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West Belconnen

Existing Road Network (Off-Site Roads)

Assessment of Road Traffic Noise Impact to Existing Receivers

Report Number 670.10602-R1

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Riverview Projects (ACT) Pty Ltd
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DOCUMENT CONTROL

Reference	Status	Date	Prepared	Checked	Authorised
670.10602-R1	Revision 1	16 June 2014	Zhang Lai	Jamie Hladky	Jamie Hladky
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Executive Summary

The future West Belconnen suburbs are to be accessed via three existing routes on the existing road network: Ginninderra Drive, Southern Cross Drive and Drake Brockman Drive. These three routes are located within well-established, predominantly residential areas. The establishment of new residential subdivisions has the potential to introduce additional road traffic along these major routes, hence increase in road noise levels experienced by existing residences.

SLR has been appointed by Riverview Projects (ACT) Pty Ltd to undertake a road traffic noise impact assessment for the existing receivers along these three major roads. This report presents the results of that assessment.

Planning Guidelines

Based on an interpretation of the 1996 Draft Noise Management Guidelines (repealed), agreed with the ESDD Transport and Planning Section, the following road traffic noise planning guidelines were identified as applicable for this assessment:

- Private open space – 58 dB $L_{A10(18hour)}$ Abbreviated 'POS 58' here
- Façade – 63 dB $L_{A10(18hour)}$ Abbreviated 'Façade 63' here
- Façade – 65 dB $L_{A10(18hour)}$ Abbreviated 'Façade 65' here

Assessment

In consultation with the ACT Government (Transport and Planning Section within the Environment and Sustainable Development Directorate), noise monitoring and concurrent traffic counts were conducted at 7 locations (see **Section 2**) to understand the existing noise climate and allow validation of the road traffic noise computer model. The results of these surveys are presented and summarised.

Computer noise modelling was conducted using the SoundPLAN V7.1 suite of acoustic prediction software, implementing the UK Department of Transport (DoT) *Calculation of Road Traffic Noise*.

Key Results

Key findings and recommendations made are summarised below.

Ginninderra Drive

- From sample surveys undertaken for this project, road traffic noise levels along Ginninderra Drive are currently in the region of 58 to 63 dB $L_{A10\ (18hr)}$ when measured at 1m from a building façade.
- Based on the current road proposals, the noise planning guidelines for future year 2041 are a combination of all three 'POS 58', 'Façade 63' and 'Façade 65' goals along Ginninderra Drive.
- Based on year 2041 traffic flows, the noise planning guidelines were predicted to be met at five of the sample locations that were chosen to be representative of groups of receivers along this alignment. These samples represent approximately 110 potentially affected receivers.
- By year 2041, the 'POS 58' planning guideline was predicted to be exceeded at three of the sample locations along the alignment. These three locations represent approximately 85 residences with private open spaces along Ginninderra Drive.
- For these receivers, implementation of a combination of 2 m high noise barrier and quieter road surfaces in certain areas (see **Appendix O**) during the opening decade of the project is predicted to give compliance with the 'POS 58' guideline. The practicality and location of these barriers will be investigated in later project stages.

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- A minor (1 dB) excess of the 'Façade 63' planning guideline was predicted at an existing church. This is not considered to be an acoustically significant excess and is unlikely to warrant further consideration of noise mitigation.

Southern Cross Drive

- From sample surveys undertaken for this project, road traffic noise levels along Southern Cross Drive were currently in the region of 63 to 68 dB $L_{A10\ (18hr)}$ when measured at 1m from a building façade.
- Based on the current road proposals, the noise planning guidelines for future year 2041 are a combination of 'Façade 63' and 'Façade 65' along Southern Cross Drive.
- Based on year 2041 traffic flows, the noise planning guidelines were predicted to be met at four of the sample locations that were chosen to be representative of groups of receivers along the alignment. These samples represent approximately 75 potentially affected receivers.
- Minor exceedances (up to 1dB) of the 'Façade 63' and 'Façade 65' planning guidelines were predicted at two of the sample representative receiver locations, beginning around year 2031. The minor exceedance occurs at just approximately 10 out of 60 properties represented by these samples, and is not considered to be acoustically significant.
- By 2021, the 'Façade 63' planning guideline was predicted to be exceeded by up to 4 dB at approximately 35 properties represented by one sample location. At and around this location, road traffic noise levels were measured to exceed the planning guidelines in the current situation, before the project commences.
- Roadside noise barriers are not currently a practical mitigation option here, due to driveway access requirements.
- The use of a quieter road surface in these locations would be expected to reduce noise levels by around 2 dB, but this would not be sufficient to give compliance with the noise guidelines.
- If it would be possible or practical to make modifications to residential building façades (new glazing etc), then these improvements would normally be capable of providing additional noise reduction of the order by which the planning guidelines are exceeded. As the existing noise levels already exceed the noise guidelines, mitigation may be beyond the remit of this project. The practicality of this mitigation option will be investigated in later project stages.

Drake Brockman Drive

- From sample surveys undertaken for this project, road traffic noise levels along Drake Brockman Drive were currently in the region of 50 to 53 dB $L_{A10\ (18hr)}$ when measured at 1m from a building façade.
- Based on the current road proposals, the noise planning guidelines for future year 2041 are a combination of 'POS 58' and 'Façade 63' along this road alignment.
- By year 2041, the noise planning guidelines were predicted to be exceeded at approximately 70 out of 105 existing residences (by between around 1 and 4 dB).
- Provision of 2 m high road side road barriers along the entire length of Drake Brockman Drive (north of the road alignment),constructed between years 2031 and 2041 is predicted to give compliance with the noise planning guidelines at that time. The practicality and location of these barriers will investigated in later project stages.

Executive Summary

- The existing traffic noise levels along Drake Brockman Drive are low. Relative increases of over 10 dB were predicted by year 2041. This means that although the future noise levels are predicted to meet the planning guidelines with the proposed mitigation in place, the subjective impression of noise increase could be greater than is captured by the guidelines.
- This potential subjective impact will need to be managed with the existing residents of these properties. It should be emphasised that this noise increase will be extremely gradual, between the onset of project development and year 2041.

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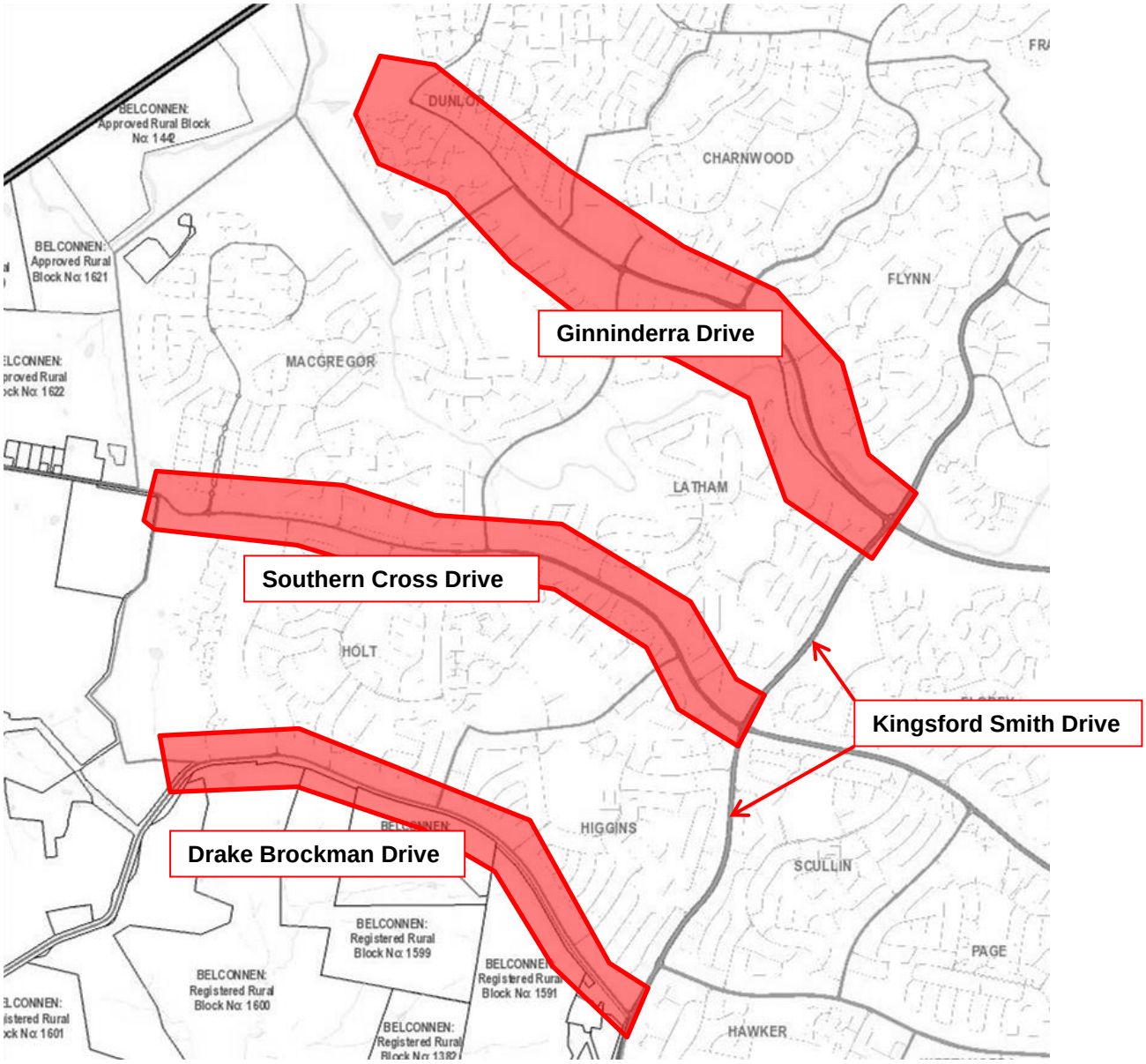
1 INTRODUCTION

SLR Consulting (SLR) has been commissioned by Riverview Projects (ACT) Pty Ltd on behalf of the ACT Land Development Agency (LDA) to assess the noise impact of the proposed new West Belconnen suburbs to receivers on the existing road network.

