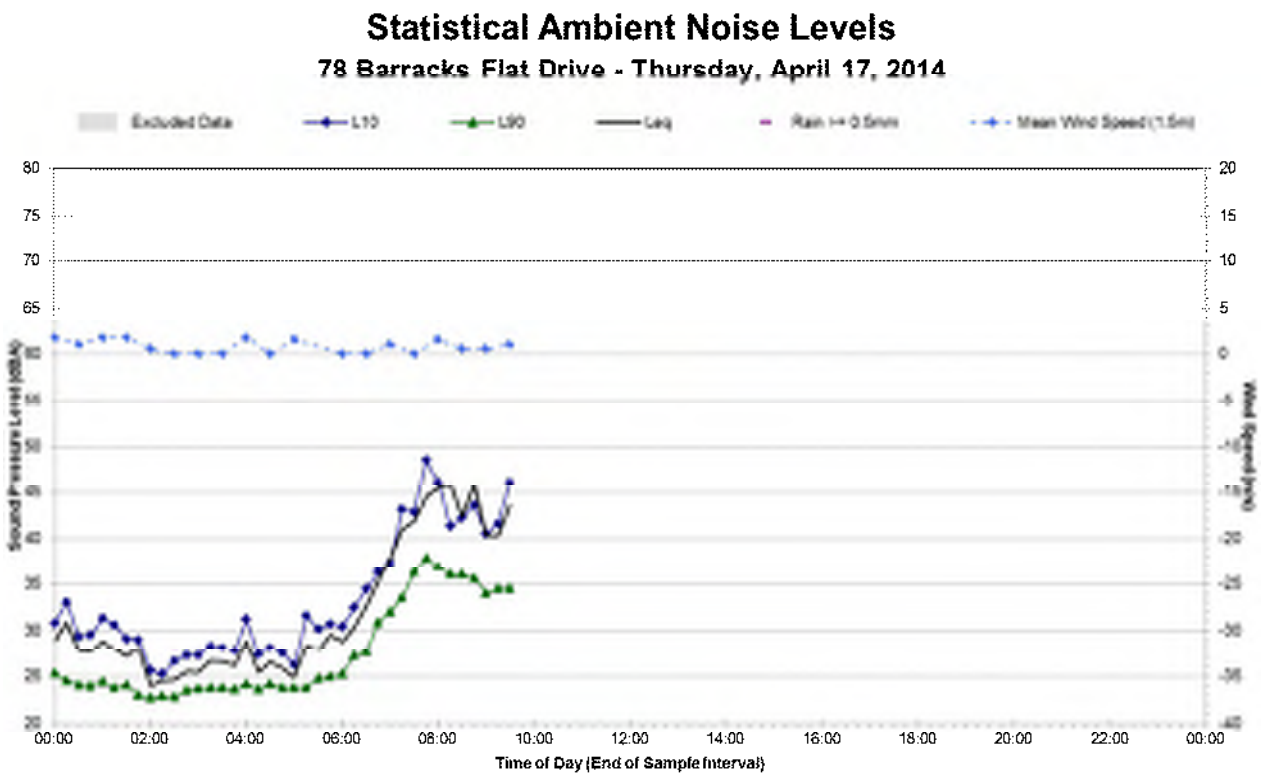
Statistical Ambient Noise Levels

78 Barracks Flat Drive - Sunday, April 13, 2014

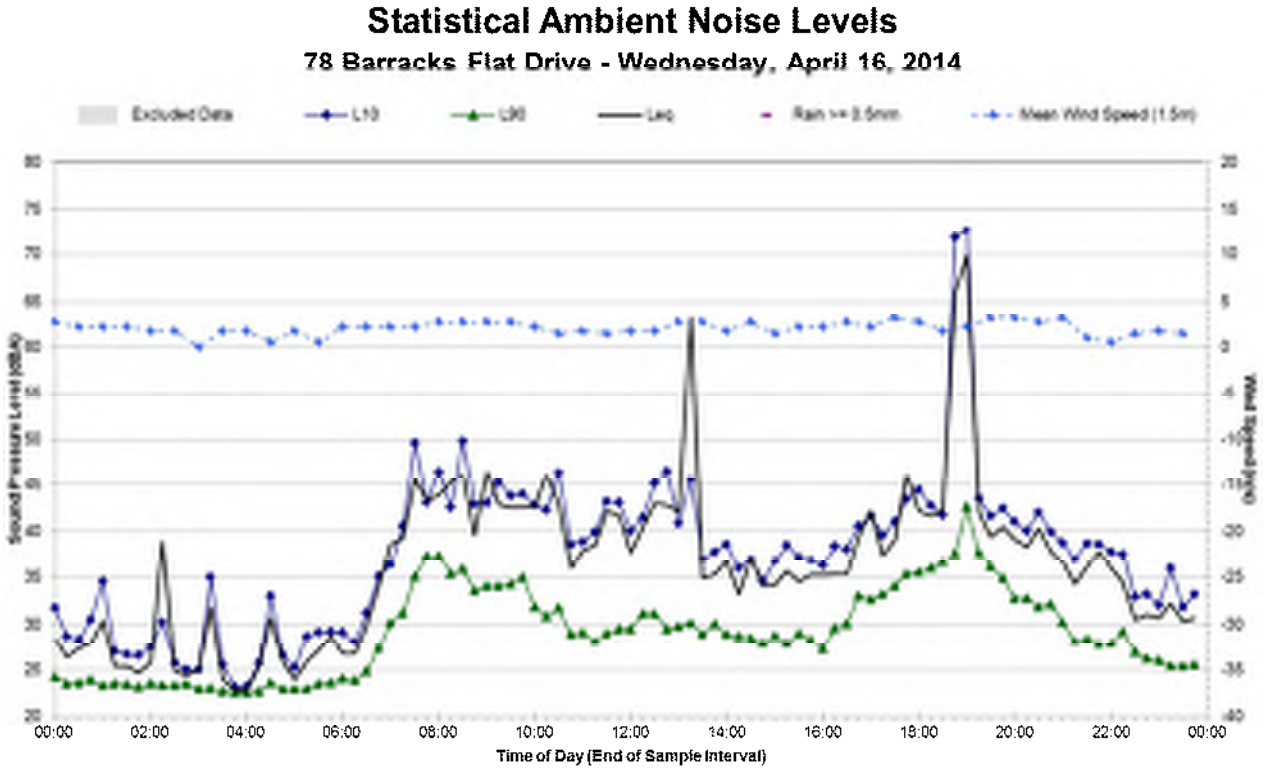


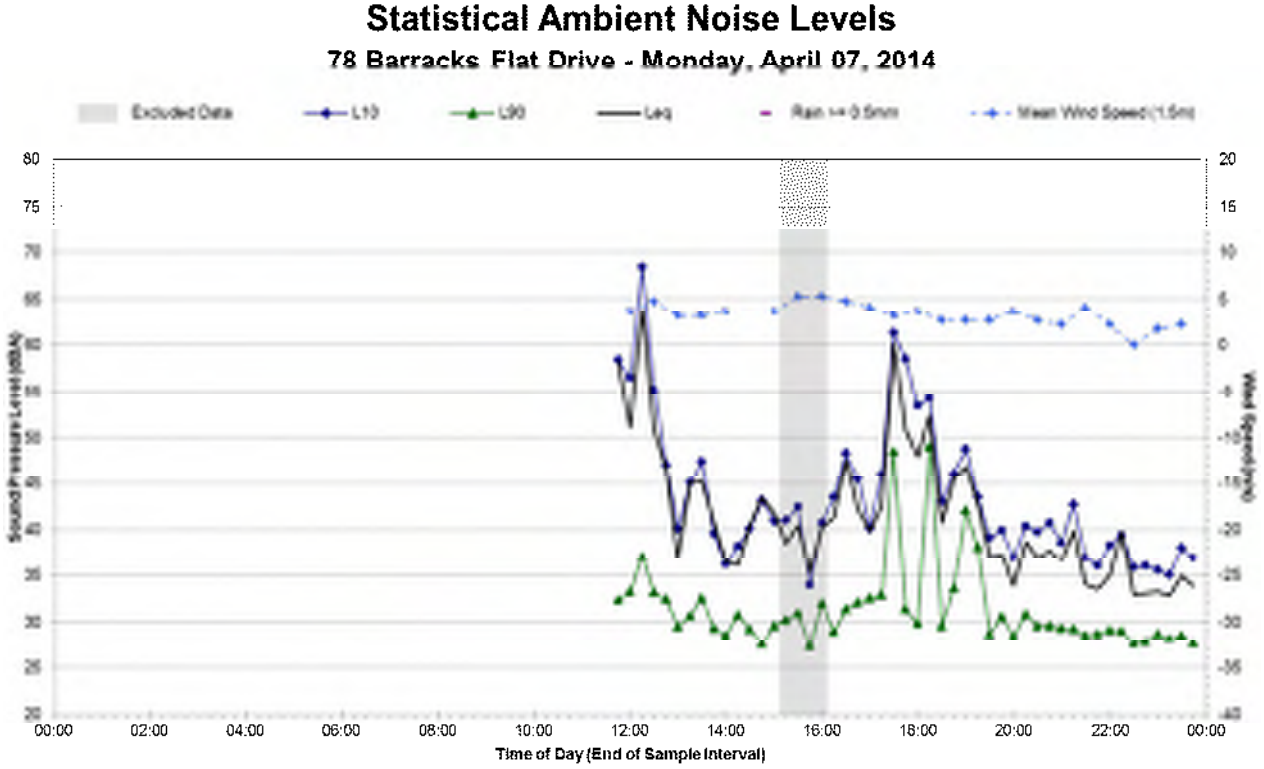
NOISE LOGGING CHARTS – 78 BARRACKS FLAT DRIVE



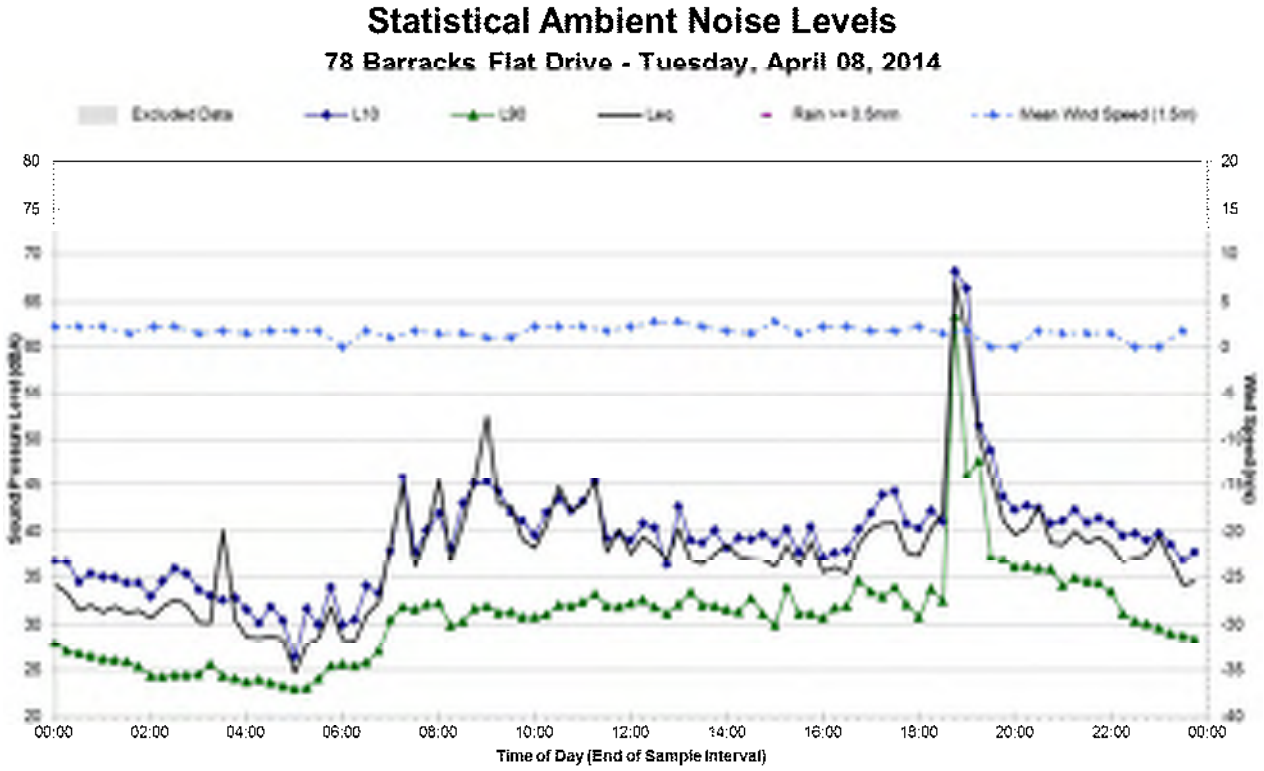


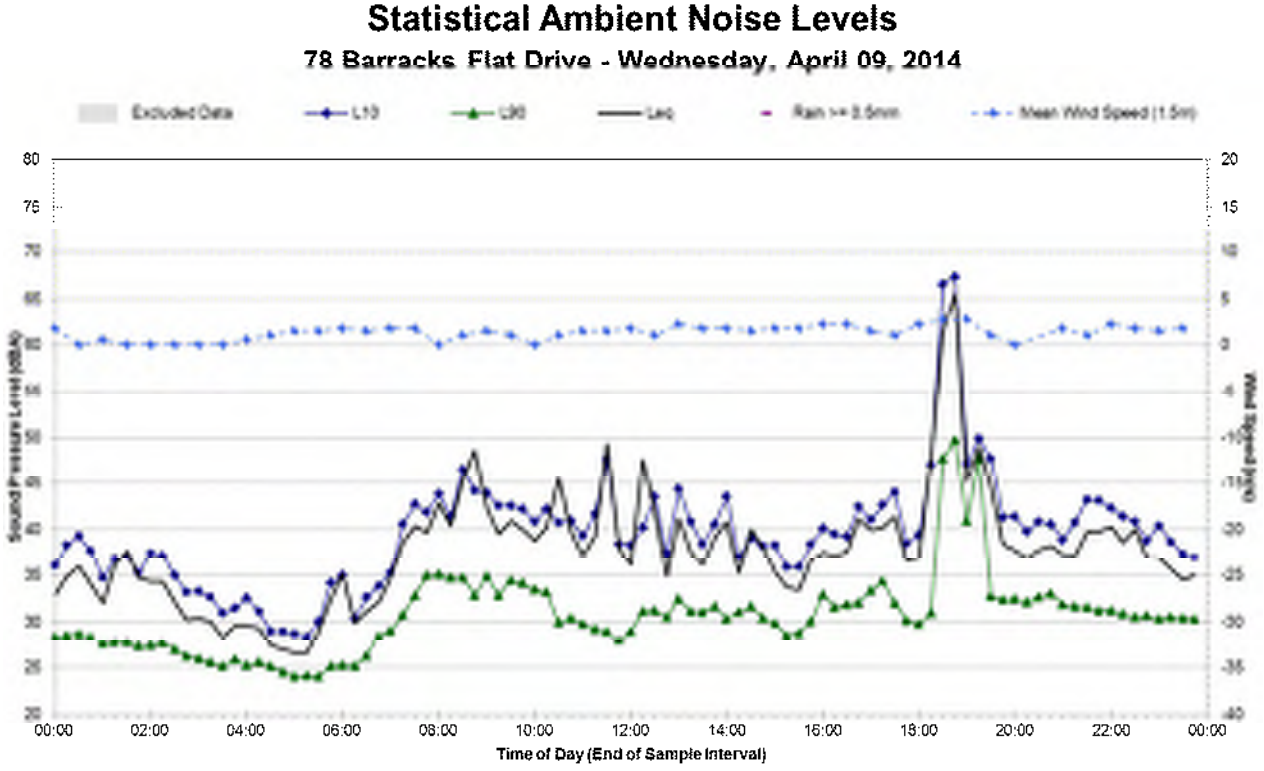
NOISE LOGGING CHARTS – 78 BARRACKS FLAT DRIVE



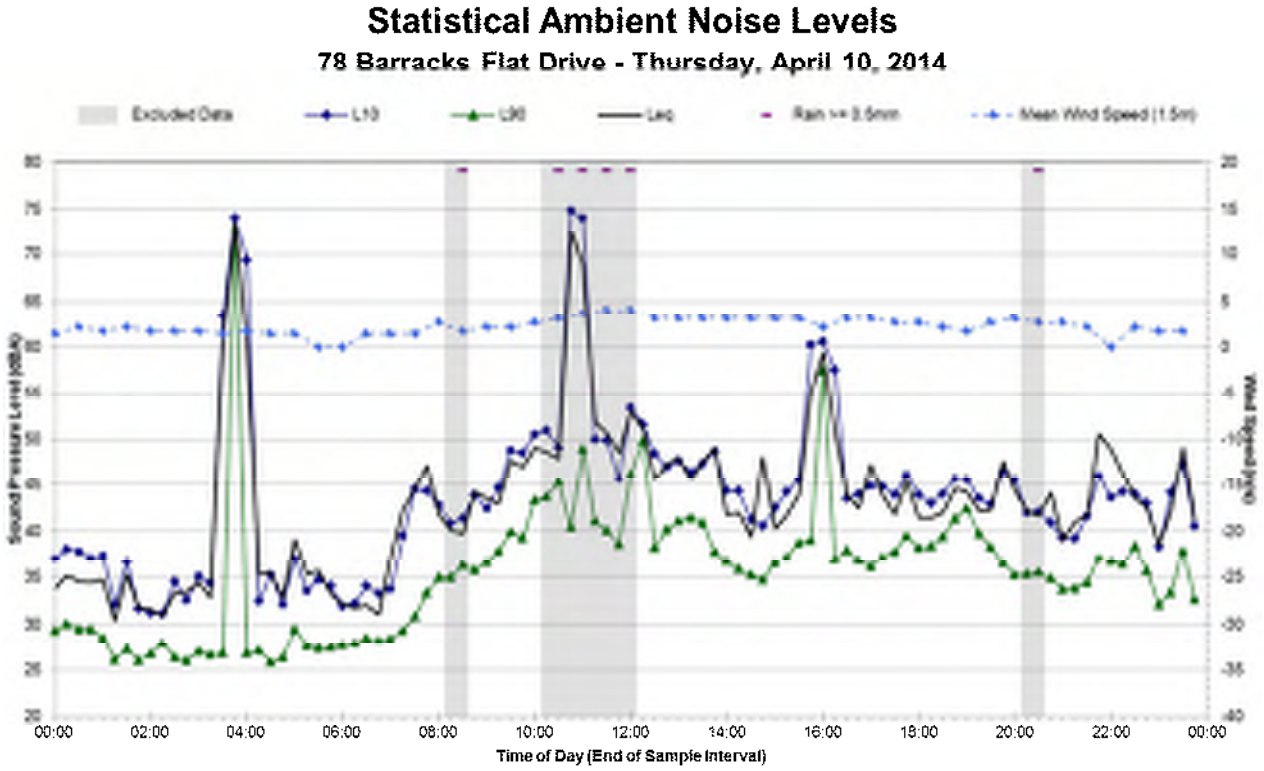


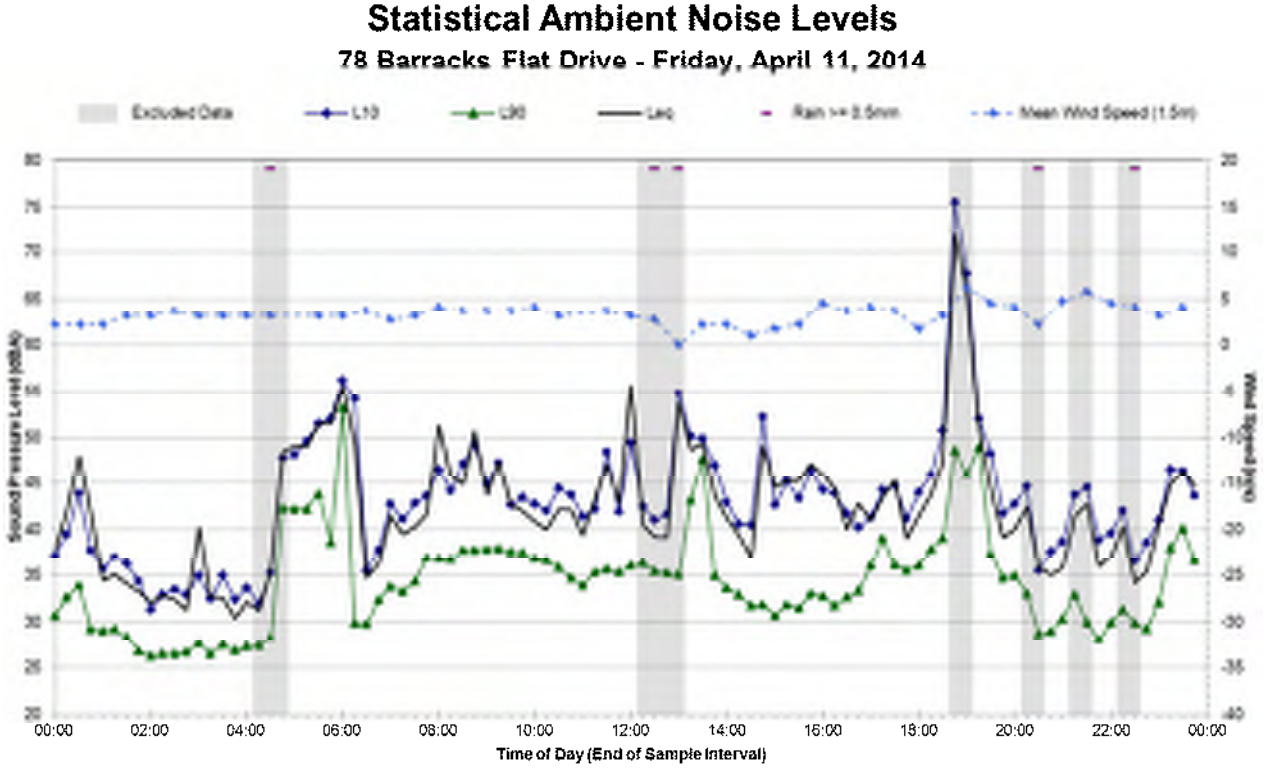
NOISE LOGGING CHARTS – 78 BARRACKS FLAT DRIVE