The future West Belconnen suburbs are to be accessed via three existing routes on the existing road network: Ginninderra Drive, Southern Cross Drive and Drake Brockman Drive. These three routes are located within well-established, predominantly residential areas. The establishment of new residential subdivisions has the potential to introduce additional road traffic along these major routes, hence increase in road noise levels experienced by existing residences.

This report presents the results and findings of road traffic noise assessment for the existing establishments along conducted in the noise assessment study area, presented in **Figure 1**. A glossary of acoustic terminology is provided in **Appendix A**.

Figure 1 Study Area – Existing Established Areas



2 EXISTING AMBIENT NOISE ENVIRONMENT

In order to characterise the noise environment across the project area and to assist with calibration of the road traffic noise model, environmental noise monitoring was performed at representative locations within the project area.

Noise monitoring was undertaken at 7 locations. Traffic flow counts were undertaken concurrently with the noise monitoring to allow the most robust calibration of the computer noise model.

In consultation with the ACT Government (Transport and Planning Section within the Environment and Sustainable Development Directorate), the noise monitoring and traffic counting locations were selected to provide a representative spread of locations. These locations have also acted as validation points on the computer noise model.

Table 1 Noise Monitoring / Traffic Flow Count Locations

Location No.	Noise Monitor Address	Corresponding Traffic Count Location	Description/Noise Monitor Details
Drake Brockman Drive			
1	180 Drake Brockman Drive	In front of 174 Drake Brockman Drive	Front of house facing subject road Noise monitor S/N: 16-004-033 16-207-045[1]
2	20 Davidson Street	Approx. 130 m west of Kinsella Street	Private open space facing subject road Noise monitor S/N: 16-203-528
Southern Cross Drive			
3	341 Southern Cross Drive	In front of 333 Southern Cross Drive	Front of house facing subject road Noise monitor S/N: 16-306-044 16-207-047[1]
4	222 Southern Cross Drive	In front of 192 Southern Cross Drive	Front of house facing subject road Noise monitor S/N: 16-207-049 16-004-033[1]
Ginninderra Drive			
5	Public land outside 39-41 Buckmaster Crescent	Approx. 380 m west of Florey Drive roundabout	Noise monitor S/N: 16-203-526 16-207-049 16-306-044[1]
6	Public land outside 14 Dobinson Place	Approx. 210 m south of Companion Crescent	Noise monitor S/N: 16-207-048 16-203-526[1]
7	Public land outside 25 Ferguson Place	Approx. 210 m south of Companion Crescent	Noise monitor S/N: 16-306-041

Note 1: Noise monitors swapped at these locations during a battery change.

The noise monitoring was conducted between 5 December and 20 December 2013 inclusive.

2.1 Noise Monitoring

2.1.1 Unattended Noise Monitoring

Unattended noise monitoring was conducted using ARL type 316 noise monitors. The instrument signal chain calibration was conducted before and after each measurement survey, with the variation in calibrated levels not exceeding ±0.5 dBA.

All unattended monitoring equipment was programmed to record continuously 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}.

In addition, operator attended monitoring was also conducted at each selected locations. This will assist in understanding of the source and spectral information

2.1.2 Attended Noise Monitoring

Operator-attended ambient noise survey was conducted at all noise monitoring locations shown in **Table 1** in order to support the identification and occurrence of ambient noise sources.

Attended ambient noise measurements were performed using a calibrated Rion NA-28 Sound Level Meter (S/N: 01060054). The instrument signal chain calibration was checked before and after measurement, with the variation in calibrated levels not exceeding the acceptable variation of ±0.5 dBA (AS 1055).

The acoustic instrumentation (SLM and calibrator) employed throughout the monitoring programme was designed to comply with the requirements of AS IEC 61672.1-2004 "*Electroacoustics - Sound Level Meters"* and carry current NATA or manufacturer calibration certificates.

2.2 Traffic Counting

Concurrent to the noise monitoring, traffic counting was also conducted. The primary objective of traffic counting is to provide a means of validating the computer noise model that will be created to assess future road traffic noise. The counting was conducted using tube counters. The tube counters were installed as close to the noise monitoring locations as was safe and practical. All traffic count locations are deemed to be representative of the traffic conditions at the associated noise monitoring location (see **Table 1**).

The results of the traffic counting provides hourly breakdown of traffic volume, classifications and average speed in each direction.

The traffic counting was conducted by Trans Traffic Survey and SLR has been advised that data indicates that variances of less than 1% have been achieved (a measure of differences between 2 tubes on a road). It is understood that Roads ACT (the road authority in ACT) allows for variances of up to 5%.

The raw traffic flow count data has been provided to the ESDD Transport and Planning Section for their future reference.

2.3 Results

2.3.1 Unattended Noise Monitoring and Traffic Count

The relevant results are summarised in **Table 2**. All noise monitoring results and traffic flow counts are presented as the average of all 18-hour periods during the overall monitoring period for assessment against the ACT noise planning guidelines, which make use of this time period.

Table 2 Unattended Noise Monitoring and Traffic Count Results

Loc. No.	Address	$L_{A10(18hr)}$ (dB)	Traffic Survey (Westbound)			Traffic Survey (Eastbound)		
			Light vehicle	Heavy vehicle	Mean Speed	Light vehicle	Heavy vehicle	Mean Speed
Drake Brockman Drive								
1	180 Drake Brockman Drive	53 (façade)	811	177	70	930	54	62
2	20 Davidson St	50 (façade)	3884	197	79	4012	136	73
Southern Cross Drive								
3	341 Southern Cross Drive	68 (façade)	5487	248	60	5088	257	62
4	222 Southern Cross Drive	63 (façade)	6502	674	66	6209	541	65
Ginninderra Drive								
5	On public land, 1 m outside solid timber fence of 39-41 Buckmaster Crescent	58 (facade)	4678	105	76	4477	295	81
6	Public land outside 14 Dobinson Place	64 (free field)	8455	523	81	8869	444	82
7	Public land outside 25 Ferguson Place	59 (free field)						

Full noise monitoring charts for the seven locations are presented in **Appendices B** to **H** of this report.

Measurements at locations 6 and 7 were made under free-field conditions, as it was not possible to identify a suitable building façade measurement position at the time of the site visits. All free-field measurements have been corrected to façade levels in subsequent calculations and assessment by the addition of 2.5dBA.

2.3.2 Operator-Attended Monitoring

Attended monitoring was conducted concurrent with the logger deployment and retrieval to observe the source and spectral information of the existing ambient noise environment. This information will be retained and may be used at later stages to provide a more robust level of detail in mitigation assessments.

The attended noise measurement results and observations are summarised in **Table 3**.

Table 3 Attended Noise Monitoring

Location	Start time (dd/mm/yy hh:mm)	Sound pressure level (dB re 20 µPa), 15 minute measurement period				Approximate observations on typical noise sources, with typical fast time-weighted noise level, in dBA
		LAmax	LA10	LA90	LAeq	
180 Drake Brockman Drive	20/12/13 14:18	85	51	38	51	Birds 37-47 Household noise 41-45 Operator 39 Passing cars 52-58 Truck 59 Intermittent road traffic
20 Davidson Street	13/12/13 07:40	73	53	44	52	Intermittent traffic 59-61 Local residents' noise 50-60
341 Southern Cross Drive	10/12/13 08:32	92	70	56	67	Constant road traffic. Light winds
222 Southern Cross Drive	10/12/13 08:05	74	65	54	62	Birds 45-49 Constant road traffic
Public land outside 39-41 Buckmaster Crescent	10/12/13 09:05	92	60	51	57	Intermittent/light road traffic Birds 42-46 Light winds
Public land outside 14 Dobinson Place	20/12/13 15:55	85	62	56	60	Constant road traffic noise 60-63 Birds 54-56 Far lane traffic 57-58 Near lane traffic 60-62 Operator 68 Car noisy exhaust 65 Harley Davidson motorbike 67 Cockatoo 71
Public land outside 25 Ferguson Place	20/12/13 16:28	71	60	53	57	Near lane traffic 58-61 Clear view to far lane Calm – light wind Bus 58-60

3 PLANNING GUDIELINES

3.1 ACT Planning Guidelines

There are currently no legislative policies or guidelines within the ACT that specifically address road traffic noise during operation of a road.

The previous *Draft Noise Management Guidelines (1996)* provided guidance in the assessment of traffic noise to sensitive areas. These guidelines were repealed by the Planning and Development Act 2007-24, s428 (2).