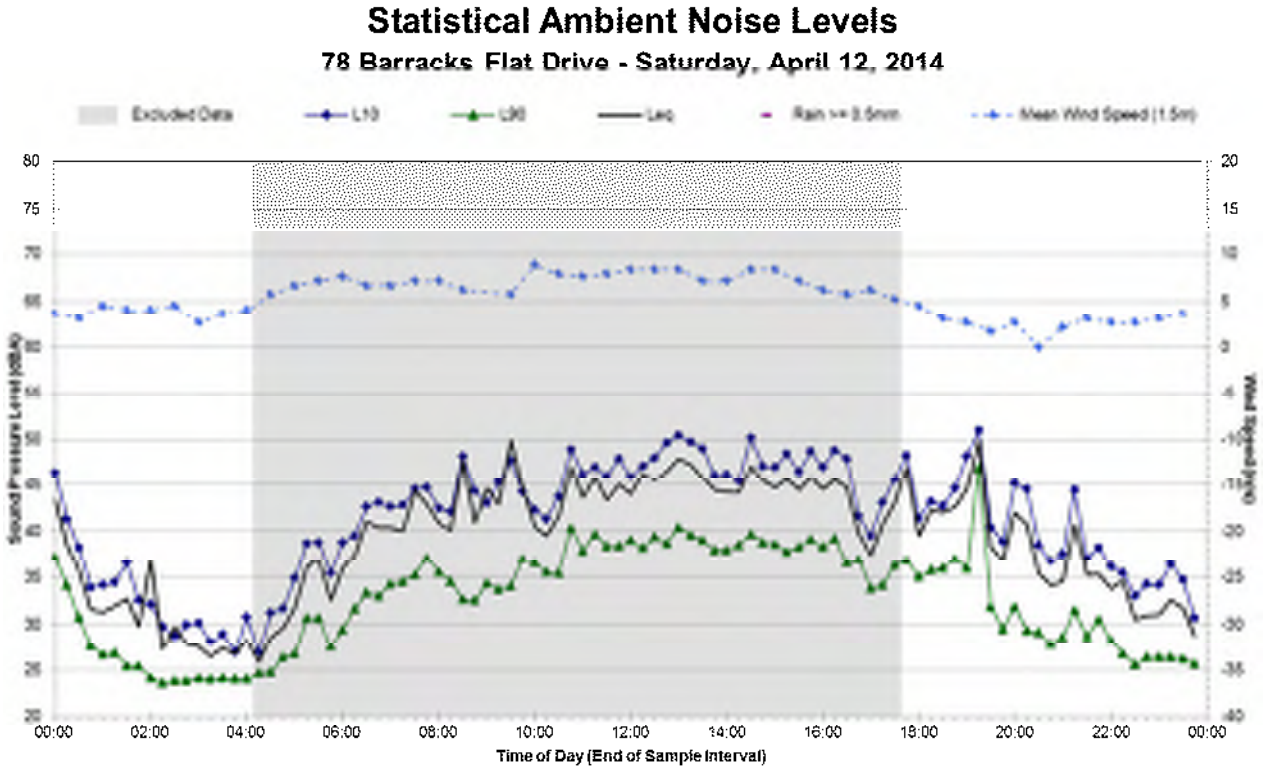


NOISE LOGGING CHARTS – 78 BARRACKS FLAT DRIVE





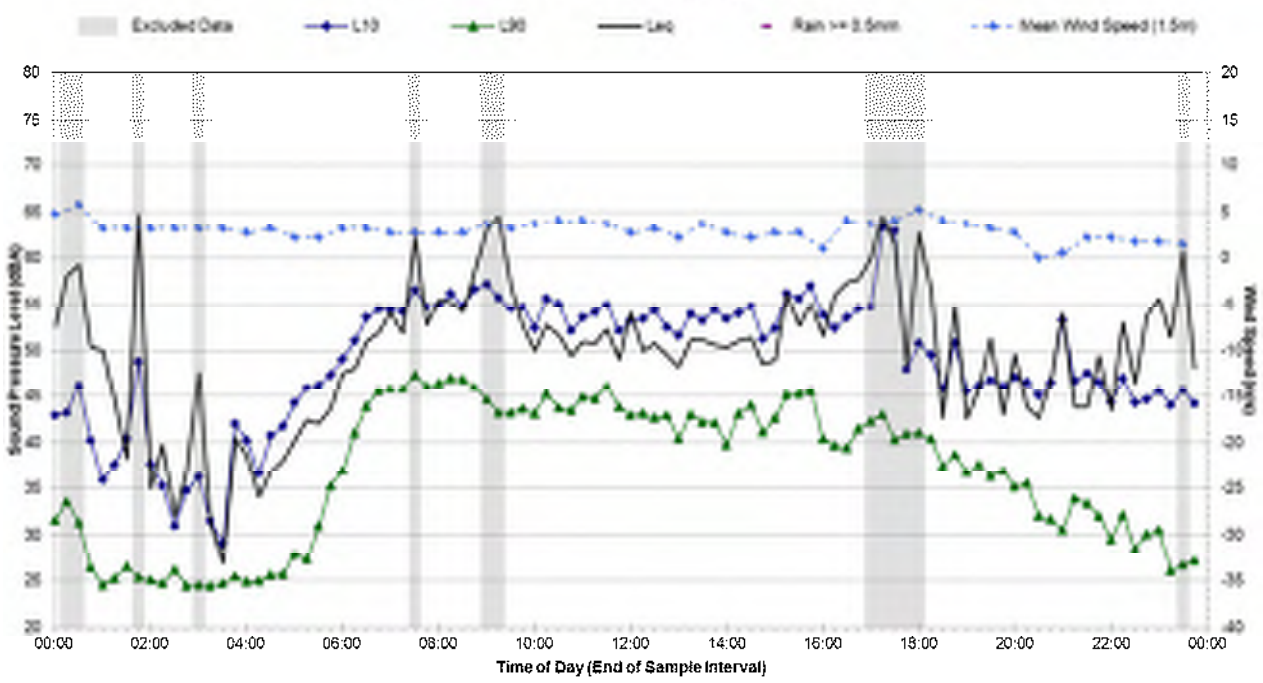
NOISE LOGGING CHARTS – 78 BARRACKS FLAT DRIVE