Nevertheless, the Guidelines provide a point of reference, and numerous road projects (both existing and still in development) have been assessed under the repealed 1996 Guidelines in the ACT. The criteria and methodology provided in this document are broadly consistent with criteria used in other Australian States and Territories.

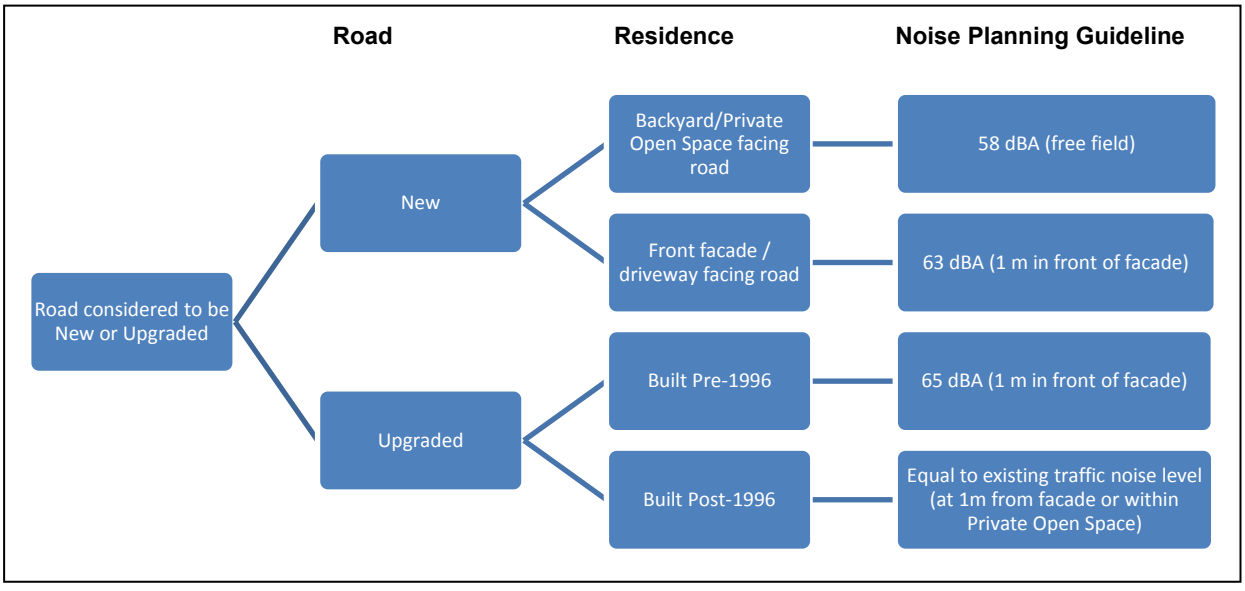
Section 3 of the Draft Guidelines provides road traffic noise criteria based on the land / building usage as well as the type of road development.

Based on our interpretation of the 1996 Guidelines and discussions with the ESDD Transport and Planning Section, the noise planning guidelines applicable are dependent on the following conditions:

- Whether or not the road, after development, is considered to be upgrade/changes of existing road/carriageway, or a new road (including new carriageway/duplication on an existing road corridor);
- Whether the potentially affected noise-receiving properties were built pre- or post-1996 (the date of the draft guidelines); and
- Whether the property has front façade/driveway or backyard/private open space (POS) facing the road.

The applicable noise planning criteria are determined using a process that can be indicated in the flow chart in **Figure 2**. This approach has been agreed with the ESDD Transport and Planning Section.

Figure 2 Noise-Sensitive Receivers Flowchart for Determination of Road Noise Goals



3.2 Summary of Guideline Values

It is understood that most of the houses in the study area along the three major roads were built prior to 1996. Therefore, the following planning guidelines apply:

- Private Open Space – 58 dBA $L_{A10(18hour)}$ (referred to for brevity as '**POS 58**' here)
- Façade – 63 dBA $L_{A10(18hour)}$ (referred to for brevity as '**Façade 63**' here)
- Façade – 65 dBA $L_{A10(18hour)}$ (referred to for brevity as '**Façade 65**' here)

3.3 Initial Note on Approaches Road Traffic Noise Mitigation in the ACT

The Guidelines advise that the noise goals are to be met via the use of appropriate setback distances, acoustic barriers or building treatments at the affected dwellings, so as to achieve appropriate internal noise levels at all relevant receivers. However, whilst noise barriers have been used in a number of cases in the ACT, this approach has been generally discouraged by ESDD. Likewise, there is a limited precedent for lower-noise road surfaces, and building treatment at dwellings is extremely rare.

However, it is recognised that increases to road traffic flows have the potential to generate disturbance to sensitive receivers. On this basis, the West Belconnen project team is proposing to thoroughly investigate noise impact as part of the detailed design and approval process.

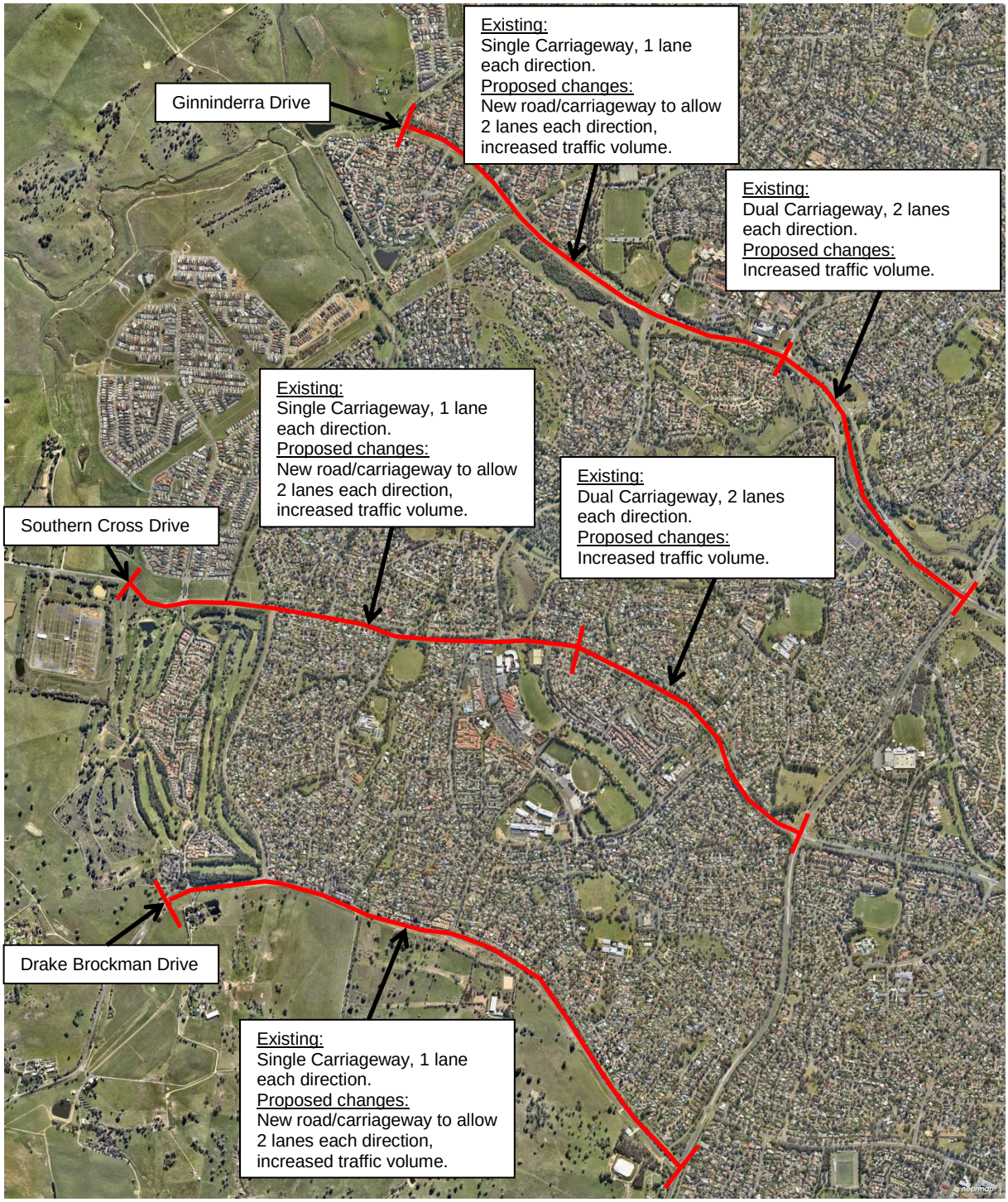
Where noise levels are predicted to exceed the guidelines values, the process of assessment generally involves a study of mitigation options, and recommendations are made for consideration where implementation is thought to be practical and realistic.

4 PROPOSED ROAD CHANGES

As detailed in **Section 3**, the applicable planning noise guideline for a particular receiver is also dependent upon the nature of the proposed changes to the road.

Based on preliminary concept plans provided by AECOM in May 2014, the extents and nature of the proposed changes are summarised graphically in **Figure 3**.

Figure 3 Existing Off-Site Road Network Indicating Proposed Road Changes



5 NOISE PREDICTIONS

5.1 Assessment Methodology

The noise modelling has been conducted using the SoundPLAN V7.1 suite of acoustic prediction software, implementing the UK Department of Transport (DoT) *Calculation of Road Traffic Noise* (CORTN) prediction model for all calculations.

Road traffic noise levels were predicted using procedures as recommended and detailed in the CORTN methodology. The input data for each section of the road for these calculations includes the total traffic count, the percentage of heavy vehicles within the total traffic flow and vehicle speed.

5.1.1 Noise Model Validation

The predicted operational noise levels for the existing scenario have been compared to the noise levels measured during the ambient noise survey, discussed in **Section 2**, for the purpose of model validation. This is shown in **Table 4**.

Table 4 Model Validation – Comparison of Predicted Noise Levels to Measured Noise Levels

Noise Monitoring Location		Measured Existing $L_{A10(18hour)}$ (dBA)	Predicted Existing $L_{A10(18hour)}$ (dBA)	Comparison of Noise Levels – Predicted Minus Measured (dBA)
Drake Brockman Drive				
1	180 Drake Brockman Drive	53	55	+2
2	20 Davidson St	50	52	+2
Southern Cross Drive				
3	341 Southern Cross Drive	68	69	+1
4	222 Southern Cross Drive	63	65	+2
Ginninderra Drive				
5	On public land, ~1 m outside solid timber fence of 39-41 Buckmaster Crescent	58	60	+2
6	Public land outside 14 Dobinson Place	64	62	-2
7	Public land outside 25 Ferguson Place	59	59	0

The NSW Environmental Noise Management Manual (ENMM) released by the NSW Roads and Maritime Services (RMS, previously Roads and Traffic Authority, RTA) notes 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 the ACT.

It is important to note that the validation assessments given in **Table 4** are made at a small number of discrete sample positions. More detailed checks have been undertaken during introduction of the source data and assumptions that are documented in **Section 5.2** below.

On the basis of the comparison of the noise model predictions with the baseline measurement results, it is concluded that the noise model provides results which enable a reliable assessment of the project.

5.2 Computer Noise Modelling Parameters and Assumptions

To assist with the modelling and assessment, a number of information packages were provided. These have formed the basis of this assessment. It is understood that some of these information are preliminary only and may be subject to change. **Table 5** provides a list of information received and assumptions in the process of the setting up the noise model.

Table 5 Computer Noise Modelling Parameters and Assumptions

Item	Date Received	Source (and Comment)
Noise Model – Existing road network, existing scenario (validation)		
3-D ground topography data for the entire study area along Drake Brockman Drive, Southern Cross Drive and Ginninderra Drive	13/12/2013	Knight Frank
CAD drawings indicating blocks and sections boundaries of the entire study area	13/12/2013	Knight Frank
CAD drawings indicating the kerb and centreline of the existing road alignments	13/12/2013	Knight Frank
Noise Model – Existing road network, future scenario (prediction) (Ginninderra Drive, Southern Cross Drive and Drake Brockman Drive only)		
CAD drawings indicating the kerb and centreline of the ultimate layout of all major roads	06/05/2014	AECOM
Design speed limit/future sign-posted speed limit	05/05/2014	AECOM
18-hour (6 am to 12 am) traffic volume and mix forecast (ie % of heavy vehicles etc) for the design year	02/05/2014, 11/02/2014	AECOM Traffic figures received was for forecast year of 2041 (optimistic/high growth scenario). % of heavy vehicles based on information provided in February 2014 for the purpose of preliminary assessment.
Traffic volume and mix forecast as above for interim years, to present gradual increase of noise.	22/05/2014	Updated AM peak traffic forecast data for year 2021, 2031 and 2041 were provided.
Intended road pavement type proposed	-	Assumed to be dense graded asphalt (DGA).
Typical section drawings at representative chainages	02/05/2014, 06/05/2014	AECOM. Hand sketch cross section at typical chainages were provided as well as kerblines and centrelines.

The results of noise predictions are presented and discussed in **Section 7** of this report.

6 GENERAL DISCUSSION ON ROAD NOISE MITIGATION OPTIONS

Noise mitigation options for a residence near to a roadway can be divided into 3 broad categories, according to the location of the mitigation:

- At the noise source;
- In the path between the source and receiver; or
- At the receiver.

This section discusses in-principal noise mitigation options, with a commentary on the general appropriateness and/or likelihood of success.

6.1 Mitigation at the Noise Source – Operational Treatments

6.1.1 Reduction in road gradient

This can have a positive effect on road traffic noise levels, as acceleration noise and engine/exhaust braking noise are reduced. A 5% reduction in road gradient can reduce traffic noise by around 1.5dBA.

Significant gradient changes to existing or realigned roads are unlikely to be practical here.

6.1.2 Reduction in vehicle speeds

Vehicle speeds would need to be limited significantly for the full length of the realignment passing affected properties to have a significant benefit in terms of noise (ie greater than 3dBA). The speed would also need to be limited over significant distances away from the receiver in order to ensure that potential benefits are not negated by acceleration and deceleration at transitional speed zones.

6.1.3 Quieter road surface options

Certain road surfaces have the potential to generate more noise than others. Smoother surfaces will generally produce less noise. There are a number of quiet road surface options available for consideration. In general, for this project such surfaces can provide up to around 2dBA noise reduction in comparison to the currently proposed surface.

Various surface options have advantages and disadvantages in terms of cost, maintenance and noise. Changes to the road surface are not always appropriate for a project, as this has broader road design implications. However, opportunities to provide quieter road surfaces have been investigated.

6.2 Mitigation in the Transfer Path – Noise Barriers

Noise mitigation in the sound transfer path generally refers to the construction of barrier walls or other physical obstructions between the sources and receiver. This can achieve a significant reduction of sound at the receiver, but this is dependent on the barrier material, the height, length, and location:

- For best effect, a noise barrier must break the direct line-of-sight between the source and receiver, although small benefits can be achieved with lower height barriers.
- Higher barriers, and those that are located closest to the source or receiver will generally provide better sound attenuation.
- For best effect, any physical obstructions employed as noise barriers would need to break line-of-sight between the residence and the road. A length equating to an angle of view of approximately 160º is generally considered to provide a minimum barrier length.

6.2.1 Noise Barrier Walls

Many roadside noise barriers have been constructed using timber fencing, precast concrete, lightweight aerated concrete, fibre cement panels, transparent acrylic panels and profiled steel cladding. There are a number of examples of road noise barrier walls in the ACT.

It would be reasonable to expect a noise reduction of at least 5dBA and perhaps 10dBA at residences from the effective design and positioning of noise barrier walls. In practical terms:

- The final height of such a roadside barrier wall would need to be confirmed in detailed design, but a height of around 2m above road level is typical.
- A barrier wall located very close to the residence would be equally effective as a roadside barrier, but would require a much higher degree of co-ordination with existing landowners.

6.2.2 Noise Barriers Formed by Earthworks

Earth berms, bunds or other earthworks can form adequate noise barriers where the use of a solid noise wall is not possible or desirable. However, these require a relatively large footprint, which is directly related to the batter and height of the berm.

As any earthworks that are proposed to form a noise barrier would need to break the line-of-sight between vehicles and the property, the mound may need to be very large. These would also need to be relatively long, equivalent to that discussed for noise barrier walls in **Section 6.2.1** above.

6.2.3 Vegetation Screening

Whilst the development of vegetation to screen the road from residences can have visual and privacy benefits, the acoustic benefits are generally insignificant. In practical terms, vegetation screening would need to be combined with more appropriate mitigation (ie a barrier wall) to be effective.

6.3 Mitigation at the Receiver – Architectural Improvements

Mitigation options at the receiver generally comprise architectural improvements to the building envelope of the affected residence to reduce internal noise levels. To our current understanding, this is not an approach that has been pursued to date in the ACT, and the road noise planning guidelines relate to noise levels external to a building facade. This discussion is given to provide a general overview of all options. The range of architectural improvements is generally limited to:

- Replacement or modification of windows, other glazing, and doors on the exposed facades;
- New seals to windows and doors;
- The sealing of existing wall vents; and

Glazing improvements will only be of value with windows and doors closed. It is often the case in other jurisdictions that a secondary decision must be made on the provision of ventilation for these rooms, such that BCA ventilation requirements are met when the windows and doors are closed to insulate against noise. This often results in a decision to either:

- Install acoustically attenuated ventilation paths or mechanical ventilation systems; or
- Continue the use of openable windows and doors for ventilation, accepting low façade sound insulation at these times.

These decisions are likely to be informed by practicality, level of disruption to the residents, and cost, following detailed surveys of each residence.

Lastly, it is important to note that the ACT noise planning guidelines include provision for ‘private open space’ – relatively quiet external areas. Building envelope improvements will not benefit these areas.

6.4 Mitigation Options – Overall Summary

Table 6 summaries the likely acoustic benefits and project impacts of the mitigation strategies discussed in the sections above at high level. A comment on 'practical likelihood' is also given, for informative purposes only.