NOISE LOGGING CHARTS – 12 ALFRED PLACE

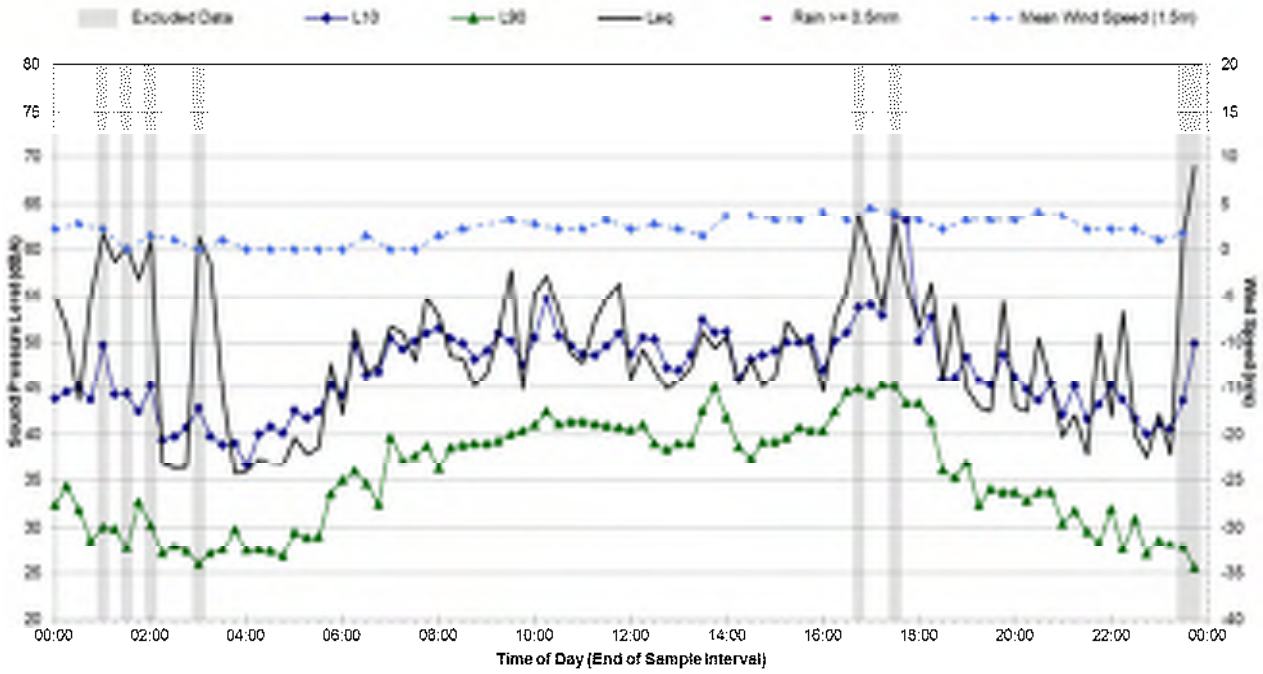
Statistical Ambient Noise Levels

12 Alfred Place - Monday, April 14, 2014

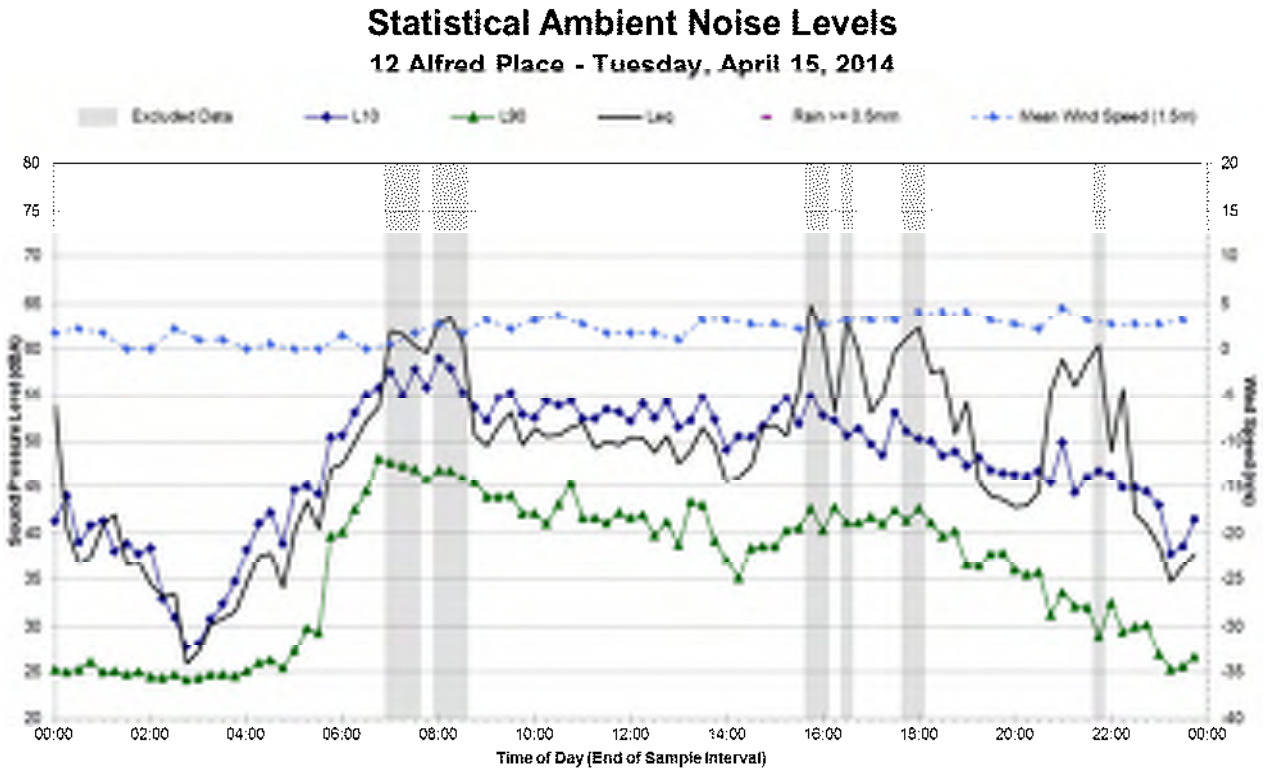


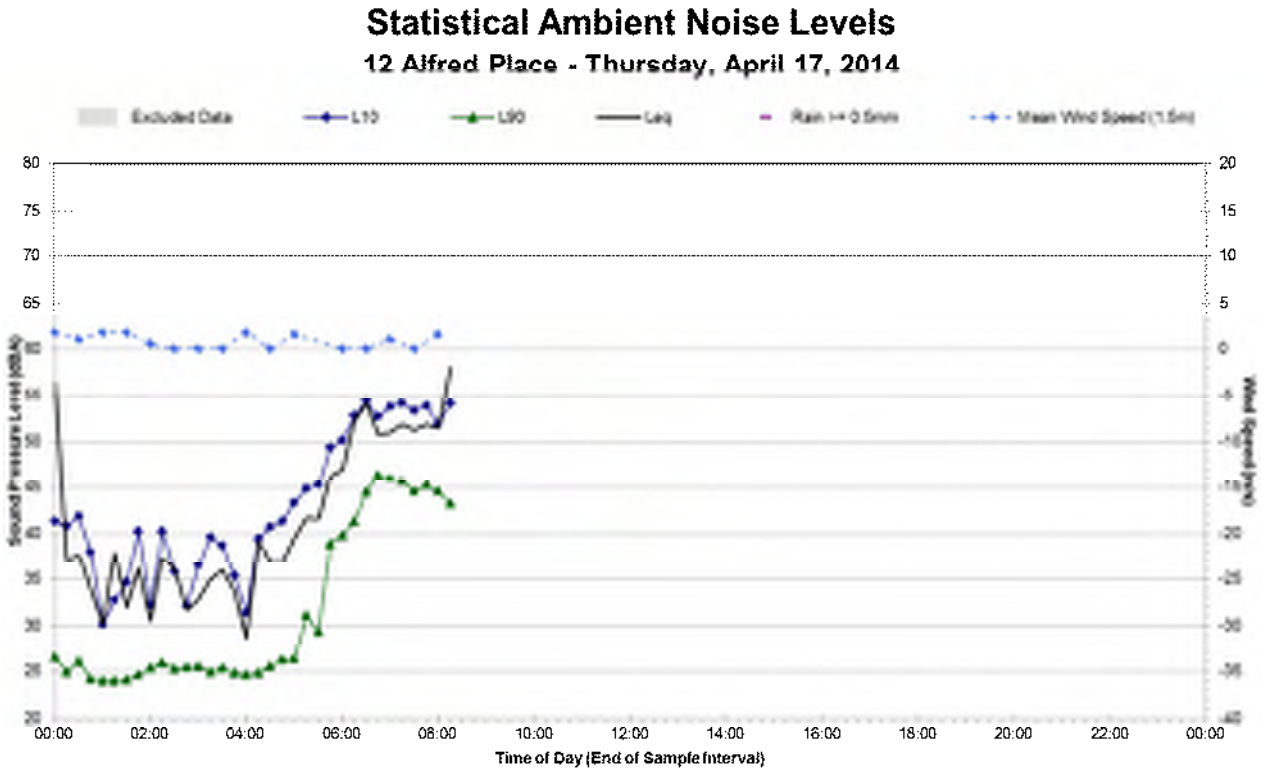
Statistical Ambient Noise Levels

12 Alfred Place - Sunday, April 13, 2014



NOISE LOGGING CHARTS – 12 ALFRED PLACE

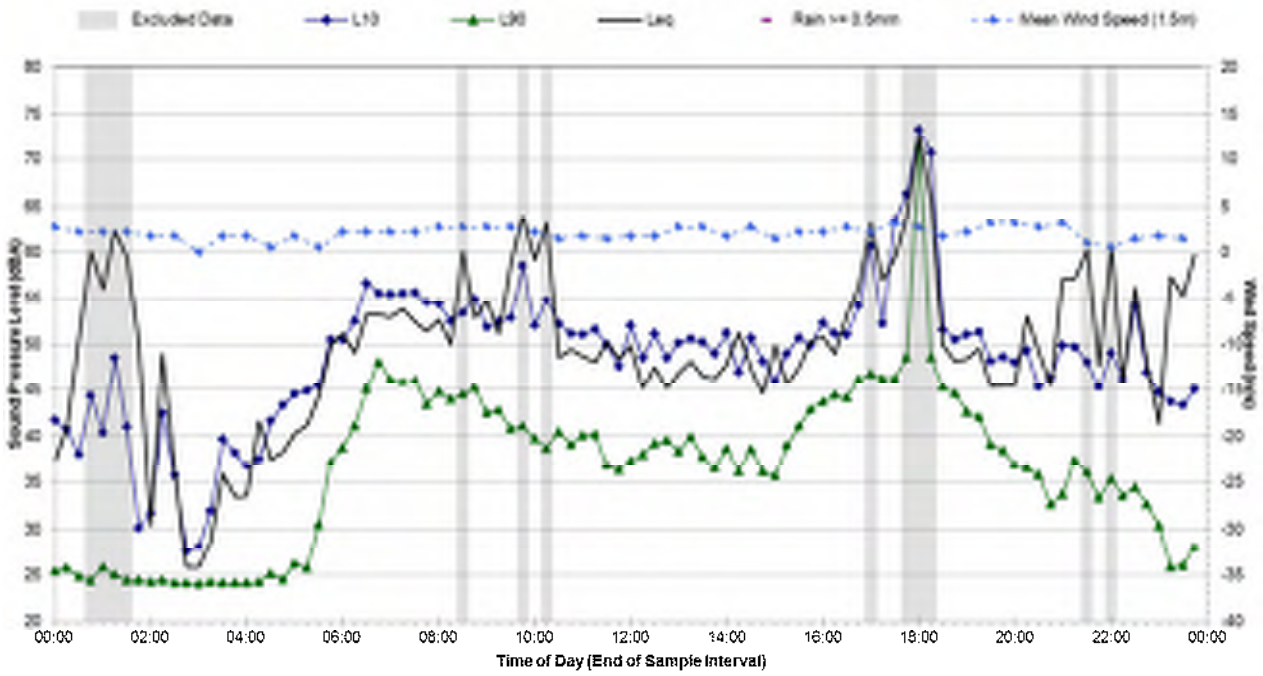




NOISE LOGGING CHARTS – 12 ALFRED PLACE

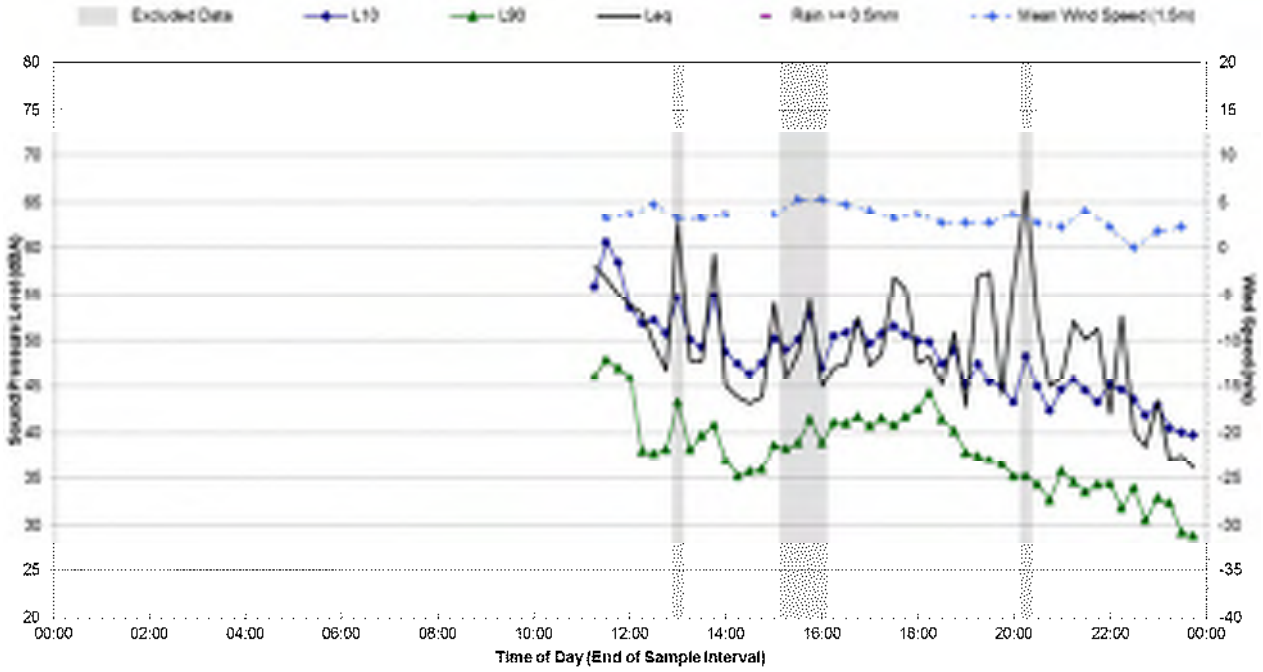
Statistical Ambient Noise Levels

12 Alfred Place - Wednesday, April 16, 2014

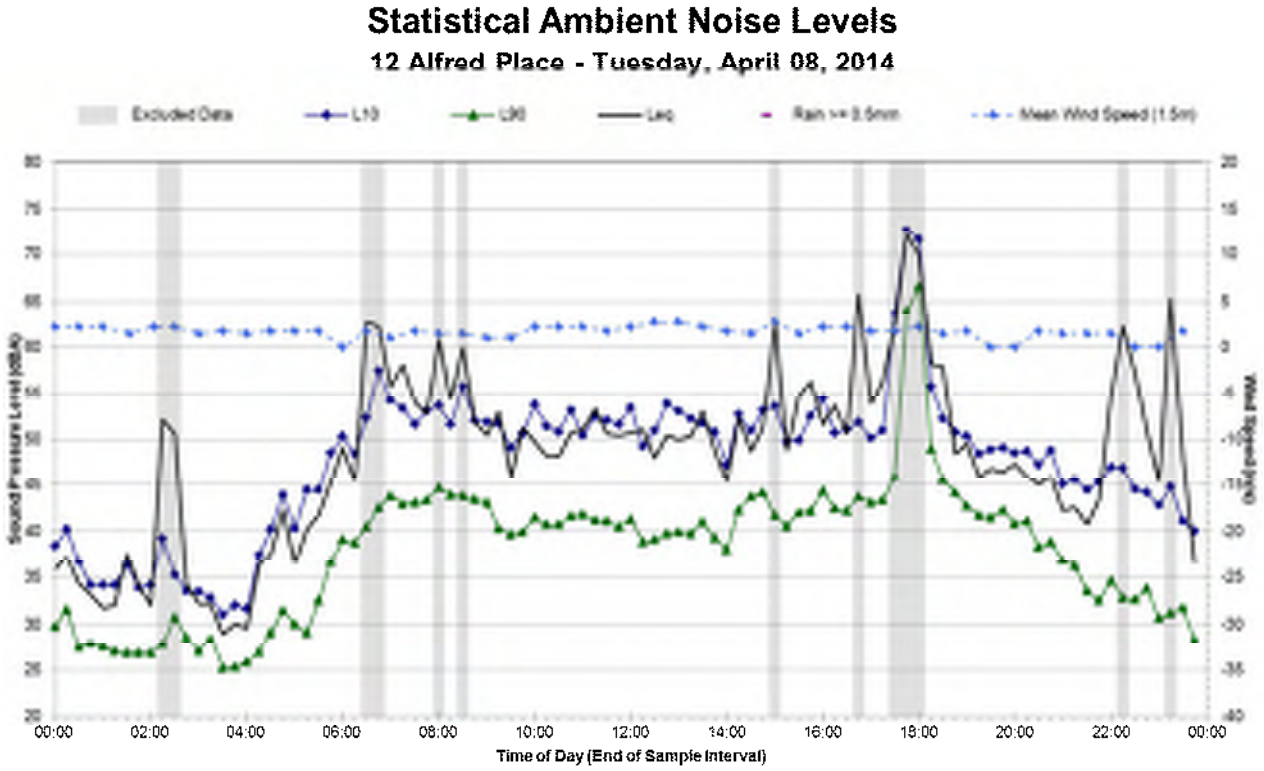


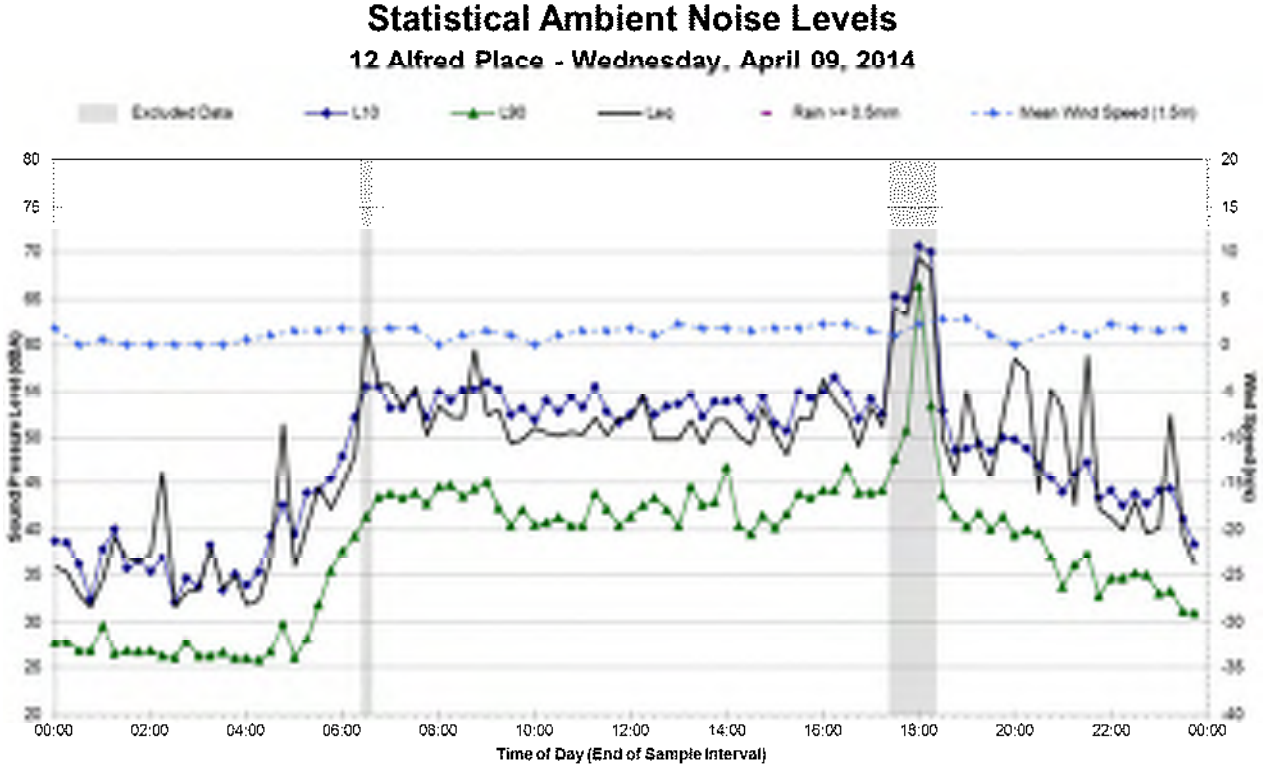
Statistical Ambient Noise Levels

12 Alfred Place - Monday, April 07, 2014

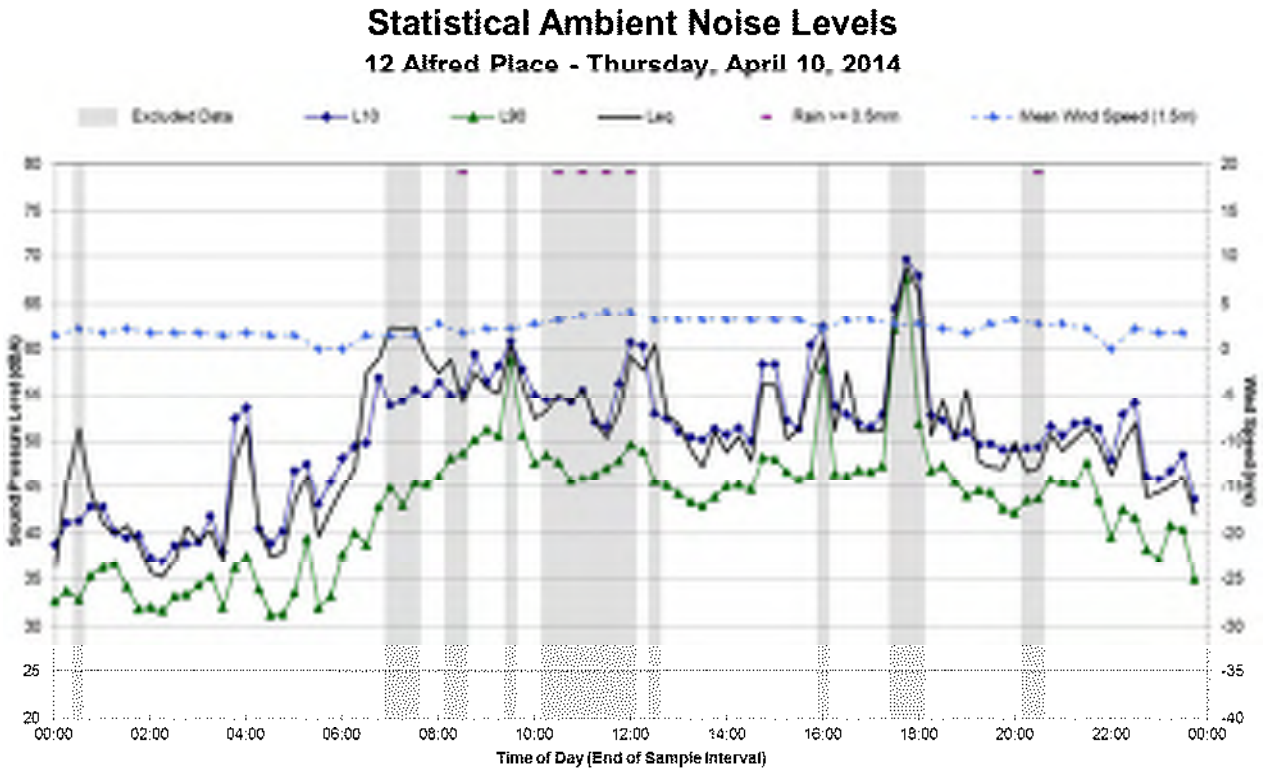


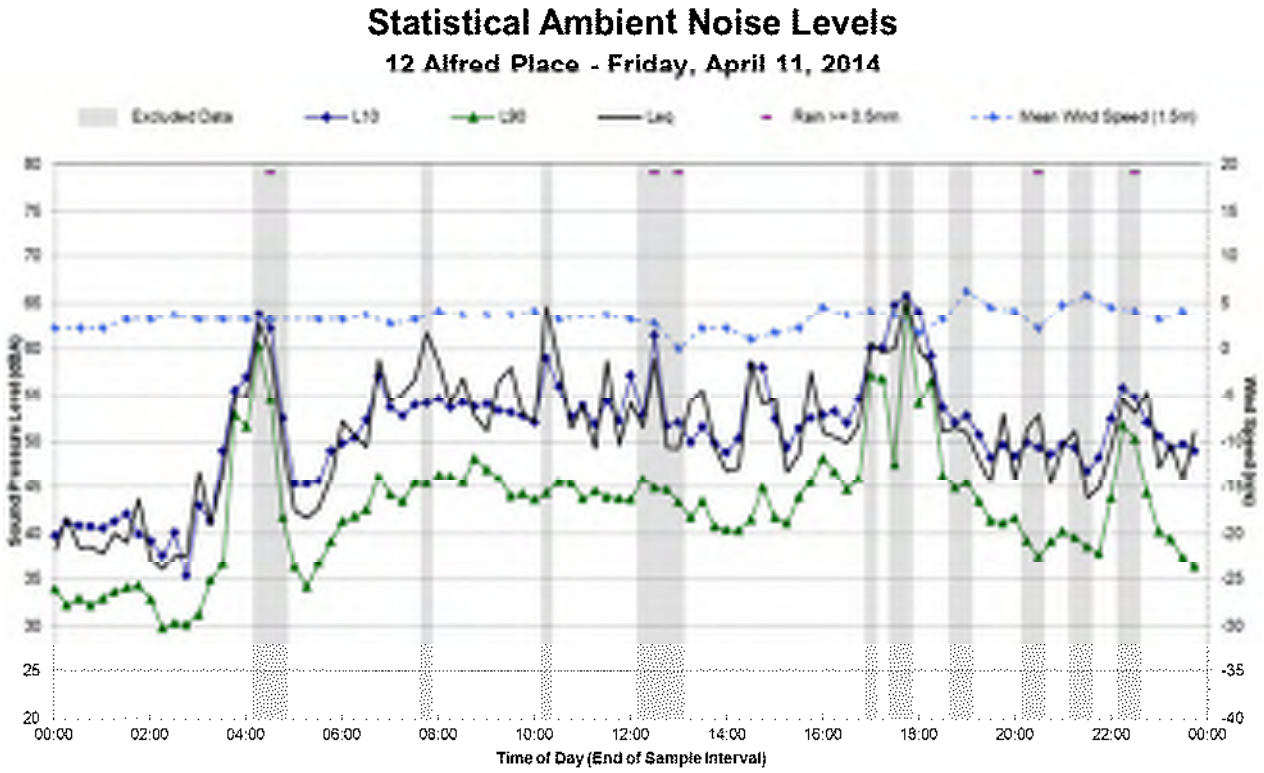
NOISE LOGGING CHARTS – 12 ALFRED PLACE



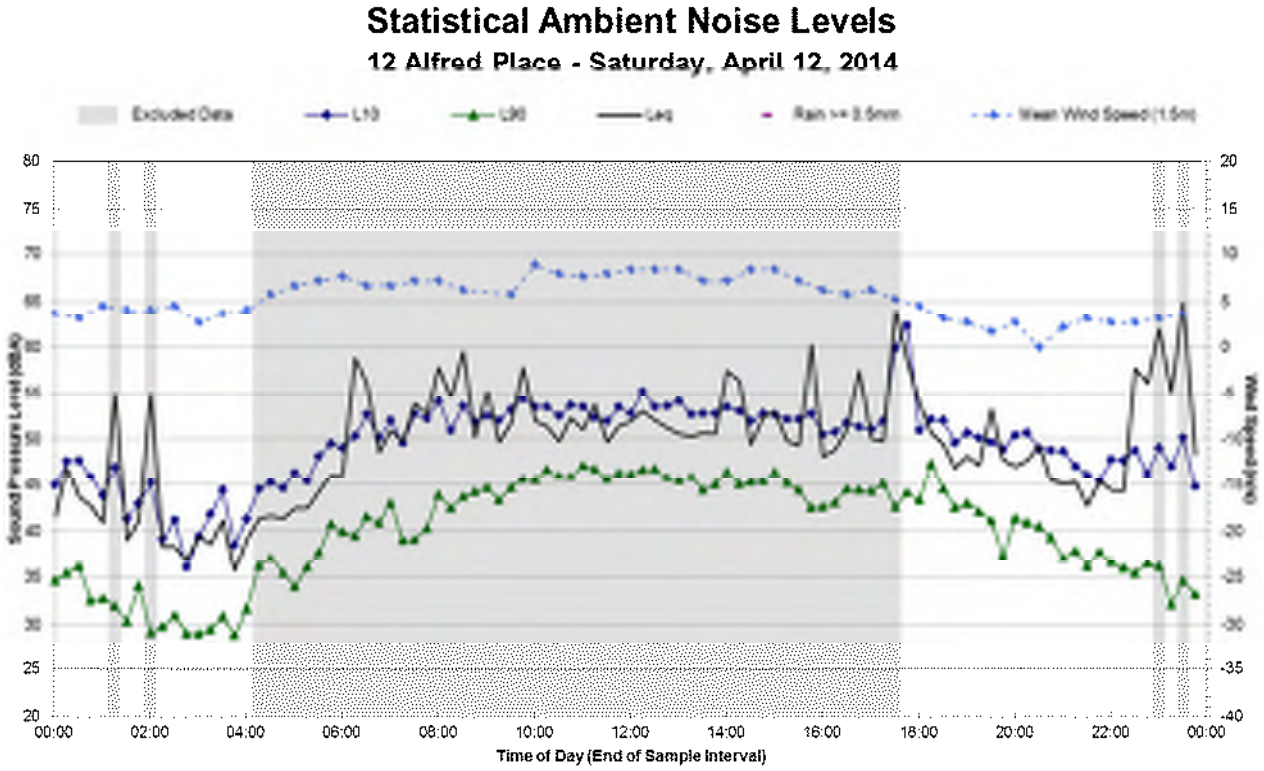


NOISE LOGGING CHARTS – 12 ALFRED PLACE





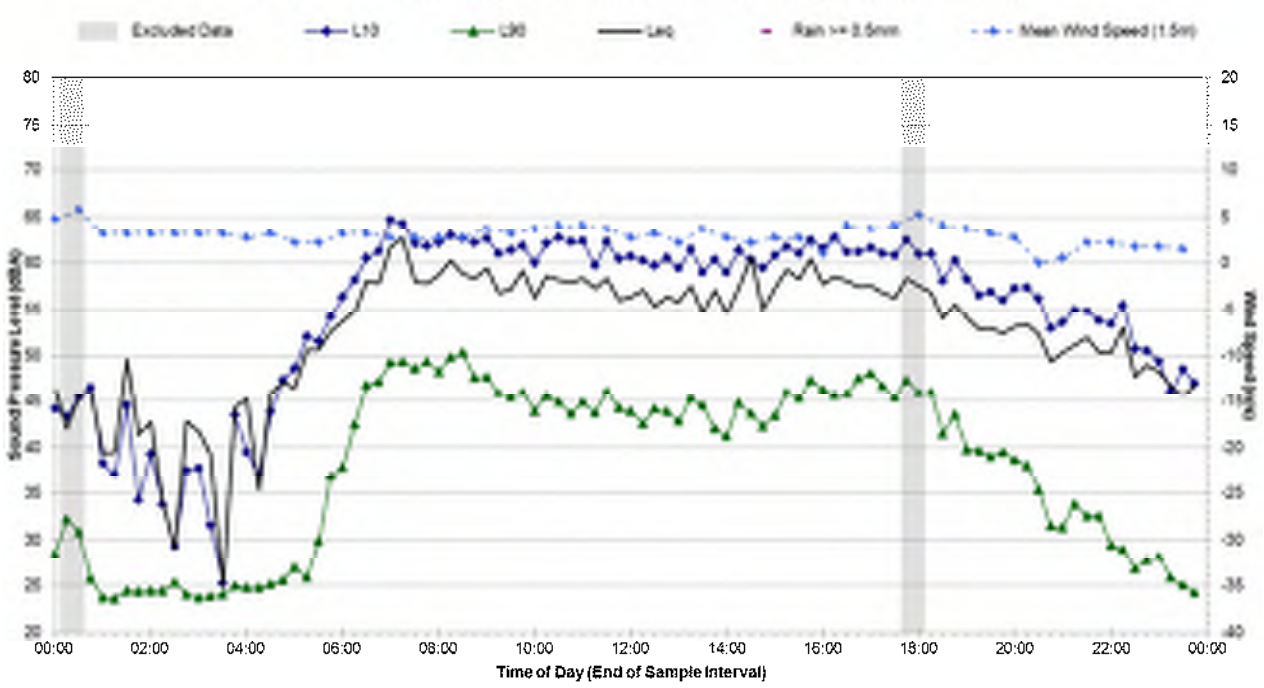
NOISE LOGGING CHARTS – 12 ALFRED PLACE



NOISE LOGGING CHARTS – EDWIN LAND PARKWAY RESERVE

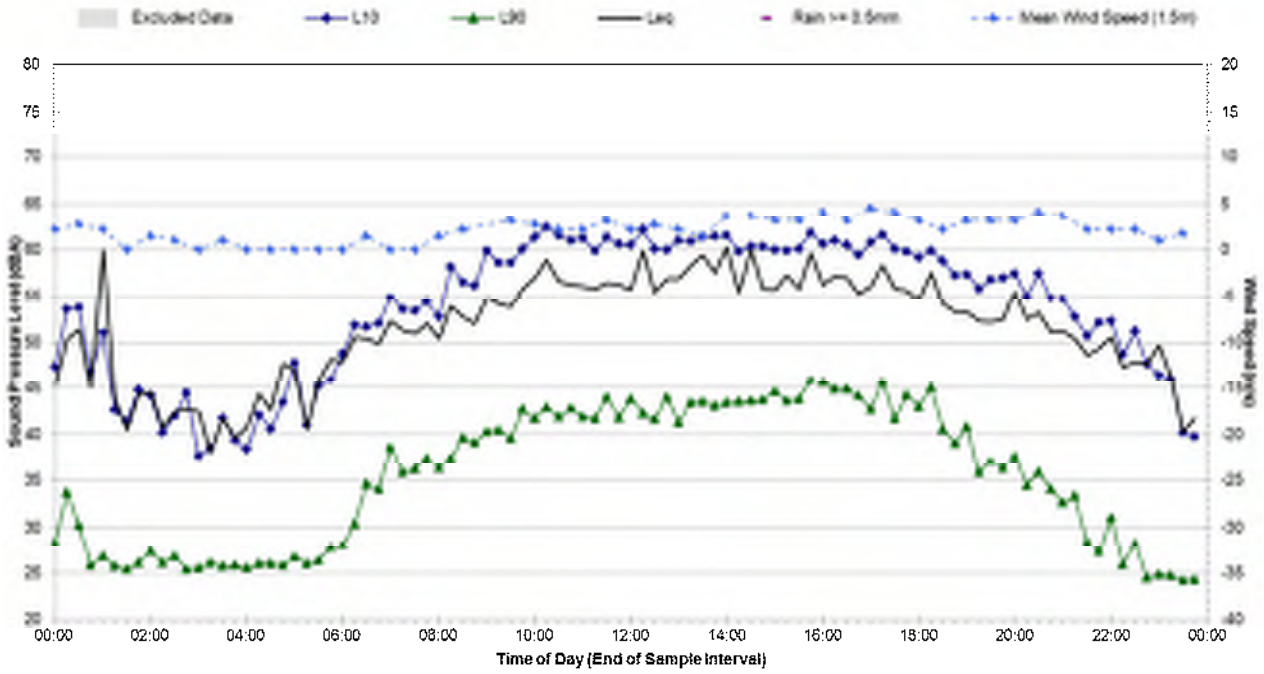
Statistical Ambient Noise Levels

Edwin Land Parkway Road Reserve - Monday, April 14, 2014



Statistical Ambient Noise Levels

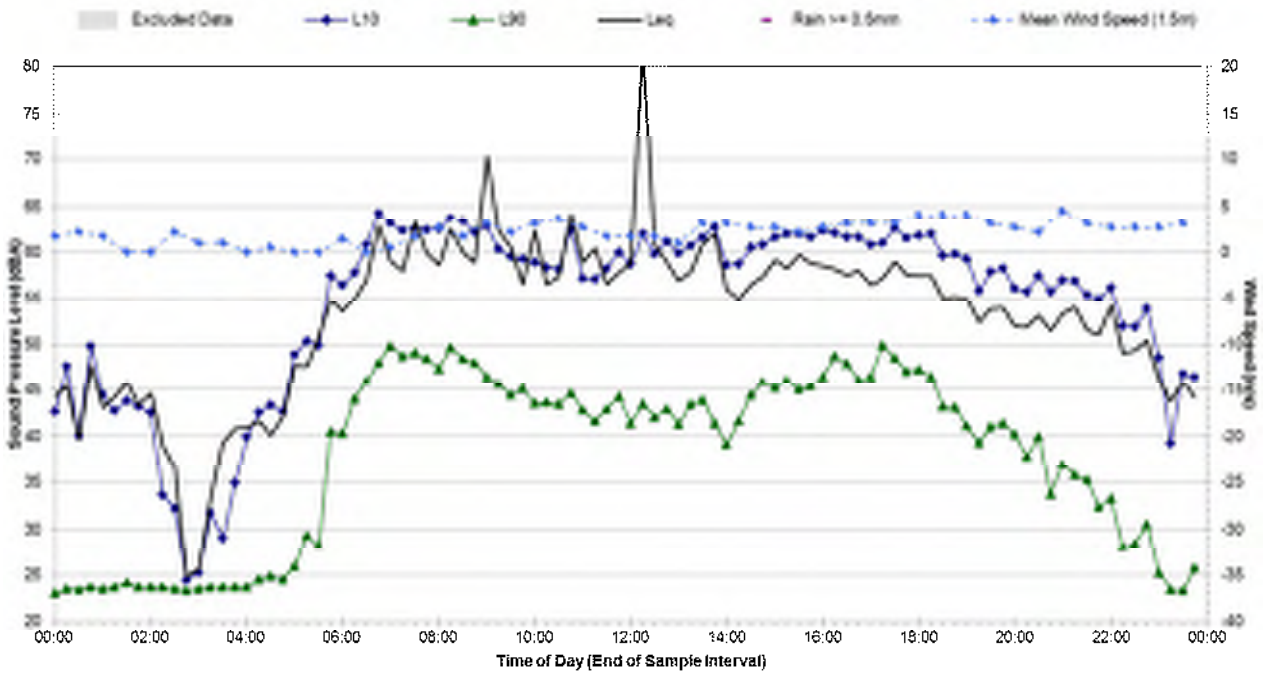
Edwin Land Parkway Road Reserve - Sunday, April 13, 2014



NOISE LOGGING CHARTS – EDWIN LAND PARKWAY RESERVE

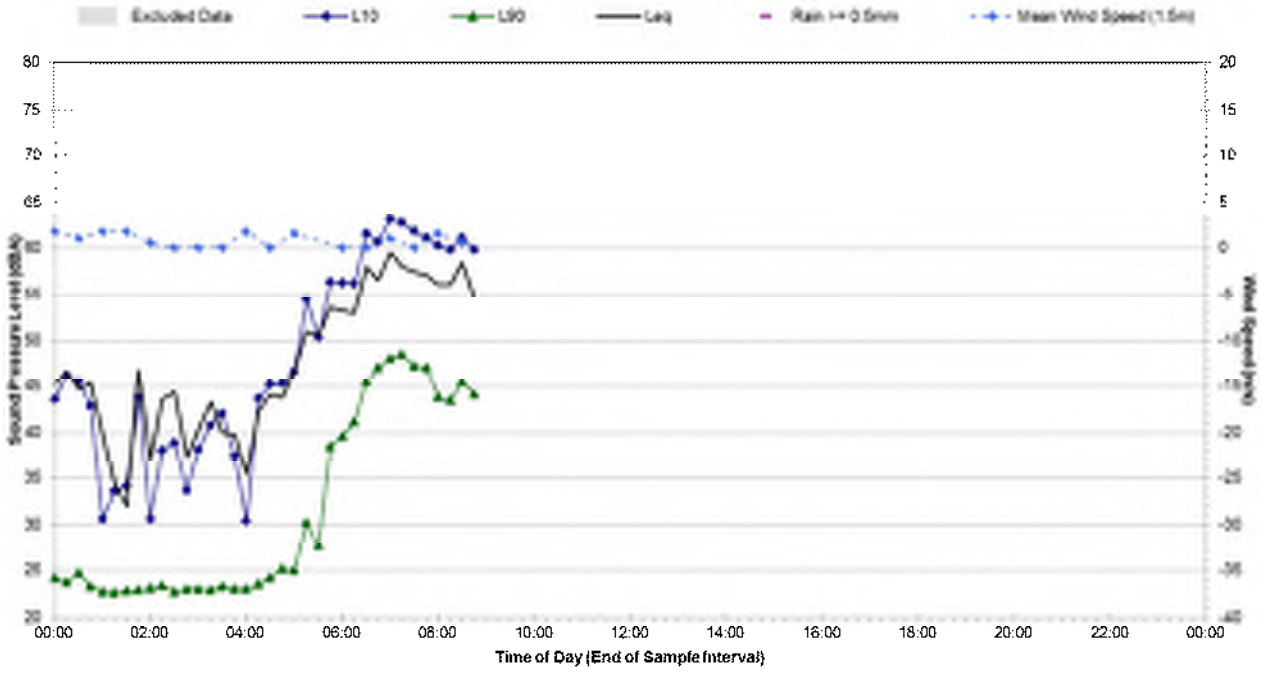
Statistical Ambient Noise Levels

Edwin Land Parkway Road Reserve - Tuesday, April 15, 2014



Statistical Ambient Noise Levels

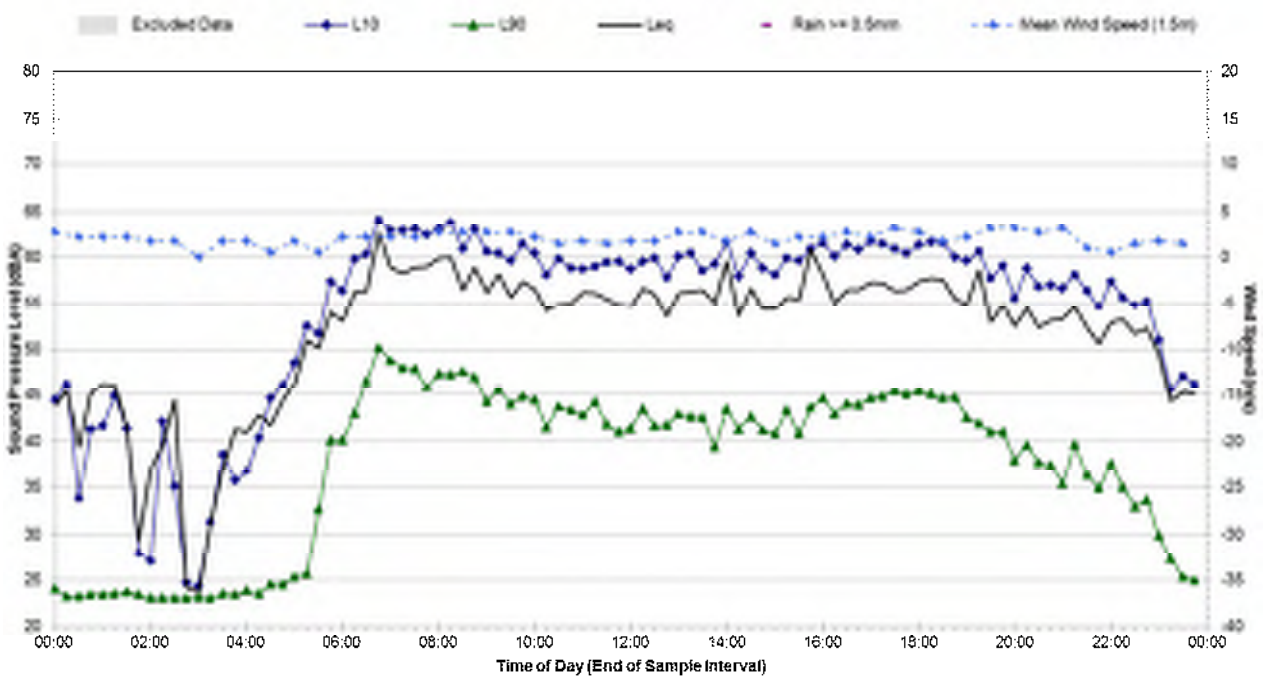
Edwin Land Parkway Road Reserve - Thursday, April 17, 2014



NOISE LOGGING CHARTS – EDWIN LAND PARKWAY RESERVE

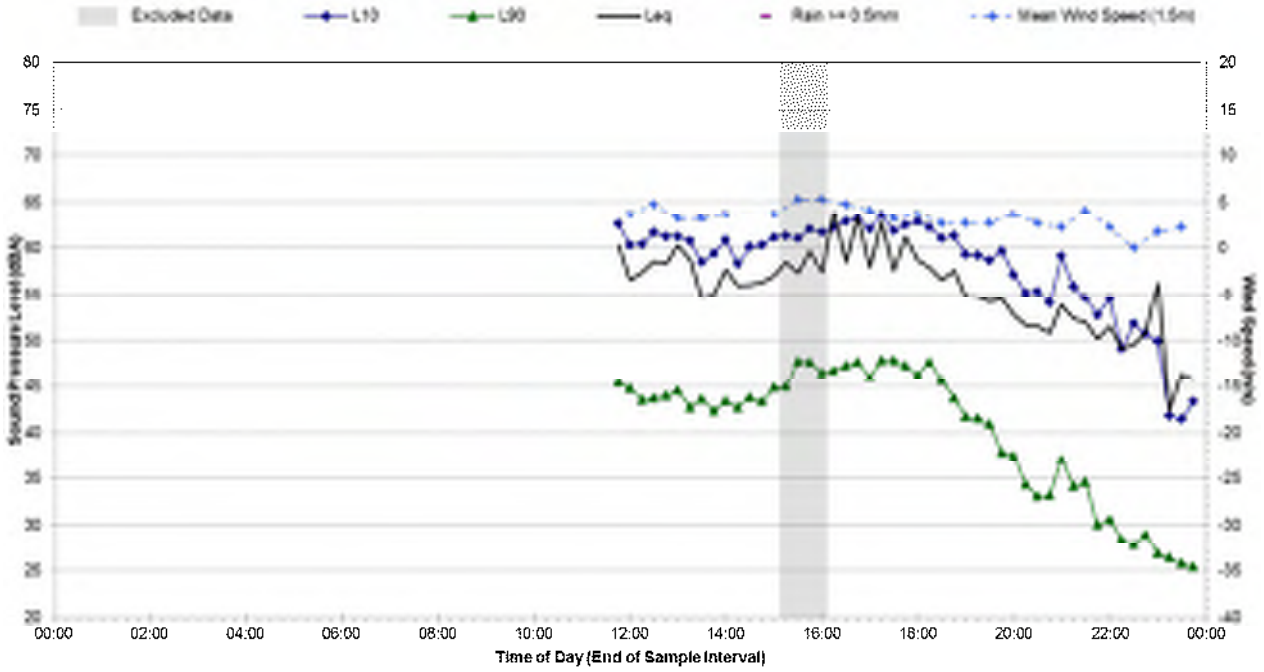
Statistical Ambient Noise Levels

Edwin Land Parkway Road Reserve - Wednesday, April 16, 2014



Statistical Ambient Noise Levels

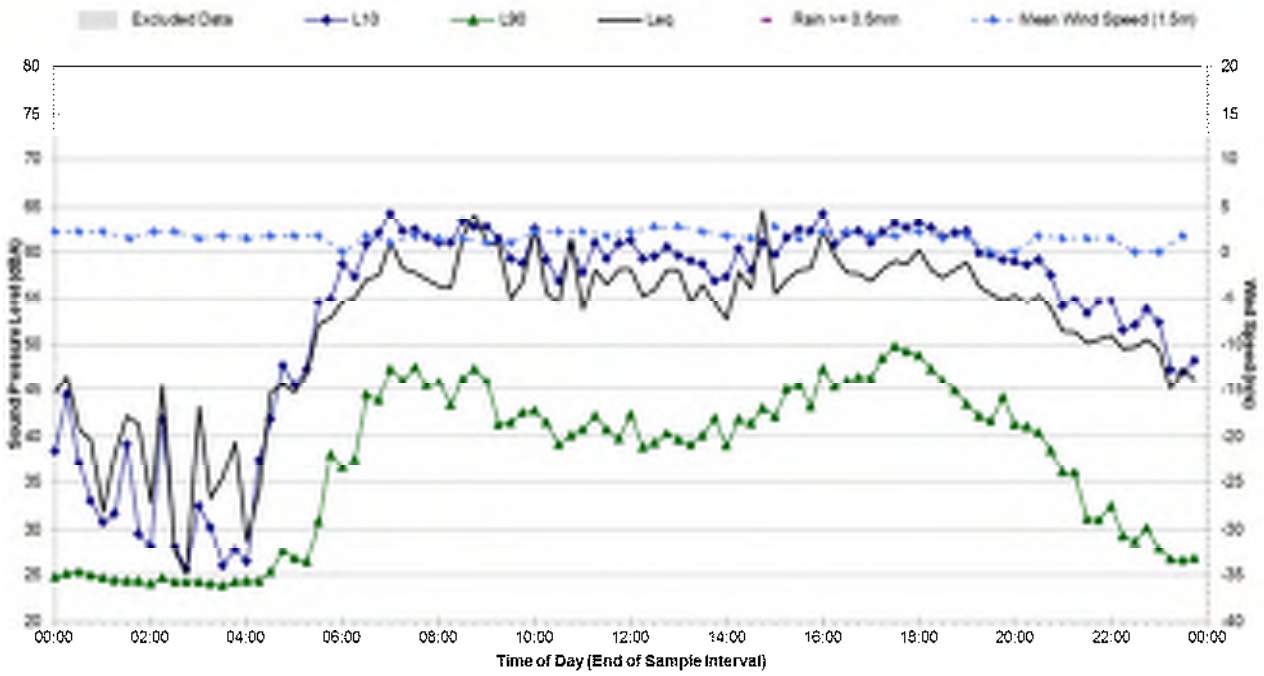
Edwin Land Parkway Road Reserve - Monday, April 07, 2014