Table 6 Commentary on overall benefits and impacts of different mitigation options

Report Section	Mitigation Option Type	Acoustic Benefit to Residence	Impact to Road Realignment Schemes	Practical Likelihood
6.1	**Operational Options**			
6.1.1	Reduction in road gradient	Very Low	Very High	Very Unlikely
6.1.2	Significant reduction In vehicle speeds	Low to Modest	High	Unlikely
6.1.3	Quieter road surface options	Low to Modest	Medium	Possible
6.2	**Barrier Options**			
6.2.3	Vegetation Screening	Effectively none	Low	Possible
6.2.1	Noise Barrier Walls	High	Medium	Likely
6.2.2	Noise Barriers Formed by Earthworks	High	Medium	Likely
6.3	**Architectural Options**			
	Windows – Retrofit additional internal glazing. Doors – replace glazed doors with double glazed units. Other façade sound insulation improvements	High – when closed None –when open	Very Low	Possible

7 NOISE PREDICTION RESULTS AND DISCUSSION

In order to provide a high-level summary of typical impacts, a sample of receivers has been excerpted from the main body of the prediction results. The predicted noise levels and resultant likely noise impacts at these sample receivers are representative of the larger population of residences along the three main routes.

The full detailed noise impact assessment (ie for all potentially affected residential receivers) is provided in the various Appendices to this report. Cross-references to relevant Appendices are made in the sections that follow.

7.1 Classification of Noise Impacts

Predicted road traffic noise levels have been calculated at three time intervals (2021, 2031 and 2041), reflecting that road traffic flows will be gradually increased over a long period of time, as development progresses within West Belconnen. In this way, the context of a gradual onset of noise impact can be indicated.

After analysis of the prediction results, it was found that there were three broad classifications of noise impact types, applicable to all receivers.

For ease of reference, a concise classification system is proposed. This can be summarised as described in **Table 7**.

Table 7 Noise Impacts – Summary of Classifications

Noise Impact Classification	Noise Impact Classification Description
1	The predicted noise level at the receiver **meets** the relevant ACT noise planning guideline for that receiver.
2	The predicted noise level at the receiver **exceeds** the relevant ACT noise planning guideline for that receiver, and there is a noise mitigation option that is thought to be practical and reasonable (subject to further detailed assessment).
3	Either: The predicted noise level at the receiver **exceeds** the relevant ACT noise planning guideline for that receiver, and following study, noise mitigation is not expected to be practical at this location; or A **minor excess** of the relevant ACT noise planning guideline is predicted at this receiver (typically 1dB), and the negative impacts of noise mitigation implementation (eg for a barrier wall - visual obstruction, physical disconnection between land areas, design implications and construction cost) are not expected to be commensurate with the noise impact predicted.

7.2 Ginninderra Drive

7.2.1 Results (Predicted Future Noise Levels Without Specific Noise Mitigation)

Figure 4 presents the locations of the representative receivers selected along this alignment. **Table 8** summarises the prediction results at the locations of the sample representative receivers.

Tabulated results for all potentially affected receivers are provided in **Appendix I**, and the results based on ultimate year 2041 traffic flows are presented graphically in **Appendix L**.

Figure 4 Approximate Location of Selected Representative Receivers – Ginninderra Drive

Table 8 Predicted Future Year Road Traffic Noise Levels – Ginninderra Drive

Sample Receiver No. (Figure 4)	Block & Section / Division	Noise Planning Guideline (Section 3)	Predicted $L_{A10(18hour)}$ – No Mitigation, By Year			Predicted excess over Planning Guideline, dBA			Final 2041 Noise Impact Classification (see Table 7)
			2021	2031	2041	2021	2031	2041	
G1	B20 S2 Dunlop	POS 58	59	58	60	+1	Pass	+2	2
G2	B5 S97 Charnwood (church)	Façade 63	64	63	64	+1	Pass	+1	3
G3	B7 S86 Flynn	Façade 65	65	65	65	Pass	Pass	Pass	1
G4	B12 S63 Flynn	Façade 65	64	63	64	Pass	Pass	Pass	1
G5	U1-5, S27 Dunlop	POS 58	60	59	63	+2	+1	+5	2
G6	B1 S25 Macgregor	POS 58	54	53	55	Pass	Pass	Pass	1
G7	B3 S108 Latham	POS 58	65	65	66	+7	+7	+8	2
G8	B3 S101 Latham	Façade 65	62	61	62	Pass	Pass	Pass	1
G9	B9 S116 Latham	Façade 65	62	61	62	Pass	Pass	Pass	1

7.2.2 Discussion

From sample surveys undertaken for this project, road traffic noise levels along Ginninderra Drive are currently in the region of 58 to 63 dB $L_{A10\ (18hr)}$ when measured at 1m from a building façade.

Based on the current road proposals, the noise planning guidelines for future year 2041 are a combination of all three 'POS 58', 'Façade 63' and 'Façade 65' goals along Ginninderra Drive (for descriptions of these guidelines see **Section 3.2**, above).

Based on the ultimate year 2041 results presented in **Table 8**, the noise guidelines were predicted to be met at sample locations G3, G4, G6, G8 and G9 which represent around 110 residential properties

Exceedances of the applicable planning guidelines were predicted at four representative locations. These exceedances were generally 'private open spaces' at the rear of properties ('POS 58'). The only exception was sample receiver G2 where the usage of the block is Community Facility (a church).

Locations G1, G5 and G7 represent approximately 85 residential properties. The predicted exceedances by year 2041 were in the range of 1 dB to 8 dB. At receivers represented by G1 and G2, these impacts are generally significant at around year 2041, meaning that a gradual noise increase would be experienced over time. Near to receivers G5 and G7, this exceedance was significant from the outset of the project.

The full results of the noise prediction for each individual property are tabulated in **Appendix I**. The applicable noise contour plots based on ultimate year 2041 traffic flows are presented in **Appendix L**.

At location G2 (Community Facility), the existing church building is the only building around this location (north of the road alignment) to exceed the planning guideline. The predicted exceedance is 1 dB, which would not normally be considered a significant exceedance. In addition, as the building is not used for residential purposes the risk of actual disturbance is low.

7.2.3 Recommendations – Possible Opportunities for Noise Mitigation

In regard to further consideration of noise mitigation, the following recommendations can be made:

- Further consideration of mitigation is not likely to be warranted for G2 (the church) as the predicted exceedance was not significant.
- Provision of mitigation strategies should be considered for the residential properties represented by G1, G5 and G7.

The following mitigation strategies are likely to be suitable:

- Provision of quieter road surface – the use of stone mastic asphalt (SMA) or open graded asphalt (OGA) can typically provide an average acoustic benefit (noise reduction) of around 2 dB.
- Provision of approximately 2 m high (relative to the road surface) road side road barriers at affected locations. In terms of length, a 160º view of the road from the receiver is generally considered to provide a minimum barrier length.

The noise contour plots using ultimate 2041 traffic flows (**Appendix O**) indicate the predicted effects of a 2 m high noise barrier in the 'with mitigation' scenario. In the 'with mitigation' figures, a quieter road surface (SMA) is also used between Florey Drive and Companion Crescent as shown in **Appendix O**.

From **Appendix O**, it can be noted that roadside barriers and quiet road surface are proposed for the same section of alignment in one location. As part of the mitigation study, the option of increased barrier height was reviewed, but it was found that 3m high barriers were not acoustically effective in this location, and it is recommended that the 2m barrier is supplemented with a quieter road surface.

Noise prediction results for each receiver with this mitigation in place, are tabulated in **Appendix I**. These results show that with the implementation of the 2 m high noise barrier and quieter road surface at the indicated locations (**Appendix O**), compliance with the planning guidelines can be achieved.

The barriers have been initially proposed from a noise mitigation perspective only. The practicality and town planning implications of the proposed noise barriers will need to be reviewed. From **Appendix O**, the proposed barrier locations would create a long strip of enclosed land between the road and the existing fences of the residences.

Assuming that noise mitigation is to be implemented, from **Table 8**, it can be noted that noise mitigation in the vicinity of the G5 and G7 sample receiver location should be constructed by year 2021, in order to address the initial increase in noise from road traffic. The gradual onset of additional traffic flow means that noise mitigation at in the vicinity of sample location G1 would not be required until sometime between the 2031 and 2014 study years.

7.2.4 Summary

For existing receivers along Ginninderra Drive, the following findings were made:

- The planning guidelines were predicted to be met with year 2041 flows at 5 sample locations representing approximately 110 residences.
- The 'POS 58' planning guideline for private open spaces was predicted to be exceeded at three (3) representative locations. These 3 sample locations represent approximately 85 residential properties with POS facing Ginninderra Drive.
- With the implementation of 2 m high noise barrier and a quieter road surface by year 2031 (at locations as indicated in **Appendix O**), compliance with the planning guidelines is predicted.
- The 'Façade 63' planning criteria was also predicted to be exceeded marginally by 1 dB at an existing church building. This is considered to be acoustically insignificant and therefore is not likely to warrant further consideration of noise mitigation.

7.3 Southern Cross Drive

7.3.1 Results (Predicted Future Year Noise Levels Without Specific Noise Mitigation)

Figure 5 presents the locations of the sample representative receivers selected along this alignment. **Table 9** summarises the prediction results at the locations of the sample representative receivers.

Tabulated results for all potentially affected receivers are provided in **Appendix J**, and the results based on ultimate year 2041 traffic flows are presented graphically in **Appendix M**.