NOISE LOGGING CHARTS – EDWIN LAND PARKWAY RESERVE

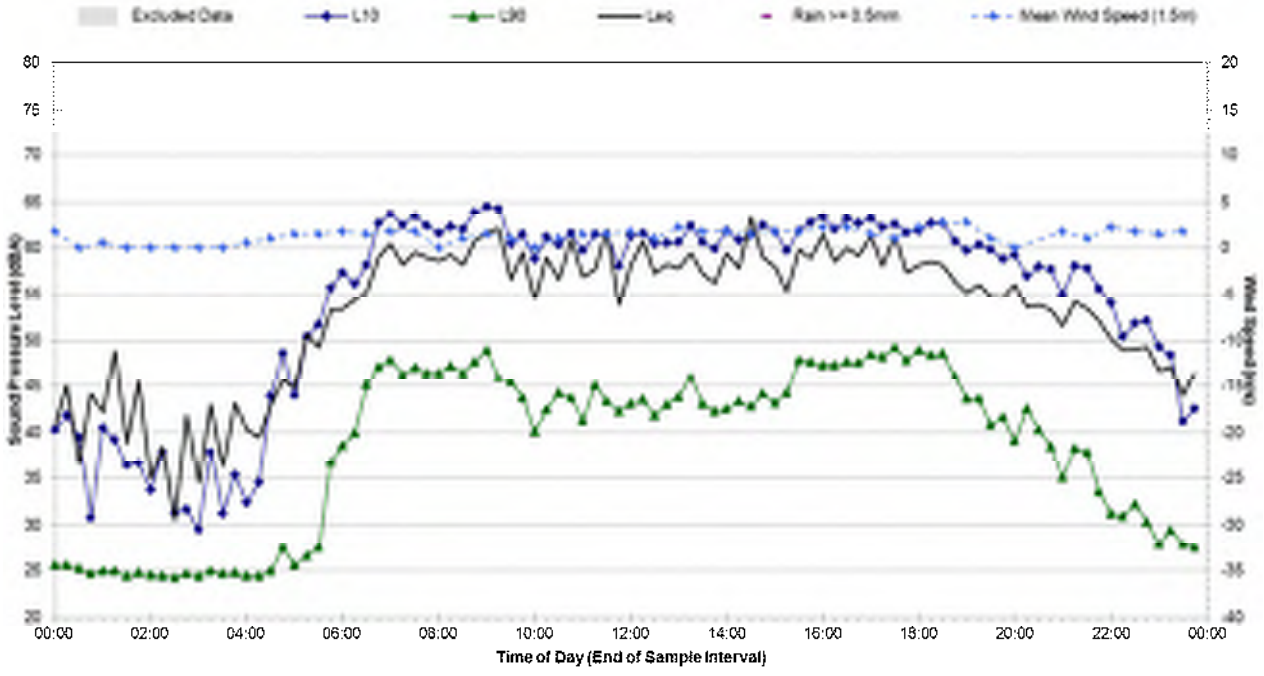
Statistical Ambient Noise Levels

Edwin Land Parkway Road Reserve - Tuesday, April 08, 2014



Statistical Ambient Noise Levels

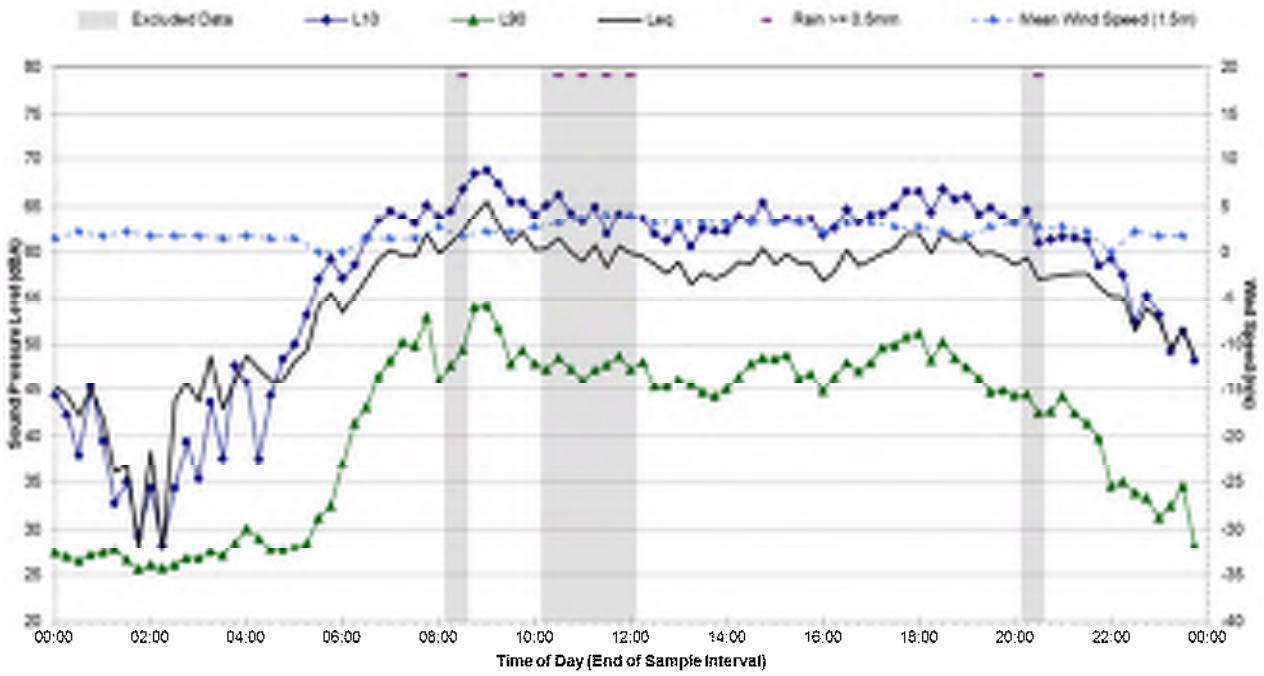
Edwin Land Parkway Road Reserve - Wednesday, April 09, 2014



NOISE LOGGING CHARTS – EDWIN LAND PARKWAY RESERVE

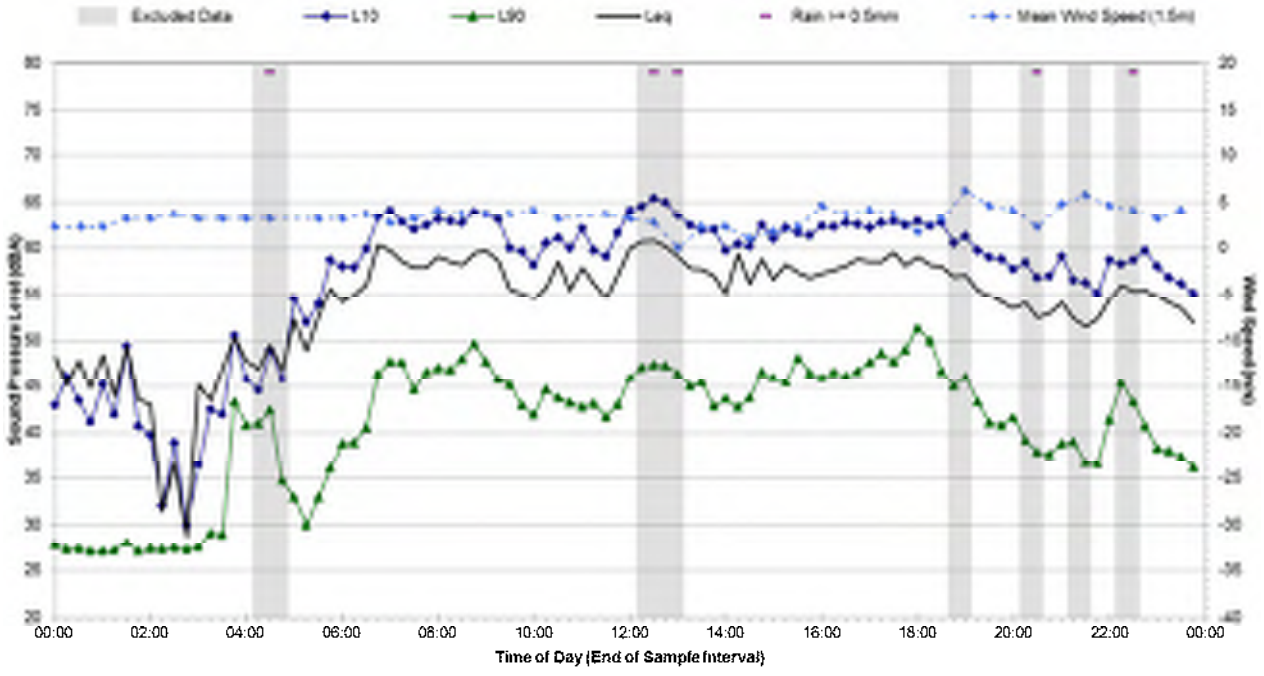
Statistical Ambient Noise Levels

Edwin Land Parkway Road Reserve - Thursday, April 10, 2014

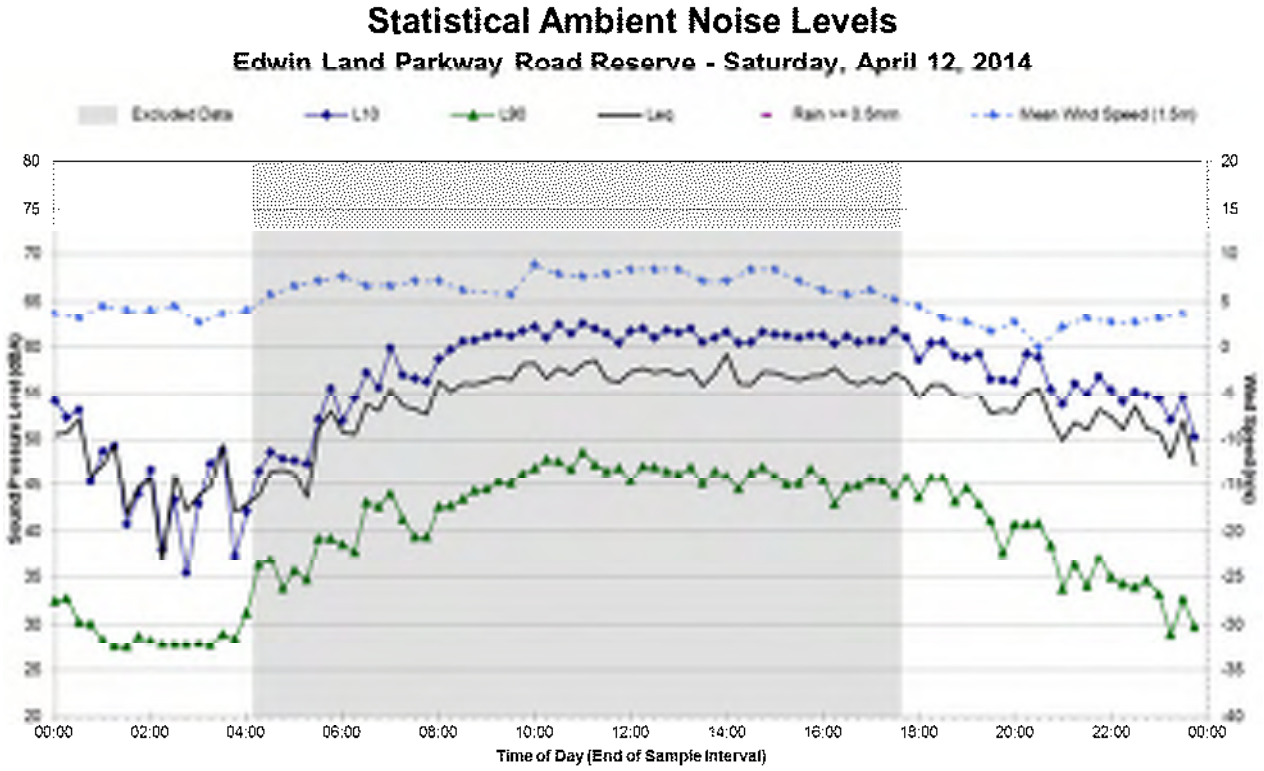


Statistical Ambient Noise Levels

Edwin Land Parkway Road Reserve - Friday, April 11, 2014



NOISE LOGGING CHARTS – EDWIN LAND PARKWAY RESERVE



YEAR OF OPENING (2019) – PREDICTED OPERATIONAL NOISE LEVELS

Receiver Address	Predicted Noise Levels, dBA				Relative Increase, dBA		'Build' Scenario Exceeds RNP Criteria Day: $L_{Aeq(15hour)}$ 55 dBA Night: $L_{Aeq(9hour)}$ 50 dBA		'Build' Scenario Exceed 12 dB 'Relative Increase Criteria'?	
	'No Build' Scenario		'Build' Scenario							
	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$
NCA1										
6 PATRICK BRICK COURT - GF	51	43	55	48	4.5	4.5	--	--	--	--
6 PATRICK BRICK COURT - F 1	52	45	57	50	4.6	4.7	2	--	--	--
8 PATRICK BRICK COURT - GF	50	42	59	51	8.8	8.7	4	1	--	--
8 PATRICK BRICK COURT - F 1	52	45	62	54	9.7	9.8	7	4	--	--
10 PATRICK BRICK COURT - GF	50	42	54	47	4.3	4.3	--	--	--	--
19 PATRICK BRICK COURT - GF	44	37	57	50	13.0	12.7	2	--	YES	YES
21 PATRICK BRICK COURT - GF	44	37	58	51	13.8	13.4	3	1	YES	YES
23 PATRICK BRICK COURT - GF	43	36	56	49	12.9	12.5	1	--	YES	YES
23 PATRICK BRICK COURT - F 1	46	39	61	54	15.3	15.0	6	4	YES	YES
25 PATRICK BRICK COURT - GF	44	37	57	50	13.3	13.1	2	--	YES	YES
25 PATRICK BRICK COURT - F 1	47	40	61	54	14.5	14.2	6	4	YES	YES
27 PATRICK BRICK COURT - GF	46	39	61	53	14.3	14.2	6	3	YES	YES
29 PATRICK BRICK COURT - GF	46	39	60	52	13.7	13.6	5	2	YES	YES
29 PATRICK BRICK COURT - F 1	49	41	62	55	13.2	13.1	7	5	YES	YES
31 PATRICK BRICK COURT - GF	46	39	58	51	12.1	11.9	3	1	YES	--
31 PATRICK BRICK COURT - F 1	49	42	61	54	12.2	12.1	6	4	YES	YES
33 PATRICK BRICK COURT - GF	42	34	58	49	16.5	14.9	3	--	YES	YES
33 PATRICK BRICK COURT - F 1	45	38	60	52	14.8	14.5	5	2	YES	YES
31 THOMAS ROYAL GARDENS - GF	43	36	58	51	15.4	15.1	3	1	YES	YES
33 THOMAS ROYAL GARDENS - GF	45	38	59	52	14.2	13.8	4	2	YES	YES
35 THOMAS ROYAL GARDENS - GF	43	36	58	51	14.8	14.5	3	1	YES	YES
37 THOMAS ROYAL GARDENS - GF	43	36	57	49	13.5	13.3	2	--	YES	YES

YEAR OF OPENING (2019) – PREDICTED OPERATIONAL NOISE LEVELS

Receiver Address	Predicted Noise Levels, dBA				Relative Increase, dBA		'Build' Scenario Exceeds RNP Criteria Day: $L_{Aeq(15hour)}$ 55 dBA Night: $L_{Aeq(9hour)}$ 50 dBA		'Build' Scenario Exceed 12 dB 'Relative Increase Criteria'?	
	'No Build' Scenario		'Build' Scenario							
	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$
39 THOMAS ROYAL GARDENS - GF	43	36	57	50	13.9	13.6	2	--	YES	YES
41 THOMAS ROYAL GARDENS - GF	43	36	58	51	15.3	15.0	3	1	YES	YES
43 THOMAS ROYAL GARDENS - GF	43	36	59	52	16.0	15.8	4	2	YES	YES
45 THOMAS ROYAL GARDENS - GF	43	36	62	55	18.8	18.6	7	5	YES	YES
47 THOMAS ROYAL GARDENS - GF	43	36	61	53	17.5	17.2	6	3	YES	YES
49 THOMAS ROYAL GARDENS - GF	43	36	62	55	19.1	18.8	7	5	YES	YES
51 THOMAS ROYAL GARDENS - GF	43	36	61	53	17.6	17.3	6	3	YES	YES
53 THOMAS ROYAL GARDENS - GF	43	36	62	55	18.6	18.4	7	5	YES	YES
55 THOMAS ROYAL GARDENS - GF	43	36	59	52	16.6	16.3	4	2	YES	YES
57 THOMAS ROYAL GARDENS - GF	43	36	61	54	18.5	18.2	6	4	YES	YES
59 THOMAS ROYAL GARDENS - GF	43	36	60	52	16.7	16.4	5	2	YES	YES
61 THOMAS ROYAL GARDENS - GF	43	36	60	53	17.3	17.0	5	3	YES	YES
NCA2										
91 ELLERTON DRIVE - GF	41	34	51	44	10.2	9.8	--	--	--	--
44 STONEHAVEN CIRCUIT - GF	49	42	57	50	8.2	8.2	2	--	--	--
46 STONEHAVEN CIRCUIT - GF	48	41	60	53	11.5	11.6	5	3	--	--
48 STONEHAVEN CIRCUIT - GF	47	40	58	51	11.7	11.5	3	1	--	--
50 STONEHAVEN CIRCUIT - GF	47	40	57	50	9.8	9.8	2	--	--	--
52 STONEHAVEN CIRCUIT - GF	47	40	58	50	10.3	10.3	3	0	--	--
54 STONEHAVEN CIRCUIT - GF	45	38	53	46	8.2	8.2	--	--	--	--
56 STONEHAVEN CIRCUIT - GF	45	38	57	50	11.6	11.6	2	--	--	--
58 STONEHAVEN CIRCUIT - GF	46	39	58	51	12.1	12.0	3	1	YES	--
60 STONEHAVEN CIRCUIT - GF	44	37	59	51	14.9	14.7	4	1	YES	YES

YEAR OF OPENING (2019) – PREDICTED OPERATIONAL NOISE LEVELS

Receiver Address	Predicted Noise Levels, dBA				Relative Increase, dBA		'Build' Scenario Exceeds RNP Criteria Day: $L_{Aeq(15hour)}$ 55 dBA Night: $L_{Aeq(9hour)}$ 50 dBA		'Build' Scenario Exceed 12 dB 'Relative Increase Criteria'?	
	'No Build' Scenario		'Build' Scenario							
	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$
62 STONEHAVEN CIRCUIT - GF	44	37	56	49	12.5	12.1	1	--	YES	YES
1 TENNYSON DRIVE - GF	42	35	53	46	10.8	10.7	--	--	--	--
2 TENNYSON DRIVE - GF	43	36	60	52	16.7	16.5	5	2	YES	YES
10 NORTHCLIFFE PLACE - GF	43	36	59	52	16.1	15.8	4	2	YES	YES
12 NORTHCLIFFE PLACE - GF	43	36	62	55	18.7	18.5	7	5	YES	YES
21 NORTHCLIFFE PLACE - GF	41	34	54	47	12.8	12.5	--	--	YES	YES
23 NORTHCLIFFE PLACE - GF	43	36	62	55	18.8	18.7	7	5	YES	YES
12 GEEBUNG PLACE - GF	39	32	48	41	8.4	8.1	--	--	--	--
14 GEEBUNG PLACE - GF	40	33	48	40	7.9	7.6	--	--	--	--
15 GEEBUNG PLACE - GF	41	34	51	43	9.3	8.9	--	--	--	--
16 GEEBUNG PLACE - GF	40	33	47	40	7.4	7.1	--	--	--	--
NCA3										
14 TAYLOR PLACE - GF	43	36	49	42	6.3	5.9	--	--	--	--
16 TAYLOR PLACE - GF	42	35	51	43	8.4	8.0	--	--	--	--
18 TAYLOR PLACE - GF	41	34	52	45	11.2	10.8	--	--	--	--
20 TAYLOR PLACE - GF	39	32	54	46	14.6	14.3	--	--	YES	YES
21 TAYLOR PLACE - GF	43	36	50	43	7.2	6.9	--	--	--	--
22 TAYLOR PLACE - GF	39	32	54	47	14.6	14.2	--	--	YES	YES
22 TAYLOR PLACE - F1	41	34	55	47	13.6	13.2	--	--	YES	YES
24 TAYLOR PLACE - GF	41	34	54	47	13.5	13.2	--	--	YES	YES
25 TAYLOR PLACE - GF	43	36	51	44	7.8	7.6	--	--	--	--
26 TAYLOR PLACE - GF	40	33	52	45	12.7	12.3	--	--	YES	YES
30 TAYLOR PLACE - GF	40	33	58	50	18.0	17.6	3	--	YES	YES

YEAR OF OPENING (2019) – PREDICTED OPERATIONAL NOISE LEVELS

Receiver Address	Predicted Noise Levels, dBA				Relative Increase, dBA		'Build' Scenario Exceeds RNP Criteria Day: $L_{Aeq(15hour)}$ 55 dBA Night: $L_{Aeq(9hour)}$ 50 dBA		'Build' Scenario Exceed 12 dB 'Relative Increase Criteria'?	
	'No Build' Scenario		'Build' Scenario							
	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$
30 TAYLOR PLACE - F1	41	34	58	51	17.1	16.9	3	1	YES	YES
32 TAYLOR PLACE - GF	36	29	56	49	19.8	19.3	1	--	YES	YES
32 TAYLOR PLACE - F1	39	32	57	50	17.8	17.5	2	--	YES	YES
34 TAYLOR PLACE - GF	42	35	51	43	8.8	8.6	--	--	--	--
36 TAYLOR PLACE - GF	40	33	50	43	10.3	10.0	--	--	--	--
38 TAYLOR PLACE - GF	37	30	55	48	17.9	17.5	--	--	YES	YES
40 TAYLOR PLACE - GF	40	33	48	40	7.6	7.3	--	--	--	--
42 TAYLOR PLACE - GF	40	33	46	39	6.3	5.9	--	--	--	--
NCA4										
26 SEVERNE STREET - GF	42	35	44	37	2.2	2.1	--	--	--	--
28 SEVERNE STREET - GF	39	32	43	36	4.1	3.8	--	--	--	--
30 SEVERNE STREET - GF	38	31	44	37	6.3	5.9	--	--	--	--
32 SEVERNE STREET - GF	42	35	47	40	5.2	5.1	--	--	--	--
34 SEVERNE STREET - GF	38	31	50	43	12.1	11.8	--	--	YES	--
36 SEVERNE STREET - GF	37	30	50	43	12.9	12.6	--	--	YES	YES
38 SEVERNE STREET - GF	38	31	49	42	10.9	10.6	--	--	--	--
40 SEVERNE STREET - GF	37	30	51	44	14.0	13.7	--	--	YES	YES
42 SEVERNE STREET - GF	37	30	45	38	7.4	7.2	--	--	--	--
44 SEVERNE STREET - GF	37	30	43	36	6.0	5.7	--	--	--	--
46 SEVERNE STREET - GF	37	30	46	39	9.1	8.9	--	--	--	--
48 SEVERNE STREET - GF	38	31	47	40	9.3	9.0	--	--	--	--
50 SEVERNE STREET - GF	39	32	47	40	7.9	7.7	--	--	--	--
NCA5										

YEAR OF OPENING (2019) – PREDICTED OPERATIONAL NOISE LEVELS

Receiver Address	Predicted Noise Levels, dBA				Relative Increase, dBA		'Build' Scenario Exceeds RNP Criteria Day: $L_{Aeq(15hour)}$ 55 dBA Night: $L_{Aeq(9hour)}$ 50 dBA		'Build' Scenario Exceed 12 dB 'Relative Increase Criteria'?	
	'No Build' Scenario		'Build' Scenario							
	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$
52 SEVERNE STREET - GF	39	32	45	38	6.4	5.5	--	--	--	--
1 WOODMAN PLACE - GF	38	32	45	38	6.8	5.9	--	--	--	--
3 WOODMAN PLACE - GF	37	31	47	39	9.3	8.2	--	--	--	--
5 WOODMAN PLACE - GF	40	34	48	41	7.9	6.9	--	--	--	--
11 WOODMAN PLACE - GF	39	33	46	38	6.4	5.5	--	--	--	--
12 WOODMAN PLACE - GF	40	34	50	43	9.5	8.4	--	--	--	--
13 WOODMAN PLACE - GF	40	33	54	46	14.0	12.8	--	--	YES	YES
22 LONERGAN DRIVE - GF	40	33	50	42	10.0	8.8	--	--	--	--
24 LONERGAN DRIVE - GF	40	34	54	46	13.9	12.7	--	--	YES	YES
26 LONERGAN DRIVE - GF	38	34	54	47	16.5	13.2	--	--	YES	YES
26 LONERGAN DRIVE - F1	38	34	55	47	17.1	13.9	--	--	YES	YES
29 LONERGAN DRIVE - GF	39	33	49	42	10.2	9.1	--	--	--	--
29 LONERGAN DRIVE - F1	40	33	50	43	10.3	9.3	--	--	--	--
31 LONERGAN DRIVE - GF	38	32	50	43	12.8	10.8	--	--	YES	--
33 LONERGAN DRIVE - GF	39	33	54	47	15.4	14.2	--	--	YES	YES
35 LONERGAN DRIVE - GF	37	31	57	50	20.1	18.9	2	--	YES	YES
35 LONERGAN DRIVE - F1	37	30	58	50	21.0	19.8	3	--	YES	YES
NCA6										
40A SEVERNE STREET - GF	38	31	56	49	18.5	18.2	1	--	YES	YES
NCA7										
123 BARRACKS FLAT DRIVE - GF	34	27	54	47	20.1	19.9	--	--	YES	YES
125 BARRACKS FLAT DRIVE - GF	36	29	57	50	21.3	21.1	2	--	YES	YES
127 BARRACKS FLAT DRIVE - GF	35	28	55	47	19.8	19.5	--	--	YES	YES

YEAR OF OPENING (2019) – PREDICTED OPERATIONAL NOISE LEVELS

Receiver Address	Predicted Noise Levels, dBA				Relative Increase, dBA		'Build' Scenario Exceeds RNP Criteria Day: $L_{Aeq(15hour)}$ 55 dBA Night: $L_{Aeq(9hour)}$ 50 dBA		'Build' Scenario Exceed 12 dB 'Relative Increase Criteria'?	
	'No Build' Scenario		'Build' Scenario							
	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$
129 BARRACKS FLAT DRIVE - GF	35	28	54	47	19.5	19.2	--	--	YES	YES
130 BARRACKS FLAT DRIVE - GF	35	28	59	52	24.4	24.2	4	2	YES	YES
130 BARRACKS FLAT DRIVE - F 1	36	29	60	53	24.1	23.9	5	3	YES	YES
131 BARRACKS FLAT DRIVE - GF	34	27	52	45	17.6	17.3	--	--	YES	YES
132 BARRACKS FLAT DRIVE - GF	33	26	56	49	22.7	22.5	1	--	YES	YES
132 BARRACKS FLAT DRIVE - F 1	37	29	57	50	20.9	20.6	2	--	YES	YES
134 BARRACKS FLAT DRIVE - GF	35	28	54	47	19.5	19.3	--	--	YES	YES
134 BARRACKS FLAT DRIVE - F 1	36	29	56	48	19.5	19.2	1	--	YES	YES
135 BARRACKS FLAT DRIVE - GF	35	27	51	44	16.7	16.6	--	--	YES	YES
136 BARRACKS FLAT DRIVE - GF	34	27	53	46	19.2	19.0	--	--	YES	YES
137 BARRACKS FLAT DRIVE - GF	34	27	50	42	15.1	14.8	--	--	YES	YES
139 BARRACKS FLAT DRIVE - GF	34	27	49	41	14.9	14.7	--	--	YES	YES
140 BARRACKS FLAT DRIVE - GF	34	27	50	43	15.7	15.4	--	--	YES	YES
141 BARRACKS FLAT DRIVE - GF	34	27	48	40	14.1	13.8	--	--	YES	YES
142 BARRACKS FLAT DRIVE - GF	35	28	50	42	15.0	14.8	--	--	YES	YES
146 BARRACKS FLAT DRIVE - GF	34	27	49	41	14.2	14.0	--	--	YES	YES
2 DOEBERL PLACE - GF	34	27	52	45	17.8	17.6	--	--	YES	YES
6 DOEBERL PLACE (SOUTH) - GF	37	29	61	53	24.0	23.8	6	3	YES	YES
6 DOEBERL PLACE (SOUTH) - F 1	37	30	61	54	24.2	23.9	6	4	YES	YES
6 DOEBERL PLACE (NORTH) - GF	35	28	59	51	23.4	23.1	4	1	YES	YES
6 DOEBERL PLACE (NORTH) - F 1	37	29	60	53	23.9	23.6	5	3	YES	YES
6 DOEBERL PLACE - GF	35	28	54	46	18.5	18.3	--	--	YES	YES
6 DOEBERL PLACE - F 1	37	29	56	49	19.5	19.3	1	--	YES	YES

YEAR OF OPENING (2019) – PREDICTED OPERATIONAL NOISE LEVELS

Receiver Address	Predicted Noise Levels, dBA				Relative Increase, dBA		'Build' Scenario Exceeds RNP Criteria Day: $L_{Aeq(15hour)}$ 55 dBA Night: $L_{Aeq(9hour)}$ 50 dBA		'Build' Scenario Exceed 12 dB 'Relative Increase Criteria'?	
	'No Build' Scenario		'Build' Scenario							
	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$
18 DOEBERL PLACE - GF	36	29	56	48	19.3	19.0	1	--	YES	YES
20 DOEBERL PLACE - GF	37	30	60	53	23.2	23.0	5	3	YES	YES
22 DOEBERL PLACE - GF	37	30	60	52	22.8	22.7	5	2	YES	YES
24 DOEBERL PLACE - GF	37	29	58	50	21.3	21.0	3	0	YES	YES
24 DOEBERL PLACE - F 1	37	30	60	52	22.4	22.1	5	2	YES	YES
26 DOEBERL PLACE - GF	37	30	58	51	20.9	20.6	3	1	YES	YES
28 DOEBERL PLACE - GF	37	30	56	49	18.8	18.5	1	--	YES	YES
28 DOEBERL PLACE - F 1	38	31	60	53	21.7	21.4	5	3	YES	YES
30 DOEBERL PLACE - GF	38	31	60	53	22.0	21.9	5	3	YES	YES
Unit 3, 32 DOEBERL PLACE - GF	36	29	57	49	20.8	20.6	2	--	YES	YES
Unit 4, 32 DOEBERL PLACE - GF	36	29	57	50	21.5	21.2	2	--	YES	YES
Unit 5, 32 DOEBERL PLACE - GF	37	30	51	44	14.2	14.0	--	--	YES	YES
Unit 6, 32 DOEBERL PLACE - GF	37	30	53	46	15.9	15.7	--	--	YES	YES
Unit 7, 32 DOEBERL PLACE - GF	36	29	54	47	17.7	17.4	--	--	YES	YES
Unit 8, 32 DOEBERL PLACE - GF	37	30	57	50	19.7	19.4	2	--	YES	YES
Unit 8, 32 DOEBERL PLACE - F 1	38	31	58	50	19.4	19.1	3	--	YES	YES
Unit 9, 32 DOEBERL PLACE - GF	37	30	57	50	20.1	19.9	2	--	YES	YES
Unit 9, 32 DOEBERL PLACE - F 1	38	31	58	51	19.7	19.5	3	1	YES	YES
Unit 10, 32 DOEBERL PLACE - GF	37	30	57	50	20.3	20.1	2	--	YES	YES
Unit 10, 32 DOEBERL PLACE - F 1	38	31	58	51	20.0	19.8	3	1	YES	YES
Unit 11, 32 DOEBERL PLACE - GF	37	30	57	49	19.7	19.4	2	--	YES	YES
Unit 11, 32 DOEBERL PLACE - F 1	38	31	58	51	19.6	19.5	3	1	YES	YES
Unit 12, 32 DOEBERL PLACE - GF	37	30	57	50	19.7	19.5	2	--	YES	YES

YEAR OF OPENING (2019) – PREDICTED OPERATIONAL NOISE LEVELS

Receiver Address	Predicted Noise Levels, dBA				Relative Increase, dBA		'Build' Scenario Exceeds RNP Criteria Day: $L_{Aeq(15hour)}$ 55 dBA Night: $L_{Aeq(9hour)}$ 50 dBA		'Build' Scenario Exceed 12 dB 'Relative Increase Criteria'?	
	'No Build' Scenario		'Build' Scenario							
	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$
Unit 12, 32 DOEBERL PLACE - F 1	38	31	58	51	20.0	19.8	3	1	YES	YES
Unit 13, 32 DOEBERL PLACE - GF	40	33	60	53	20.0	19.7	5	3	YES	YES
Unit 13, 32 DOEBERL PLACE - F 1	41	34	61	54	19.9	19.7	6	4	YES	YES
NCA8(A)										
69 RIVER DRIVE - GF	38	31	51	43	13.1	12.9	--	--	YES	YES
69 RIVER DRIVE - F 1	39	32	53	45	13.6	13.3	--	--	YES	YES
73 RIVER DRIVE - GF	38	31	52	44	13.9	13.6	--	--	YES	YES
73 RIVER DRIVE - F 1	39	32	53	46	14.2	14.0	--	--	YES	YES
75 RIVER DRIVE - GF	38	31	53	46	15.5	15.3	--	--	YES	YES
78 BARRACKS FLAT DRIVE - GF	38	30	51	44	13.6	13.6	--	--	YES	YES
78 BARRACKS FLAT DRIVE - F 1	40	33	58	50	17.3	17.3	3	--	YES	YES
79 BARRACKS FLAT DRIVE - GF	41	34	51	44	9.1	9.3	--	--	--	--
80 BARRACKS FLAT DRIVE - GF	38	30	54	47	16.7	16.8	--	--	YES	YES
80 BARRACKS FLAT DRIVE - F 1	41	33	61	54	20.6	20.4	6	4	YES	YES
82 BARRACKS FLAT DRIVE - F 1	38	31	59	52	20.7	20.6	4	2	YES	YES
84 BARRACKS FLAT DRIVE - GF	36	29	54	46	17.4	17.3	--	--	YES	YES
86 BARRACKS FLAT DRIVE - GF	37	30	52	45	15.0	14.8	--	--	YES	YES
88 BARRACKS FLAT DRIVE - GF	37	30	52	45	14.6	14.4	--	--	YES	YES
90 BARRACKS FLAT DRIVE - GF	38	31	59	52	21.4	21.2	4	2	YES	YES
92 BARRACKS FLAT DRIVE - F 1	39	32	56	48	17.0	16.8	1	--	YES	YES
94 BARRACKS FLAT DRIVE - GF	38	31	50	43	12.5	12.3	--	--	YES	YES
96 BARRACKS FLAT DRIVE - GF	36	28	55	48	19.4	19.3	--	--	YES	YES
96 BARRACKS FLAT DRIVE - F 1	39	32	57	50	18.2	17.9	2	--	YES	YES

YEAR OF OPENING (2019) – PREDICTED OPERATIONAL NOISE LEVELS

Receiver Address	Predicted Noise Levels, dBA				Relative Increase, dBA		'Build' Scenario Exceeds RNP Criteria Day: $L_{Aeq(15hour)}$ 55 dBA Night: $L_{Aeq(9hour)}$ 50 dBA		'Build' Scenario Exceed 12 dB 'Relative Increase Criteria'?	
	'No Build' Scenario		'Build' Scenario							
	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$
98 BARRACKS FLAT DRIVE - GF	34	27	58	50	23.4	23.3	3	0	YES	YES
98 BARRACKS FLAT DRIVE - F 1	38	31	59	52	21.6	21.3	4	2	YES	YES
100 BARRACKS FLAT DRIVE - GF	34	27	57	49	22.8	22.7	2	--	YES	YES
100 BARRACKS FLAT DRIVE - F 1	38	31	59	52	21.0	20.9	4	2	YES	YES
104 BARRACKS FLAT DRIVE - GF	36	29	60	52	23.7	23.5	5	2	YES	YES
105 BARRACKS FLAT DRIVE - GF	33	26	54	46	20.1	19.8	--	--	YES	YES
105 BARRACKS FLAT DRIVE - F 1	38	30	55	48	17.6	17.3	--	--	YES	YES
106 BARRACKS FLAT DRIVE - GF	36	29	59	51	23.0	22.7	4	1	YES	YES
107 BARRACKS FLAT DRIVE - GF	37	30	53	46	16.5	16.3	--	--	YES	YES
108 BARRACKS FLAT DRIVE - GF	33	26	58	51	25.2	25.0	3	1	YES	YES
108 BARRACKS FLAT DRIVE - F 1	36	29	61	53	24.6	24.3	6	3	YES	YES
110 BARRACKS FLAT DRIVE - GF	33	26	59	51	25.9	25.7	4	1	YES	YES
110 BARRACKS FLAT DRIVE - F 1	36	29	61	53	24.5	24.4	6	3	YES	YES
112 BARRACKS FLAT DRIVE - GF	35	28	59.2	51.9	24.0	23.9	4	2	YES	YES
114 BARRACKS FLAT DRIVE - GF	35	28	59	52	23.8	23.6	4	2	YES	YES
116 BARRACKS FLAT DRIVE - GF	33	26	58	50	25.0	24.7	3	--	YES	YES
116 BARRACKS FLAT DRIVE - F 1	36	29	59	52	22.7	22.4	4	2	YES	YES
118 BARRACKS FLAT DRIVE - GF	34	27	57	49	22.6	22.4	2	--	YES	YES
120 BARRACKS FLAT DRIVE - GF	35	28	57	49	21.4	21.1	2	--	YES	YES
122 BARRACKS FLAT DRIVE - GF	35	28	55	48	20.3	20.0	--	--	YES	YES
126A BARRACKS FLAT DRIVE - GF	32	25	55	48	22.9	22.7	--	--	YES	YES
126A BARRACKS FLAT DRIVE - F 1	35	28	57	50	22.1	21.9	2	--	YES	YES
126B BARRACKS FLAT DRIVE - GF	36	29	55	48	18.8	18.5	--	--	YES	YES

YEAR OF OPENING (2019) – PREDICTED OPERATIONAL NOISE LEVELS

Receiver Address	Predicted Noise Levels, dBA				Relative Increase, dBA		'Build' Scenario Exceeds RNP Criteria Day: $L_{Aeq(15hour)}$ 55 dBA Night: $L_{Aeq(9hour)}$ 50 dBA		'Build' Scenario Exceed 12 dB 'Relative Increase Criteria'?	
	'No Build' Scenario		'Build' Scenario							
	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$
126B BARRACKS FLAT DRIVE - F 1	37	30	56	49	19.5	19.2	1	--	YES	YES
NCA8(B)										
74 BARRACKS FLAT DRIVE - GF	42	34	56	49	14.3	14.2	1	--	YES	YES
77 BARRACKS FLAT DRIVE - GF	42	35	51	44	8.5	8.8	--	--	--	--
1 WEBBER PLACE - GF	39	32	50	43	10.6	10.8	--	--	--	--
3 WEBBER PLACE - GF	35	28	50	43	14.9	14.8	--	--	YES	YES
3 WEBBER PLACE - F 1	41	34	53	45	11.9	11.8	--	--	--	--
5 WEBBER PLACE - GF	39	31	52	44	13.0	12.8	--	--	YES	YES
7 WEBBER PLACE - GF	36	28	53	45	17.1	17.0	--	--	YES	YES
7 WEBBER PLACE - F 1	41	34	56	49	15.1	15.0	1	--	YES	YES
9 WEBBER PLACE - GF	38	30	54	47	16.3	16.2	--	--	YES	YES
9 WEBBER PLACE - F 1	42	35	58	51	16.1	16.1	3	1	YES	YES
11 WEBBER PLACE - GF	42	35	52	45	10.3	10.3	--	--	--	--
12 WEBBER PLACE - GF	44	37	52	45	8.1	8.1	--	--	--	--
12 WEBBER PLACE - F 1	50	42	60	52	10.1	10.0	5	2	--	--
13 WEBBER PLACE - GF	43	35	53	46	10.6	10.5	--	--	--	--
11 FITZGIBBON PLACE - GF	44	36	49	42	5.7	5.5	--	--	--	--
13 FITZGIBBON PLACE - GF	45	38	53	45	7.6	7.5	--	--	--	--
15 FITZGIBBON PLACE - GF	47	40	56	49	8.8	8.7	1	--	--	--
16 FITZGIBBON PLACE - GF	48	40	57	49	9.2	9.2	2	--	--	--
17 FITZGIBBON PLACE - GF	50	43	57	50	6.5	6.4	2	--	--	--
15 CAROLINE PLACE - GF	50	43	59	51	8.8	8.8	4	1	--	--
17 CAROLINE PLACE - GF	50	43	60	52	9.5	9.4	5	2	--	--