Figure 5 Approximate Location of Selected Representative Receivers – Southern Cross Drive

Table 9 Predicted Future Road Traffic Noise Levels – Southern Cross Drive

Sample Receiver No. (Figure 5)	Block & Section / Division	Noise Planning Guideline (Section 3)	Predicted $L_{A10(18hour)}$ – No Mitigation, By Year			Predicted excess over Planning Guideline, dBA			Noise Impact Classification (see Table 7)
			2021	2031	2041	2021	2031	2041	
S1	B46 S66 Macgregor	Façade 63	63	64	64	Pass	+1	+1	3
S2	B25 S38 Macgregor	Façade 65	65	65	66	Pass	Pass	+1	3
S3	B1 S44 Latham	Façade 65	63	63	64	Pass	Pass	Pass	1
S4	B6 S5 Holt	Façade 63	66	67	67	+3	+4	+4	3
S5	B11 S84 Holt	Façade 65	60	60	61	Pass	Pass	Pass	1
S6	B15 S76 Holt	Façade 65	59	60	61	Pass	Pass	Pass	1
S7	B1 S20 Higgins	Façade 65	61	61	61	Pass	Pass	Pass	1

7.3.2 Discussion

From sample surveys undertaken for this project, road traffic noise levels along Southern Cross Drive were currently in the region of 63 to 68 dB $L_{A10\ (18hr)}$ when measured at 1m from a building façade.

The applicable planning guidelines along Southern Cross Drive for future year 2041 are a combination of 'Façade 63' and 'Façade 65' (for descriptions of these guidelines see **Section 3.2**, above).

From **Table 9,** based on year 2041 traffic flows, the noise planning guidelines were predicted to be met at four of the sample locations. These samples represent approximately 75 potentially affected receivers.

At sample locations S1 and S2, minor exceedances of up to 1 dB were predicted, beginning at around year 2031. As discussed above, the difference of 1 dB is not normally considered to be acoustically significant and is unlikely to be perceptible by residents. However, sample locations S1 and S2 represent a total of approximately 60 residences. Based on the full results presented in **Appendix J**, approximately ten (10) of the 60 properties were predicted to exceed the planning guideline by 1 dB at year 2031. Noise contour plots based on ultimate year 2041 traffic are presented in **Appendix M**.

By year 2021, an exceedance of up to 4 dB was predicted for sample location S4. This location represents approximately 35 residential properties with front façade/driveway facing Southern Cross Drive. It should be noted that the *existing* road traffic noise levels at this location already significantly exceed the 'Façade 63' planning guideline (see **Table 2** location 3, where 68dBA was measured).

The proposed road upgrade does not include local service roads to service these properties. As such, the driveways to these properties will be accessed (as is the existing arrangement) directly from the main alignment of Southern Cross Drive. Noise barriers will therefore not be practical.

As the existing noise levels already exceed the noise guidelines, mitigation may be beyond the remit of this project. The practicality of this mitigation option will be investigated in later project stages. Further investigation should be made into the practicality and value of offering building envelope improvements to these residences, as discussed at broad terms in **Section 6.3** above.

7.3.3 Recommendations – Possible Opportunities for Noise Mitigation

In regard to the provision of noise mitigation, the following recommendations can be made:

- Further consideration of mitigation is not likely to be required for residences in the S1 and S2 sample areas as the predicted exceedance was not significant (1 dB at approximately 10 out of 60 properties in this group).
- A quieter road surface has the potential to reduce the noise impact, but the improvement (typically around 2 dB) would not be sufficient to achieve compliance with the planning guidelines.
- When considering that the existing traffic noise levels exceed the planning guideline by around 5 dB, the provision of specific noise mitigation may not be within the remit of this project. It is recommended that further study is made into the possibility of providing building envelope improvement options to these residences.

7.3.4 Summary

For the existing receivers along Southern Cross Drive, the following findings were made:

- The planning guidelines ('Façade 63' and 'Facade 65') were predicted to be exceeded at sample locations S1 and S2 by up to 1 dB. These two sample locations represent approximately 60 residential properties. The predicted exceedance occurs at approximately 10 out of 60 properties and is therefore not considered to be acoustically significant.

- As such, noise mitigation is not expected to be pursued for these locations. However, if noise mitigation is to be pursued here, a quieter road surface could be appropriate, as barriers are unlikely to be practical, and this small reduction could be provided by the road surface. The cost and operational/maintenance road design implications of such an option are expected to outweigh this relatively minor acoustic benefit.
- The 'Façade 63' planning criteria was also predicted to be exceeded by up to 4 dB at approximately 35 properties represented by sample location S4. Roadside noise barriers are currently not a possible mitigation option due to driveway access requirements. The use of a quieter road surface would not be sufficient to give compliance with the noise guidelines.
- On these bases, no road or roadside noise mitigation is currently expected to be implemented along Southern Cross Drive. However the possibility, practicality and value of noise mitigation applied at the receivers (building envelope improvements) should be investigated.

7.4 Drake Brockman Drive

7.4.1 Results (Predicted Future Year Noise Levels Without Specific Noise Mitigation)

Figure 6 presents the locations of the sample representative receivers selected along this alignment. **Table 10** summarises the prediction results at the locations of the sample representative receivers.

Tabulated results for all potentially affected receivers are provided in **Appendix K**, and the results based on ultimate year 2041 traffic flows are presented graphically in **Appendix N**.

Figure 6 Approximate Locations of Selected Representative Receivers – Drake Brockman Drive

Table 10 Predicted Future Road Traffic Noise Levels – Drake Brockman Drive

Sample Receiver No. (Figure 6)	Block & Section / Division	Noise Planning Guideline (Section 3)	Predicted $L_{A10(18hour)}$ – No Mitigation, By Year			Predicted excess over Planning Guideline, dBA			Noise Impact Classification (see Table 7)
			2021	2031	2041	2021	2031	2041	
D1	B45 S34 Holt	Façade 63	61	62	65	Pass	Pass	+2	2
D2	B9 S24 Holt	Façade 63	62	63	66	Pass	Pass	+3	2
D3	B18 S7 Higgins	POS 58	59	60	62	+1	+1	+4	2
D4	B1 S44 Higgins	POS 58	56	57	59	Pass	Pass	+1	2
D5	B45 S41 Higgins	POS 58	59	59	62	+1	+1	+4	2

7.4.2 Discussion

From sample surveys undertaken for this project, road traffic noise levels along Drake Brockman Drive were currently in the region of 50 to 53 dB $L_{A10\ (18hr)}$ when measured at 1m from a building façade.

The applicable planning guidelines along Drake Brockman Drive for future year 2041 are a combination of 'Façade 63' and 'POS 58' (for descriptions of these guidelines see **Section 3.2**, above).

The results show that by 2041 exceedance of the planning guidelines were predicted at all 5 sample representative locations. The exceedances are in the ranges of 1 to 4 dB.

Referring to the full results table in **Appendix K**, a total of approximately 105 residential properties were identified to be potentially impacted by noise from Drake Brockman Drive. It is predicted that approximately 70 out of these 105 properties exceed the applicable planning guidelines, by between 1 and 4 dB. The applicable noise contour plots based on ultimate year 2041 traffic flows are presented in **Appendix N**.

It should also be noted that the existing traffic noise levels along Drake Brockman Drive is relatively low (**Table 2**), meaning that the subjective impression of noise increase is likely to be greater than would be expected by simply assessing against the planning guideline values.

Increases of 10 dB and greater above the existing condition are predicted by year 2041 (ie comparing the 50 to 53dB $L_{A1018hr}$ results measured in **Table 2** to the future 59 to 66dB $L_{A1018hr}$ predicted values in **Table 10**).

This potential subjective impact will need to be managed with the existing residents of these properties. It should be emphasised that this noise increase will be extremely gradual, over 25 years, between the onset of project development and year 2041.

7.4.3 Recommendations – Possible Opportunities for Noise Mitigation

In regard to the provision of noise mitigation, the following recommendations can be made:

- Further consideration of mitigation should be further considered for the entire length of Drake Brockman Drive (along existing receivers). A total of approximately 70 out of 105 properties were predicted to exceed the applicable planning guidelines.
- The application of roadside noise barriers along Drake Brockman Drive is generally expected to be practical along the entire alignment, apart from at intersections. Residential properties in the eastern half of the alignment have private open spaces facing the road and do not have road access requirements. For the western half of residential properties with front façade/driveways addressing the road, a local service road is part of the proposed upgrade, creating a reservation.

The following noise mitigation strategy is therefore likely to be suitable:

- By year 2041, the provision of 2 m high (relative to the road surface) road side road barriers along the entire length of Drake Brockman Drive (north of the road alignment only), at the reservation between Drake Brockman Drive and the access road.
- In terms of length, a 160º view of the road from the receiver is generally considered to provide a minimum barrier length. Generally, the barrier should screen the residence for not less than 90% of the road.

The noise contour plots presented in **Appendix P** indicate the predicted effects of a 2 m (relative to the road surface) high noise barrier in the 'with mitigation' scenario using ultimate 2041 traffic flows. The predicted results at individual receivers are also tabulated in **Appendix K**.

These results show that with the implementation of noise barriers at the indicated locations (**Appendix P**), compliance with the planning guidelines can be achieved for these residences.

The barriers have been initially proposed from a noise mitigation perspective only. The practicality and town planning implications of the proposed noise barriers will be investigated in later project stages. From **Appendix P**, the proposed barrier locations would create a long strip of enclosed land between the road and the existing fences of the residences.

Assuming that noise mitigation is to be implemented, from **Table 10**, it can be noted that the gradual onset of additional traffic flow means that this noise mitigation would not be required until sometime between the 2031 and 2041 study years.