YEAR OF OPENING (2019) – PREDICTED OPERATIONAL NOISE LEVELS

Receiver Address	Predicted Noise Levels, dBA				Relative Increase, dBA		'Build' Scenario Exceeds RNP Criteria Day: $L_{Aeq(15hour)}$ 55 dBA Night: $L_{Aeq(9hour)}$ 50 dBA		'Build' Scenario Exceed 12 dB 'Relative Increase Criteria'?	
	'No Build' Scenario		'Build' Scenario							
	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$
18 CAROLINE PLACE - GF	52	45	55	47	2.7	2.6	--	--	--	--
19 CAROLINE PLACE - GF	53	46	61	53	7.6	7.4	6	3	--	--
20 CAROLINE PLACE - GF	55	48	62	55	7.1	7.1	7	5	--	--
12 ALFRED PLACE - GF	55	48	59	51	3.7	3.6	4	1	--	--
14 ALFRED PLACE - GF	56	48	59	52	3.6	3.5	4	2	--	--
16 ALFRED PLACE - GF	55	47	59	51	4.0	3.9	4	1	--	--
18 ALFRED PLACE - GF	55	47	59	52	4.4	4.3	4	2	--	--
18 ALFRED PLACE - F 1	55	48	61	54	5.6	5.6	6	4	--	--
20 ALFRED PLACE - GF	53	46	56	49	3.1	3.1	1	--	--	--
20 ALFRED PLACE - F 1	56	49	60	52	3.4	3.4	5	2	--	--

DESIGN YEAR (10 YEARS AFTER OPENING) – PREDICTED OPERATIONAL NOISE LEVELS

Receiver Address	Predicted Noise Levels, dBA				Relative Increase, dBA		'Build' Scenario Exceeds RNP Criteria Day: $L_{Aeq(15hour)}$ 55 dBA Night: $L_{Aeq(9hour)}$ 50 dBA		'Build' Scenario Exceed 12 dB 'Relative Increase Criteria'?	
	'No Build' Scenario		'Build' Scenario							
	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$
NCA1										
6 PATRICK BRICK COURT - GF	53	45	57	49	4.0	3.7	2	--	--	--
6 PATRICK BRICK COURT - F 1	55	47	58	50	3.5	3.2	3	--	--	--
8 PATRICK BRICK COURT - GF	51	44	61	52	9.7	8.3	6	2	--	--
8 PATRICK BRICK COURT - F 1	55	47	63	55	8.5	8.2	8	5	--	--
10 PATRICK BRICK COURT - GF	52	44	55	47	3.0	2.6	--	--	--	--
19 PATRICK BRICK COURT - GF	45	38	59	51	14.1	13.1	4	1	YES	YES
21 PATRICK BRICK COURT - GF	45	38	60	52	15.5	14.5	5	2	YES	YES
23 PATRICK BRICK COURT - GF	44	37	58	49	14.4	12.4	3	--	YES	YES
23 PATRICK BRICK COURT - F 1	46	39	62	54	15.8	14.8	7	4	YES	YES
25 PATRICK BRICK COURT - GF	44	37	59	50	14.6	12.6	4	--	YES	YES
25 PATRICK BRICK COURT - F 1	47	40	62	54	14.7	13.9	7	4	YES	YES
27 PATRICK BRICK COURT - GF	48	40	62	54	14.4	13.8	7	4	YES	YES
29 PATRICK BRICK COURT - GF	48	40	61	53	13.5	13.0	6	3	YES	YES
29 PATRICK BRICK COURT - F 1	51	43	63	55	12.2	11.9	8	5	YES	--
31 PATRICK BRICK COURT - GF	47	40	60	51	12.8	11.2	5	1	YES	--
31 PATRICK BRICK COURT - F 1	51	43	63	54	12.2	10.7	8	4	YES	--
33 PATRICK BRICK COURT - GF	42	35	60	51	17.8	16.6	5	1	YES	YES
33 PATRICK BRICK COURT - F 1	46	38	62	54	16.2	15.1	7	4	YES	YES
31 THOMAS ROYAL GARDENS - GF	43	36	60	51	16.7	14.7	5	1	YES	YES
33 THOMAS ROYAL GARDENS - GF	46	39	60	52	14.4	13.4	5	2	YES	YES
35 THOMAS ROYAL GARDENS - GF	44	37	60	52	16.3	15.2	5	2	YES	YES
37 THOMAS ROYAL GARDENS - GF	44	37	58	50	14.4	13.4	3	--	YES	YES

DESIGN YEAR (10 YEARS AFTER OPENING) – PREDICTED OPERATIONAL NOISE LEVELS

Receiver Address	Predicted Noise Levels, dBA				Relative Increase, dBA		'Build' Scenario Exceeds RNP Criteria Day: $L_{Aeq(15hour)}$ 55 dBA Night: $L_{Aeq(9hour)}$ 50 dBA		'Build' Scenario Exceed 12 dB 'Relative Increase Criteria'?	
	'No Build' Scenario		'Build' Scenario							
	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$
39 THOMAS ROYAL GARDENS - GF	44	37	59	51	15.4	14.4	4	1	YES	YES
41 THOMAS ROYAL GARDENS - GF	44	37	60	52	16.5	15.4	5	2	YES	YES
43 THOMAS ROYAL GARDENS - GF	44	37	60	52	16.4	15.4	5	2	YES	YES
45 THOMAS ROYAL GARDENS - GF	44	37	63	55	19.4	18.4	8	5	YES	YES
47 THOMAS ROYAL GARDENS - GF	44	37	62	54	18.5	17.5	7	4	YES	YES
49 THOMAS ROYAL GARDENS - GF	44	37	63	55	19.5	18.5	8	5	YES	YES
51 THOMAS ROYAL GARDENS - GF	44	37	63	54	19.5	17.5	8	4	YES	YES
53 THOMAS ROYAL GARDENS - GF	44	37	63	55	19.5	18.5	8	5	YES	YES
55 THOMAS ROYAL GARDENS - GF	43	36	60	52	16.7	15.7	5	2	YES	YES
57 THOMAS ROYAL GARDENS - GF	43	36	63	55	19.8	18.8	8	5	YES	YES
59 THOMAS ROYAL GARDENS - GF	43	36	62	54	18.6	17.6	7	4	YES	YES
61 THOMAS ROYAL GARDENS - GF	43	36	62	53	18.7	16.7	7	3	YES	YES
NCA2										
91 ELLERTON DRIVE - GF	44	37	51	43	6.9	5.7	--	--	--	--
44 STONEHAVEN CIRCUIT - GF	51	43	57	49	6.3	6.2	2	--	--	--
46 STONEHAVEN CIRCUIT - GF	51	43	60	52	8.8	8.7	5	2	--	--
48 STONEHAVEN CIRCUIT - GF	48	41	58	50	10.4	9.3	3	--	--	--
50 STONEHAVEN CIRCUIT - GF	50	43	57	49	7.2	6.1	2	--	--	--
52 STONEHAVEN CIRCUIT - GF	50	42	58	50	7.8	7.7	3	--	--	--
54 STONEHAVEN CIRCUIT - GF	50	42	53	45	3.2	3.2	--	--	--	--
56 STONEHAVEN CIRCUIT - GF	49	42	57	49	8.0	6.9	2	--	--	--
58 STONEHAVEN CIRCUIT - GF	49	41	58	50	8.9	8.8	3	--	--	--
60 STONEHAVEN CIRCUIT - GF	46	39	59	51	12.6	11.5	4	1	YES	--

DESIGN YEAR (10 YEARS AFTER OPENING) – PREDICTED OPERATIONAL NOISE LEVELS

Receiver Address	Predicted Noise Levels, dBA				Relative Increase, dBA		'Build' Scenario Exceeds RNP Criteria Day: $L_{Aeq(15hour)}$ 55 dBA Night: $L_{Aeq(9hour)}$ 50 dBA		'Build' Scenario Exceed 12 dB 'Relative Increase Criteria'?	
	'No Build' Scenario		'Build' Scenario							
	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$
62 STONEHAVEN CIRCUIT - GF	46	38	56	48	10.0	9.8	1	--	--	--
1 TENNYSON DRIVE - GF	44	37	53	45	9.2	8.1	--	--	--	--
2 TENNYSON DRIVE - GF	44	37	60	52	15.9	14.7	5	2	YES	YES
10 NORTHCLIFFE PLACE - GF	44	37	60	51	15.6	14.4	5	1	YES	YES
12 NORTHCLIFFE PLACE - GF	44	37	62	54	18.2	17.0	7	4	YES	YES
21 NORTHCLIFFE PLACE - GF	42	35	54	46	12.2	11.0	--	--	YES	--
23 NORTHCLIFFE PLACE - GF	45	38	62	54	17.4	16.2	7	4	YES	YES
12 GEEBUNG PLACE - GF	40	33	48	40	7.9	6.9	--	--	--	--
14 GEEBUNG PLACE - GF	40	33	48	40	7.6	6.6	--	--	--	--
15 GEEBUNG PLACE - GF	42	35	51	42	8.5	7.4	--	--	--	--
16 GEEBUNG PLACE - GF	40	33	47	39	7.3	6.3	--	--	--	--
NCA3										
14 TAYLOR PLACE - GF	43	36	49	41	6.1	5.2	--	--	--	--
16 TAYLOR PLACE - GF	43	36	51	43	7.7	6.6	--	--	--	--
18 TAYLOR PLACE - GF	42	35	52	44	10.2	9.1	--	--	--	--
20 TAYLOR PLACE - GF	39	32	53	45	14.4	13.2	--	--	YES	YES
21 TAYLOR PLACE - GF	39	32	50	42	11.3	10.2	--	--	--	--
22 TAYLOR PLACE - GF	41	34	54	46	13.0	11.8	--	--	YES	--
22 TAYLOR PLACE - F1	41	34	55	47	13.8	12.6	--	--	YES	YES
24 TAYLOR PLACE - GF	41	34	55	46	13.5	12.3	--	--	YES	YES
25 TAYLOR PLACE - GF	39	33	51	43	11.7	9.6	--	--	--	--
26 TAYLOR PLACE - GF	40	33	53	44	12.5	11.4	--	--	YES	--
30 TAYLOR PLACE - GF	41	34	58	50	16.8	15.6	3	--	YES	YES

DESIGN YEAR (10 YEARS AFTER OPENING) – PREDICTED OPERATIONAL NOISE LEVELS

Receiver Address	Predicted Noise Levels, dBA				Relative Increase, dBA		'Build' Scenario Exceeds RNP Criteria Day: $L_{Aeq(15hour)}$ 55 dBA Night: $L_{Aeq(9hour)}$ 50 dBA		'Build' Scenario Exceed 12 dB 'Relative Increase Criteria'?	
	'No Build' Scenario		'Build' Scenario							
	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$
30 TAYLOR PLACE - F1	41	34	59	50	17.5	16.3	4	--	YES	YES
32 TAYLOR PLACE - GF	39	32	56	48	17.2	15.9	1	--	YES	YES
32 TAYLOR PLACE - F1	39	32	57	49	18.3	17.1	2	--	YES	YES
34 TAYLOR PLACE - GF	40	34	50	42	10.3	8.2	--	--	--	--
36 TAYLOR PLACE - GF	40	34	50	42	9.9	7.7	--	--	--	--
38 TAYLOR PLACE - GF	37	30	56	47	18.5	17.2	1	--	YES	YES
40 TAYLOR PLACE - GF	38	31	48	40	10.3	9.3	--	--	--	--
42 TAYLOR PLACE - GF	39	32	47	39	7.9	7.0	--	--	--	--
NCA4										
26 SEVERNE STREET - GF	42	35	45	37	2.2	1.9	--	--	--	--
28 SEVERNE STREET - GF	39	32	43	36	4.1	3.3	--	--	--	--
30 SEVERNE STREET - GF	38	31	45	37	6.4	5.4	--	--	--	--
32 SEVERNE STREET - GF	42	35	48	40	5.4	4.6	--	--	--	--
34 SEVERNE STREET - GF	38	32	50	42	12.1	10.7	--	--	YES	--
36 SEVERNE STREET - GF	38	31	51	42	12.9	11.6	--	--	YES	--
38 SEVERNE STREET - GF	39	32	50	42	10.9	9.8	--	--	--	--
40 SEVERNE STREET - GF	38	31	52	44	14.2	12.9	--	--	YES	YES
42 SEVERNE STREET - GF	38	31	45	37	7.1	6.1	--	--	--	--
44 SEVERNE STREET - GF	38	31	44	36	5.9	4.9	--	--	--	--
46 SEVERNE STREET - GF	38	31	47	39	8.9	7.8	--	--	--	--
48 SEVERNE STREET - GF	38	31	47	39	9.2	8.1	--	--	--	--
50 SEVERNE STREET - GF	40	33	48	40	7.4	6.5	--	--	--	--
NCA5										

DESIGN YEAR (10 YEARS AFTER OPENING) – PREDICTED OPERATIONAL NOISE LEVELS

Receiver Address	Predicted Noise Levels, dBA				Relative Increase, dBA		'Build' Scenario Exceeds RNP Criteria Day: $L_{Aeq(15hour)}$ 55 dBA Night: $L_{Aeq(9hour)}$ 50 dBA		'Build' Scenario Exceed 12 dB 'Relative Increase Criteria'?	
	'No Build' Scenario		'Build' Scenario							
	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$
52 SEVERNE STREET - GF	39	32	45	37	6.0	4.9	--	--	--	--
1 WOODMAN PLACE - GF	39	32	46	38	7.0	6.0	--	--	--	--
3 WOODMAN PLACE - GF	38	31	47	39	8.7	7.6	--	--	--	--
5 WOODMAN PLACE - GF	41	34	49	41	7.7	6.7	--	--	--	--
11 WOODMAN PLACE - GF	40	33	46	38	6.3	5.4	--	--	--	--
12 WOODMAN PLACE - GF	41	34	50	42	9.1	8.0	--	--	--	--
13 WOODMAN PLACE - GF	40	33	54	46	13.9	12.7	--	--	YES	YES
22 LONERGAN DRIVE - GF	40	33	50	42	10.1	9.0	--	--	--	--
24 LONERGAN DRIVE - GF	40	33	54	46	13.8	12.6	--	--	YES	YES
26 LONERGAN DRIVE - GF	38	33	55	46	16.5	13.2	--	--	YES	YES
26 LONERGAN DRIVE - F1	38	33	55	47	17.1	13.9	--	--	YES	YES
29 LONERGAN DRIVE - GF	39	32	49	41	9.8	8.7	--	--	--	--
29 LONERGAN DRIVE - F1	40	33	50	42	9.9	8.9	--	--	--	--
31 LONERGAN DRIVE - GF	38	32	51	43	12.7	10.7	--	--	YES	--
33 LONERGAN DRIVE - GF	39	32	55	46	15.5	14.3	--	--	YES	YES
35 LONERGAN DRIVE - GF	36	29	55	47	19.3	18.1	--	--	YES	YES
35 LONERGAN DRIVE - F1	36	29	56	48	20.1	18.8	1	--	YES	YES
NCA6										
40A SEVERNE STREET - GF	39	32	57	49	17.9	16.7	2	--	YES	YES
NCA7										
123 BARRACKS FLAT DRIVE - GF	37	30	53	45	15.9	14.6	--	--	YES	YES
125 BARRACKS FLAT DRIVE - GF	38	32	53	45	14.5	13.1	--	--	YES	YES
127 BARRACKS FLAT DRIVE - GF	38	31	52	44	13.7	13.2	--	--	YES	YES

DESIGN YEAR (10 YEARS AFTER OPENING) – PREDICTED OPERATIONAL NOISE LEVELS

Receiver Address	Predicted Noise Levels, dBA				Relative Increase, dBA		'Build' Scenario Exceeds RNP Criteria Day: $L_{Aeq(15hour)}$ 55 dBA Night: $L_{Aeq(9hour)}$ 50 dBA		'Build' Scenario Exceed 12 dB 'Relative Increase Criteria'?	
	'No Build' Scenario		'Build' Scenario							
	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$
129 BARRACKS FLAT DRIVE - GF	38	31	52	43	13.2	12.8	--	--	YES	YES
130 BARRACKS FLAT DRIVE - GF	38	31	60	52	21.9	20.8	5	2	YES	YES
130 BARRACKS FLAT DRIVE - F 1	39	32	61	53	21.9	20.9	6	3	YES	YES
131 BARRACKS FLAT DRIVE - GF	37	30	50	42	12.9	11.7	--	--	YES	--
132 BARRACKS FLAT DRIVE - GF	36	29	53	45	16.8	15.6	--	--	YES	YES
132 BARRACKS FLAT DRIVE - F 1	39	32	56	47	16.3	15.1	1	--	YES	YES
134 BARRACKS FLAT DRIVE - GF	38	31	52	44	14.8	13.5	--	--	YES	YES
134 BARRACKS FLAT DRIVE - F 1	39	32	55	47	16.0	14.6	--	--	YES	YES
135 BARRACKS FLAT DRIVE - GF	36	29	49	41	13.9	12.6	--	--	YES	YES
136 BARRACKS FLAT DRIVE - GF	37	30	51	43	14.0	13.2	--	--	YES	YES
137 BARRACKS FLAT DRIVE - GF	35	29	48	40	12.8	11.6	--	--	YES	--
139 BARRACKS FLAT DRIVE - GF	35	28	48	39	13.0	11.7	--	--	YES	--
140 BARRACKS FLAT DRIVE - GF	37	30	49	41	12.0	10.8	--	--	--	--
141 BARRACKS FLAT DRIVE - GF	35	28	47	39	12.4	11.1	--	--	YES	--
142 BARRACKS FLAT DRIVE - GF	37	30	49	41	11.6	10.4	--	--	--	--
146 BARRACKS FLAT DRIVE - GF	37	30	48	40	11.0	9.8	--	--	--	--
2 DOEBERL PLACE - GF	37	30	50	42	13.4	12.2	--	--	YES	YES
6 DOEBERL PLACE (SOUTH) - GF	38	31	62	54	24.4	23.3	7	4	YES	YES
6 DOEBERL PLACE (SOUTH) - F 1	39	32	63	55	23.9	22.9	8	5	YES	YES
6 DOEBERL PLACE (NORTH) - GF	39	32	61	54	21.9	22.1	6	4	YES	YES
6 DOEBERL PLACE (NORTH) - F 1	40	33	62	56	22.4	22.7	7	6	YES	YES
6 DOEBERL PLACE - GF	36	29	51	43	15.1	13.9	--	--	YES	YES
6 DOEBERL PLACE - F 1	37	30	53	45	16.2	15.0	--	--	YES	YES

DESIGN YEAR (10 YEARS AFTER OPENING) – PREDICTED OPERATIONAL NOISE LEVELS

Receiver Address	Predicted Noise Levels, dBA				Relative Increase, dBA		'Build' Scenario Exceeds RNP Criteria Day: $L_{Aeq(15hour)}$ 55 dBA Night: $L_{Aeq(9hour)}$ 50 dBA		'Build' Scenario Exceed 12 dB 'Relative Increase Criteria'?	
	'No Build' Scenario		'Build' Scenario							
	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$
18 DOEBERL PLACE - GF	39	32	59	51	20.3	19.0	4	1	YES	YES
20 DOEBERL PLACE - GF	39	33	62	54	22.3	21.2	7	4	YES	YES
22 DOEBERL PLACE - GF	39	32	61	53	21.9	20.8	6	3	YES	YES
24 DOEBERL PLACE - GF	39	32	60	52	20.9	19.7	5	2	YES	YES
24 DOEBERL PLACE - F 1	40	33	61	53	21.4	20.3	6	3	YES	YES
26 DOEBERL PLACE - GF	38	31	61	53	22.5	21.3	6	3	YES	YES
28 DOEBERL PLACE - GF	38	31	61	52	22.3	21.1	6	2	YES	YES
28 DOEBERL PLACE - F 1	39	32	62	54	22.4	21.4	7	4	YES	YES
30 DOEBERL PLACE - GF	39	32	62	54	22.9	21.8	7	4	YES	YES
Unit 3, 32 DOEBERL PLACE - GF	39	32	61	53	21.7	20.6	6	3	YES	YES
Unit 4, 32 DOEBERL PLACE - GF	39	32	62	54	22.5	21.4	7	4	YES	YES
Unit 5, 32 DOEBERL PLACE - GF	40	33	55	47	14.6	13.4	--	--	YES	YES
Unit 6, 32 DOEBERL PLACE - GF	40	33	57	49	16.5	15.4	2	--	YES	YES
Unit 7, 32 DOEBERL PLACE - GF	40	33	58	50	18.6	17.3	3	--	YES	YES
Unit 8, 32 DOEBERL PLACE - GF	40	34	61	53	20.7	19.5	6	3	YES	YES
Unit 8, 32 DOEBERL PLACE - F 1	42	35	62	54	20.1	19.0	7	4	YES	YES
Unit 9, 32 DOEBERL PLACE - GF	40	34	62	54	21.2	20.1	7	4	YES	YES
Unit 9, 32 DOEBERL PLACE - F 1	42	35	62	54	20.6	19.6	7	4	YES	YES
Unit 10, 32 DOEBERL PLACE - GF	41	34	62	54	21.2	20.2	7	4	YES	YES
Unit 10, 32 DOEBERL PLACE - F 1	42	35	63	55	20.8	19.7	8	5	YES	YES
Unit 11, 32 DOEBERL PLACE - GF	41	34	61	53	20.7	19.5	6	3	YES	YES
Unit 11, 32 DOEBERL PLACE - F 1	42	35	62	54	20.4	19.3	7	4	YES	YES
Unit 12, 32 DOEBERL PLACE - GF	41	34	62	54	21.2	20.0	7	4	YES	YES

DESIGN YEAR (10 YEARS AFTER OPENING) – PREDICTED OPERATIONAL NOISE LEVELS

Receiver Address	Predicted Noise Levels, dBA				Relative Increase, dBA		'Build' Scenario Exceeds RNP Criteria Day: $L_{Aeq(15hour)}$ 55 dBA Night: $L_{Aeq(9hour)}$ 50 dBA		'Build' Scenario Exceed 12 dB 'Relative Increase Criteria'?	
	'No Build' Scenario		'Build' Scenario							
	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$
Unit 12, 32 DOEBERL PLACE - F 1	42	35	63	55	20.8	19.8	8	5	YES	YES
Unit 13, 32 DOEBERL PLACE - GF	41	34	62	54	21.0	20.0	7	4	YES	YES
Unit 13, 32 DOEBERL PLACE - F 1	42	35	63	55	20.8	19.8	8	5	YES	YES
NCA8(A)										
69 RIVER DRIVE - GF	40	33	50	42	9.7	8.4	--	--	--	--
69 RIVER DRIVE - F 1	42	35	51	43	9.8	8.6	--	--	--	--
73 RIVER DRIVE - GF	40	33	50	42	10.2	8.9	--	--	--	--
73 RIVER DRIVE - F 1	41	34	52	44	10.5	9.3	--	--	--	--
75 RIVER DRIVE - GF	40	33	51	43	11.1	9.9	--	--	--	--
78 BARRACKS FLAT DRIVE - GF	38	30	52	43	13.5	13.4	--	--	YES	YES
78 BARRACKS FLAT DRIVE - F 1	39	32	58	50	18.9	17.8	3	--	YES	YES
79 BARRACKS FLAT DRIVE - GF	39	32	49	41	10.0	9.4	--	--	--	--
80 BARRACKS FLAT DRIVE - GF	39	32	55	46	15.6	14.4	--	--	YES	YES
80 BARRACKS FLAT DRIVE - F 1	41	33	61	53	20.4	20.2	6	3	YES	YES
82 BARRACKS FLAT DRIVE - F 1	39	32	57	49	18.1	17.1	2	--	YES	YES
84 BARRACKS FLAT DRIVE - GF	43	36	61	53	18.0	16.9	6	3	YES	YES
86 BARRACKS FLAT DRIVE - GF	37	30	54	46	17.1	16.0	--	--	YES	YES
88 BARRACKS FLAT DRIVE - GF	39	32	52	44	13.6	12.5	--	--	YES	YES
90 BARRACKS FLAT DRIVE - GF	41	34	52	44	11.4	10.4	--	--	--	--
92 BARRACKS FLAT DRIVE - F 1	41	34	60	51	18.9	17.8	5	1	YES	YES
94 BARRACKS FLAT DRIVE - GF	42	35	56	48	14.5	13.4	1	--	YES	YES
96 BARRACKS FLAT DRIVE - GF	42	35	51	43	8.8	7.7	--	--	--	--
96 BARRACKS FLAT DRIVE - F 1	39	32	56	47	16.7	15.7	1	--	YES	YES

DESIGN YEAR (10 YEARS AFTER OPENING) – PREDICTED OPERATIONAL NOISE LEVELS

Receiver Address	Predicted Noise Levels, dBA				Relative Increase, dBA		'Build' Scenario Exceeds RNP Criteria Day: $L_{Aeq(15hour)}$ 55 dBA Night: $L_{Aeq(9hour)}$ 50 dBA		'Build' Scenario Exceed 12 dB 'Relative Increase Criteria'?	
	'No Build' Scenario		'Build' Scenario							
	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$
98 BARRACKS FLAT DRIVE - GF	42	35	58	49	15.7	14.6	3	--	YES	YES
98 BARRACKS FLAT DRIVE - F 1	38	31	58	50	20.4	19.4	3	--	YES	YES
100 BARRACKS FLAT DRIVE - GF	41	34	60	52	18.5	17.3	5	2	YES	YES
100 BARRACKS FLAT DRIVE - F 1	37	30	57	49	20.4	19.3	2	--	YES	YES
104 BARRACKS FLAT DRIVE - GF	41	34	59	51	18.7	17.5	4	1	YES	YES
105 BARRACKS FLAT DRIVE - GF	38	31	60	52	21.9	21.2	5	2	YES	YES
105 BARRACKS FLAT DRIVE - F 1	41	33	53	45	11.8	11.5	--	--	--	--
106 BARRACKS FLAT DRIVE - GF	42	34	55	47	12.7	12.5	--	--	YES	YES
107 BARRACKS FLAT DRIVE - GF	37	30	59	51	21.9	20.7	4	1	YES	YES
108 BARRACKS FLAT DRIVE - GF	41	33	53	45	11.9	11.6	--	--	--	--
108 BARRACKS FLAT DRIVE - F 1	37	29	58	50	21.6	20.4	3	--	YES	YES
110 BARRACKS FLAT DRIVE - GF	40	33	61	53	21.5	20.3	6	3	YES	YES
110 BARRACKS FLAT DRIVE - F 1	35	28	59	50	23.2	22.0	4	--	YES	YES
112 BARRACKS FLAT DRIVE - GF	38	31	61	53	22.4	21.2	6	3	YES	YES
114 BARRACKS FLAT DRIVE - GF	39	31	59	51	20.4	19.7	4	1	YES	YES
116 BARRACKS FLAT DRIVE - GF	37	30	58	50	21.1	19.8	3	--	YES	YES
116 BARRACKS FLAT DRIVE - F 1	35	28	57	49	21.5	20.4	2	--	YES	YES
118 BARRACKS FLAT DRIVE - GF	39	32	59	50	19.9	18.7	4	0	YES	YES
120 BARRACKS FLAT DRIVE - GF	36	29	56	48	19.4	18.2	1	--	YES	YES
122 BARRACKS FLAT DRIVE - GF	37	30	55	47	17.9	16.7	--	--	YES	YES
126A BARRACKS FLAT DRIVE - GF	38	31	54	46	16.5	15.2	--	--	YES	YES
126A BARRACKS FLAT DRIVE - F 1	35	28	53	45	17.7	16.5	--	--	YES	YES
126B BARRACKS FLAT DRIVE - GF	38	31	55	47	17.2	16.0	--	--	YES	YES

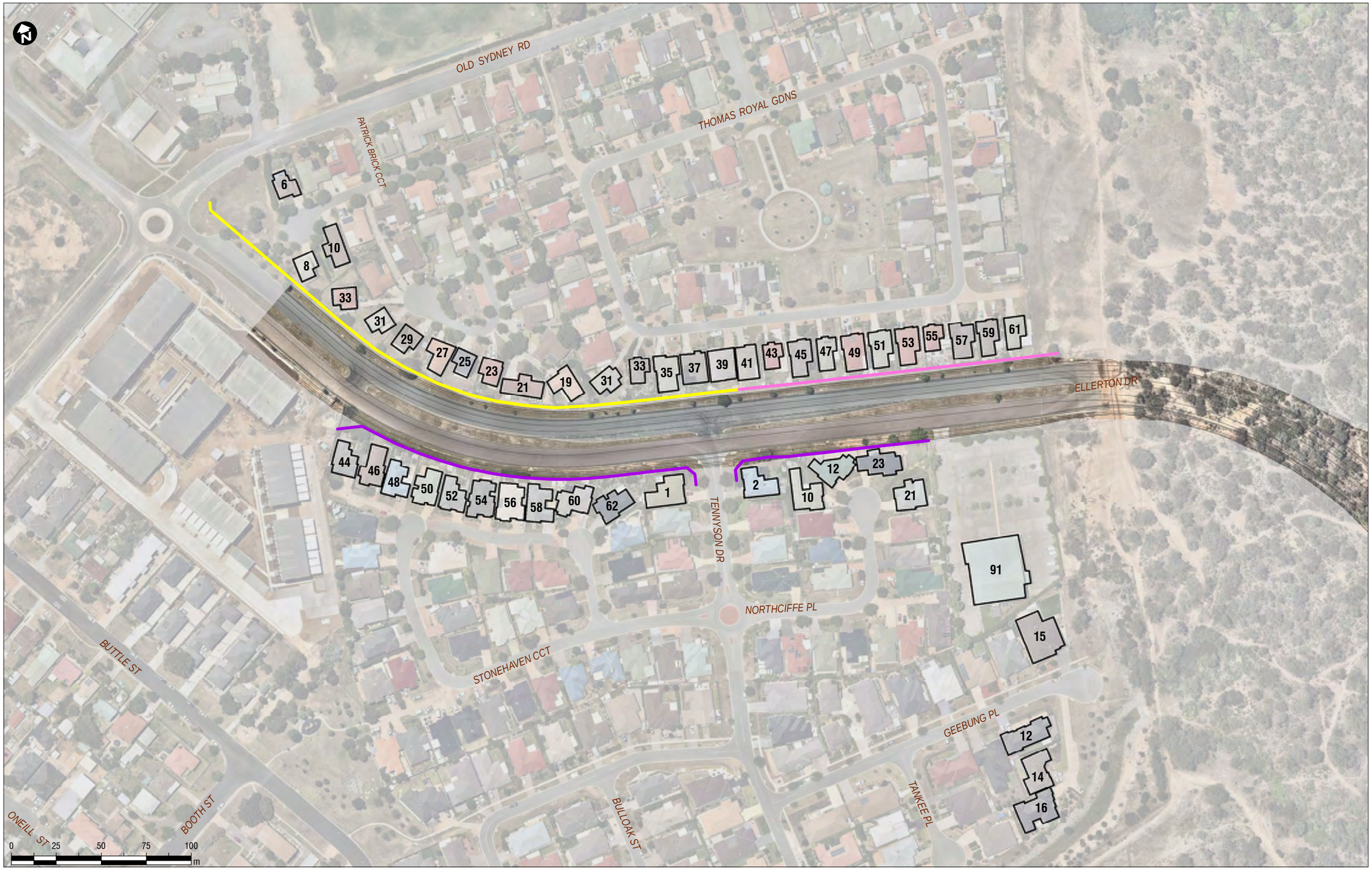
DESIGN YEAR (10 YEARS AFTER OPENING) – PREDICTED OPERATIONAL NOISE LEVELS

Receiver Address	Predicted Noise Levels, dBA				Relative Increase, dBA		'Build' Scenario Exceeds RNP Criteria Day: $L_{Aeq(15hour)}$ 55 dBA Night: $L_{Aeq(9hour)}$ 50 dBA		'Build' Scenario Exceed 12 dB 'Relative Increase Criteria'?	
	'No Build' Scenario		'Build' Scenario							
	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$
126B BARRACKS FLAT DRIVE - F 1	35	28	50	42	15.3	14.1	--	--	YES	YES
NCA8(B)										
74 BARRACKS FLAT DRIVE - GF	43	36	56	48	12.4	11.3	1	--	YES	--
77 BARRACKS FLAT DRIVE - GF	45	38	51	43	6.0	5.8	--	--	--	--
1 WEBBER PLACE - GF	41	34	50	42	9.4	8.8	--	--	--	--
3 WEBBER PLACE - GF	37	30	50	42	13.9	12.9	--	--	YES	YES
3 WEBBER PLACE - F 1	42	35	53	45	10.8	10.0	--	--	--	--
5 WEBBER PLACE - GF	40	33	52	43	11.9	10.9	--	--	--	--
7 WEBBER PLACE - GF	37	30	53	44	15.5	14.6	--	--	YES	YES
7 WEBBER PLACE - F 1	42	35	56	48	14.2	13.2	1	--	YES	YES
9 WEBBER PLACE - GF	40	32	54	46	14.5	13.6	--	--	YES	YES
9 WEBBER PLACE - F 1	44	37	59	50	15.0	13.9	4	0	YES	YES
11 WEBBER PLACE - GF	44	36	53	45	9.1	8.2	--	--	--	--
12 WEBBER PLACE - GF	46	39	53	45	6.7	5.9	--	--	--	--
12 WEBBER PLACE - F 1	52	44	60	52	8.8	7.9	5	2	--	--
13 WEBBER PLACE - GF	45	37	54	46	9.1	8.2	--	--	--	--
11 FITZGIBBON PLACE - GF	45	38	48	41	3.9	3.0	--	--	--	--
13 FITZGIBBON PLACE - GF	47	40	53	45	6.1	5.3	--	--	--	--
15 FITZGIBBON PLACE - GF	49	42	57	49	7.1	6.4	2	--	--	--
16 FITZGIBBON PLACE - GF	50	42	57	49	7.8	7.0	2	--	--	--
17 FITZGIBBON PLACE - GF	52	45	58	50	5.3	4.6	3	--	--	--
15 CAROLINE PLACE - GF	52	45	60	52	7.5	6.7	5	2	--	--
17 CAROLINE PLACE - GF	52	45	60	52	8.0	7.2	5	2	--	--

DESIGN YEAR (10 YEARS AFTER OPENING) – PREDICTED OPERATIONAL NOISE LEVELS

Receiver Address	Predicted Noise Levels, dBA				Relative Increase, dBA		'Build' Scenario Exceeds RNP Criteria Day: $L_{Aeq(15hour)}$ 55 dBA Night: $L_{Aeq(9hour)}$ 50 dBA		'Build' Scenario Exceed 12 dB 'Relative Increase Criteria'?	
	'No Build' Scenario		'Build' Scenario							
	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$
18 CAROLINE PLACE - GF	53	46	55	48	2.0	1.7	--	--	--	--
19 CAROLINE PLACE - GF	55	48	62	54	6.3	5.6	7	4	--	--
20 CAROLINE PLACE - GF	57	50	63	55	6.1	5.3	8	5	--	--
12 ALFRED PLACE - GF	57	49	59	52	2.7	2.2	4	2	--	--
14 ALFRED PLACE - GF	57	50	60	53	2.8	2.2	5	3	--	--
16 ALFRED PLACE - GF	57	50	60	52	2.7	2.3	5	2	--	--
18 ALFRED PLACE - GF	57	50	60	53	3.5	3.0	5	3	--	--
18 ALFRED PLACE - F 1	58	50	62	54	4.6	3.9	7	4	--	--
20 ALFRED PLACE - GF	54	46	56	49	2.6	2.3	1	--	--	--
20 ALFRED PLACE - F 1	57	50	60	52	2.4	2.0	5	2	--	--

LOCATIONS OF NOISE BARRIERS AND ASSESSED PROPERTIES



H:\Projects-SLR\630-Srv\NT\L670-CAN\670.10568 Ellerton Drive Extension\GIS\R670\10568_O_AssessedBuildings_09.mxd

SLR
SUITE 3, LEVEL 4
11 LONDON CRT
CANBERRA ACT 2600
AUSTRALIA
T: 61 2 6287 0800
F: 61 2 6287 0801
www.slrconsulting.com

Project No.:	670.10568
Date:	15/02/2017
Drawn by:	NT
Scale:	1:2,000
Sheet Size:	A3
Projection:	GDA 1994 MGA Zone 55

Noise Barrier Height

- 4.2m
- 3.6m
- 3.0m
- 2.4m

Proposed EDE Design

Assessed Buildings (Building Base Height, Building Roof Height)

* SMA Road Surface

Queanbeyan City Council

ELLERTON DRIVE EXTENSION

Locations of Noise Barriers

FIGURE O - 1

H:\Projects-SLR\630-Srv\NTL\670-CAN\670.10568 Ellerton Drive Extension\GIS\R670\10568_O_AssessedBuildings_09.mxd

SLR
SUITE 3, LEVEL 4
11 LONDON CRT
CANBERRA ACT 2600
AUSTRALIA
T: 61 2 6287 0800
F: 61 2 6287 0801
www.slrconsulting.com

Project No.:	670.10568
Date:	15/02/2017
Drawn by:	NT
Scale:	1:2,500
Sheet Size:	A3
Projection:	GDA 1994 MGA Zone 55

Noise Barrier Height
- 4.2m
- 3.6m
- 3.0m
- 2.4m

Proposed EDE Design

Assessed Buildings (Building Base Height, Building Roof Height)

* SMA Road Surface

Queanbeyan City Council

ELLERTON DRIVE EXTENSION

Locations of Noise Barriers

FIGURE O - 2

H:\Projects-SLR\630-Srv\NTL\670-CAN\670.10568 Ellerton Drive Extension\SLR670.10568_O_AssessedBuildings_09.mxd

SLR
SUITE 3, LEVEL 4
11 LONDON CRT
CANBERRA ACT 2600
AUSTRALIA
T: 61 2 6287 0800
F: 61 2 6287 0801
www.slrconsulting.com

Project No.:	670.10568
Date:	15/02/2017
Drawn by:	NT
Scale:	1:3,000
Sheet Size:	A3
Projection:	GDA 1994 MGA Zone 55

Noise Barrier Height

- 4.2m
- 3.6m
- 3.0m
- 2.4m

Proposed EDE Design

Assessed Buildings (Building Base Height, Building Roof Height)

* SMA Road Surface

Queanbeyan City Council

ELLERTON DRIVE EXTENSION

Locations of Noise Barriers

FIGURE O - 3