7.4.4 Summary

For the existing receivers along Drake Brockman Drive, the following findings were made:

- Predicted noise levels at approximately 70 out of 105 existing properties exceed the applicable planning guidelines, by 1 to 4 dB.
- Existing road traffic noise levels along Drake Brockman Drive are low, and relative increases of over 10 dB were predicted by year 2041. This means that the subjective impression of noise increase is likely to be greater than is captured by assessment against the planning guidelines.
- With 2 m high road side road barriers along the entire length of Drake Brockman Drive (north of the road alignment only) between this main road and the access road, then compliance with the noise planning guideline would be achieved. The gradual onset of additional traffic flow means that these noise barriers would not necessarily be required until sometime between the 2031 and 2041 study years.
- The existing traffic noise levels along Drake Brockman Drive are low. Relative increases of over 10 dB were predicted by year 2041. This means that although the future noise levels are predicted to meet the planning guidelines with the proposed mitigation in place, the subjective impression of noise increase could be greater than is captured by the guidelines.
- This potential subjective impact will need to be managed with the existing residents of these properties. It should be emphasised that this noise increase will be extremely gradual, over 25 years between the onset of project development and year 2041.

8 CONCLUSION

SLR has undertaken a road traffic noise impact assessment for the existing receivers along the three major roads that lead to the proposed residential subdivision of West Belconnen; Ginninderra Drive, Southern Cross Drive and Drake Brockman Drive

In consultation with the ACT Government (Transport and Planning Section within the Environment and Sustainable Development Directorate), noise monitoring and concurrent traffic counts were conducted at 7 locations to understand the existing noise climate and allow validation of the road traffic noise computer model.

The results of these surveys have been presented and summarised.

Based on an interpretation of the 1996 Draft Noise Management Guidelines (repealed), agreed with the ESDD Transport and Planning Section, the following road traffic noise planning guidelines have been identified as applicable for this assessment:

- Private open space – 58 dB $L_{A10(18hour)}$ Abbreviated 'POS 58' here
- Façade – 63 dB $L_{A10(18hour)}$ Abbreviated 'Façade 63' here
- Façade – 65 dB $L_{A10(18hour)}$ Abbreviated 'Façade 65' here

Computer noise modelling has been conducted using the SoundPLAN V7.1 suite of acoustic prediction software, implementing the UK Department of Transport (DoT) *Calculation of Road Traffic Noise* (CORTN).

The findings and recommendations made are summarised below:

Ginninderra Drive

- From sample surveys undertaken for this project, road traffic noise levels along Ginninderra Drive are currently in the region of 58 to 63 dB $L_{A10\ (18hr)}$ when measured at 1m from a building façade.
- Based on the current road proposals, the noise planning guidelines for future year 2041 are a combination of all three 'POS 58', 'Façade 63' and 'Façade 65' goals along Ginninderra Drive.
- Based on year 2041 traffic flows, the noise planning guidelines were predicted to be met at five of the sample locations that were chosen to be representative of groups of receivers along this alignment. These samples represent approximately 110 potentially affected receivers.
- By year 2041, the 'POS 58' planning guideline was predicted to be exceeded at three of the sample locations along the alignment. These three locations represent approximately 85 residences with private open spaces along Ginninderra Drive.
- For these receivers, implementation of a combination of 2 m high noise barrier and quieter road surfaces in certain areas (see **Appendix O**) during the opening decade of the project is predicted to give compliance with the 'POS 58' guideline. The practicality and location of these barriers will investigated in later project stages.
- A minor (1 dB) excess of the 'Façade 63' planning guideline was predicted at an existing church. This is not considered to be an acoustically significant excess and is unlikely to warrant further consideration of noise mitigation.

Southern Cross Drive

- From sample surveys undertaken for this project, road traffic noise levels along Southern Cross Drive were currently in the region of 63 to 68dB $L_{A10\ (18hr)}$ when measured at 1m from a building façade.
- Based on the current road proposals, the noise planning guidelines for future year 2041 are a combination of 'Façade 63' and 'Façade 65' along Southern Cross Drive.

- Based on year 2041 traffic flows, the noise planning guidelines were predicted to be met at four of the sample locations that were chosen to be representative of groups of receivers along the alignment. These samples represent approximately 75 potentially affected receivers.
- Minor exceedances (up to 1dB) of the 'Façade 63' and 'Façade 65' planning guidelines were predicted at two of the sample representative receiver locations, beginning around year 2031. The minor exceedance occurs at just approximately 10 out of 60 properties represented by these samples, and is not considered to be acoustically significant.
- By 2021, the 'Façade 63' planning guideline was predicted to be exceeded by up to 4 dB at approximately 35 properties represented by one sample location. At and around this location, road traffic noise levels were measured to exceed the planning guidelines in the current situation, before the project commences.
- Roadside noise barriers are not currently a practical mitigation option here, due to driveway access requirements.
- The use of a quieter road surface in these locations would be expected to reduce noise levels by around 2 dB, but this would not be sufficient to give compliance with the noise guidelines.
- If it would be possible or practical to make modifications to residential building façades (new glazing etc), then these improvements would normally be capable of providing additional noise reduction of the order by which the planning guidelines are exceeded. As the existing noise levels already exceed the noise guidelines, mitigation may be beyond the remit of this project. The practicality of this mitigation option will be investigated in later project stages.

Drake Brockman Drive

- From sample surveys undertaken for this project, road traffic noise levels along Drake Brockman Drive were currently in the region of 50 to 53dB $L_{A10\ (18hr)}$ when measured at 1m from a building façade.
- Based on the current road proposals, the noise planning guidelines for future year 2041 are a combination of 'POS 58' and 'Façade 63' along this road alignment.
- By year 2041, the noise planning guidelines were predicted to be exceeded at approximately 70 out of 105 existing residences (by between around 1 and 4 dB).
- Provision of 2 m high road side road barriers along the entire length of Drake Brockman Drive (north of the road alignment),constructed between years 2031 and 2041 is predicted to give compliance with the noise planning guidelines at that time. The practicality and location of these barriers will investigated in later project stages.
- The existing traffic noise levels along Drake Brockman Drive are low. Relative increases of over 10 dB were predicted by year 2041. This means that although the future noise levels are predicted to meet the planning guidelines with the proposed mitigation in place, the subjective impression of noise increase could be greater than is captured by the guidelines.
- This potential subjective impact will need to be managed with the existing residents of these properties. It should be emphasised that this noise increase will be extremely gradual, between the onset of project development and year 2041.

Glossary of Acoustic Terminology

1 Sound Level or Noise Level

The terms "sound" and "noise" are almost interchangeable, except that in common usage "noise" is often used to refer 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.

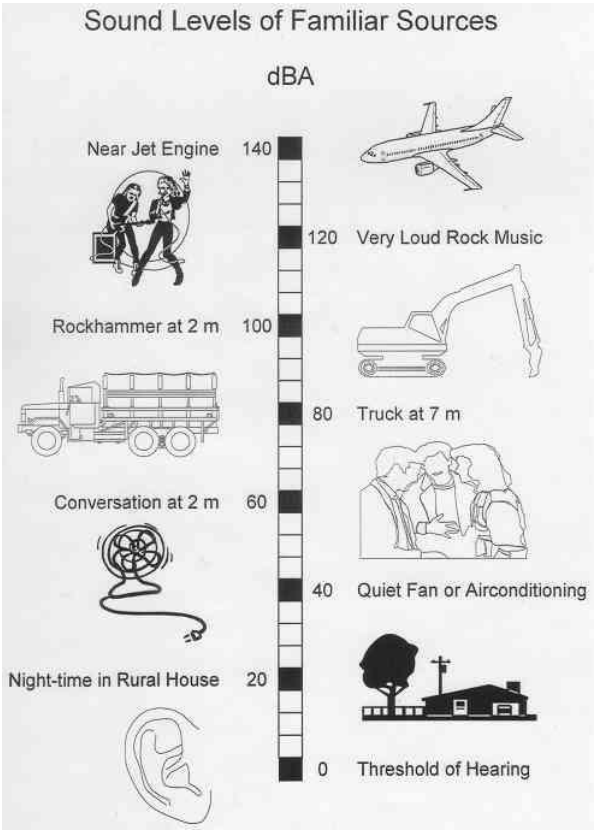
The symbols SPL, L or L_P are commonly used to represent Sound Pressure Level. The symbol L_A represents A-weighted Sound Pressure Level. The standard reference unit for Sound Pressure Levels expressed in decibels is 2×10^{-5} Pa.

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 Sound Power Level

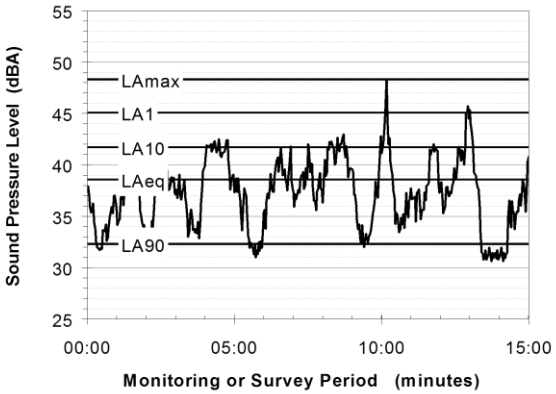
The Sound Power of a source is the rate at which it emits acoustic energy. As with Sound Pressure Levels, Sound Power Levels are expressed in decibel units (dB or dBA), but may be identified by the symbols SWL or L_W, or by the reference unit 10^{-12} W.

The relationship between Sound Power and Sound Pressure may be likened to an electric radiator, which is characterised by a power rating, but has an effect on the surrounding environment that can be measured in terms of a different parameter, temperature.

4 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 L_{AN}, where L_{AN} is the A-weighted sound pressure level exceeded for N% of a given measurement period. For example, the L_{A1} is the noise level exceeded for 1% of the time, L_{A10} 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_{Amax} The maximum noise level during the 15 minute interval

L_{A1} The noise level exceeded for 1% of the 15 minute interval.

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_{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_{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.

When dealing with numerous days of statistical noise data, it is sometimes necessary to define the typical noise levels at a given monitoring location for a particular time of day. A standardised method is available for determining these representative levels.

This method produces a level representing the "repeatable minimum" L_{A90} noise level over the daytime and night-time measurement periods, as required by the EPA. In addition the method produces mean or "average" levels representative of the other descriptors (L_{Aeq}, L_{A10}, etc).

5 Tonality

Tonal noise contains one or more prominent tones (ie distinct frequency components), and is normally regarded as more offensive than "broad band" noise.

6 Impulsiveness

An impulsive noise is characterised by one or more short sharp peaks in the time domain, such as occurs during hammering.

7 Frequency Analysis

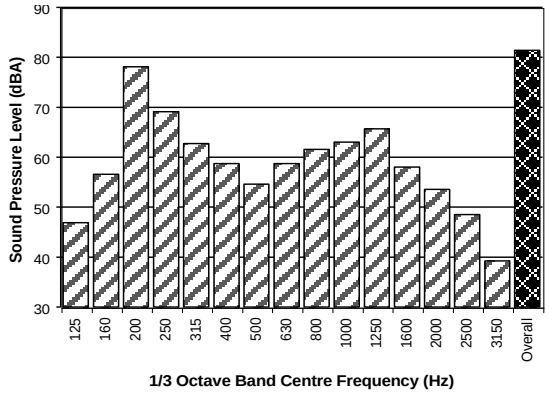
Frequency analysis is the process used to examine the tones (or frequency components) which make up the overall noise or vibration signal. This analysis was traditionally carried out using analogue electronic filters, but is now normally carried out using Fast Fourier Transform (FFT) analysers.

The units for frequency are Hertz (Hz), which represent the number of cycles per second.

Frequency analysis can be in:

- Octave bands (where the centre frequency and width of each band is double the previous band)
- 1/3 octave bands (3 bands in each octave band)
- Narrow band (where the spectrum is divided into 400 or more bands of equal width)

The following figure shows a 1/3 octave band frequency analysis where the noise is dominated by the 200 Hz band. Note that the indicated level of each individual band is less than the overall level, which is the logarithmic sum of the bands.



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 $20 \log (V/V_o)$, where V_o 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 Over-Pressure

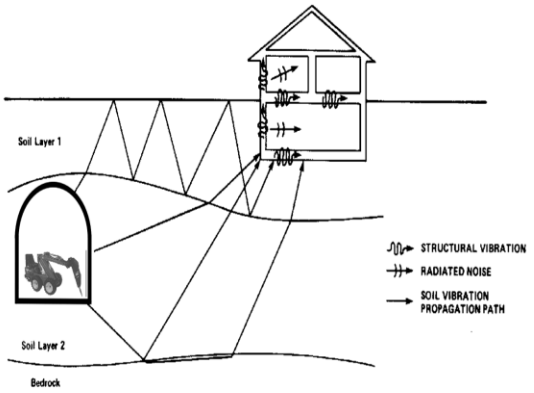
The term "over-pressure" is used to describe the air pressure pulse emitted during blasting or similar events. The peak level of an event is normally measured using a microphone in the same manner as linear noise (ie unweighted), at frequencies both in and below the audible range.

11 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 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.

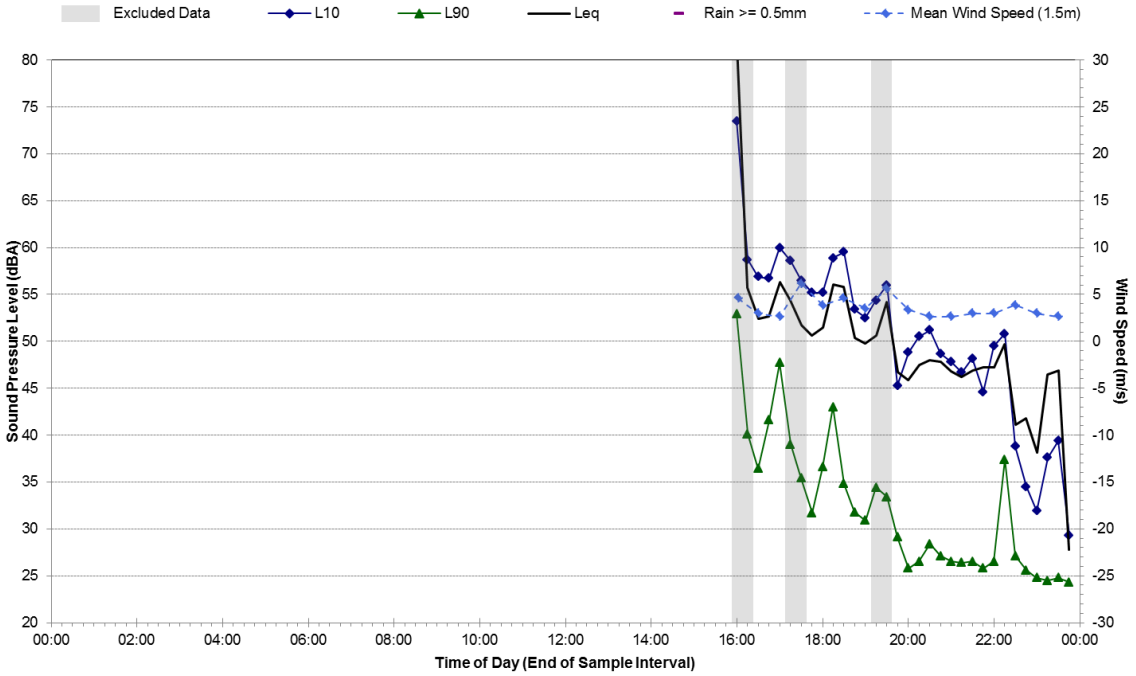


The term "regenerated noise" is also used in other instances where energy is converted to noise away from the primary source. One example would be a fan blowing air through a discharge grill. The fan is the energy source and primary noise source. Additional noise may be created by the aerodynamic effect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

Noise Monitoring Charts – Location 1 - 180 Drack Brockman Drive

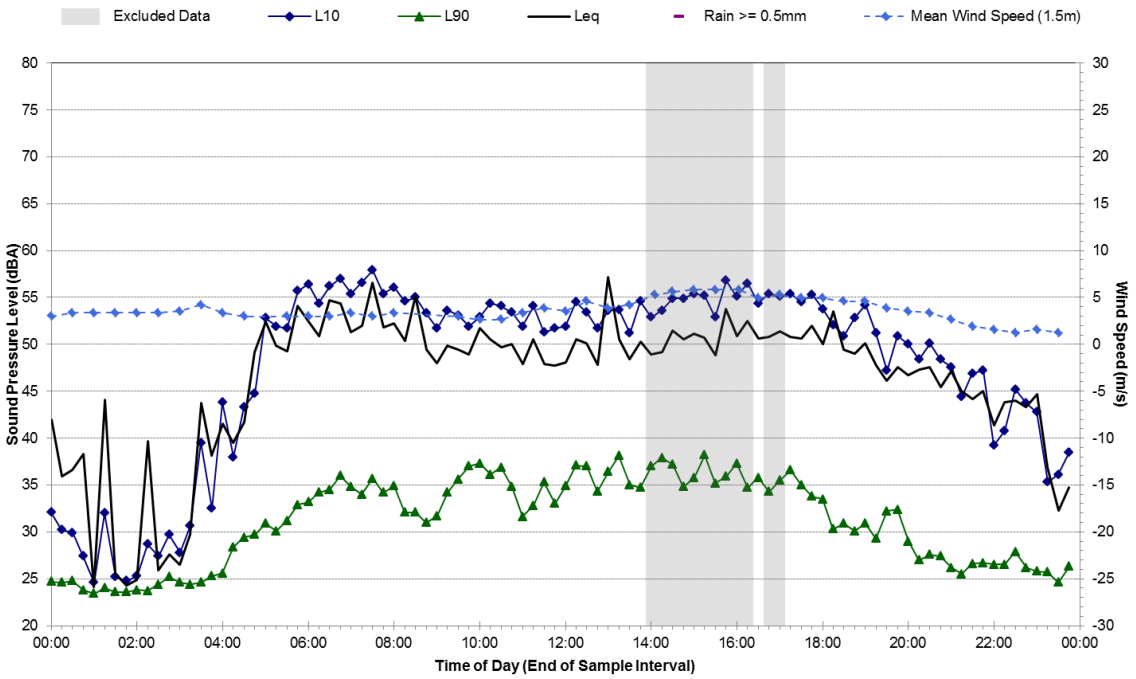
Statistical Ambient Noise Levels

180 Drake Brockman Drive - Thursday, December 05, 2013



Statistical Ambient Noise Levels

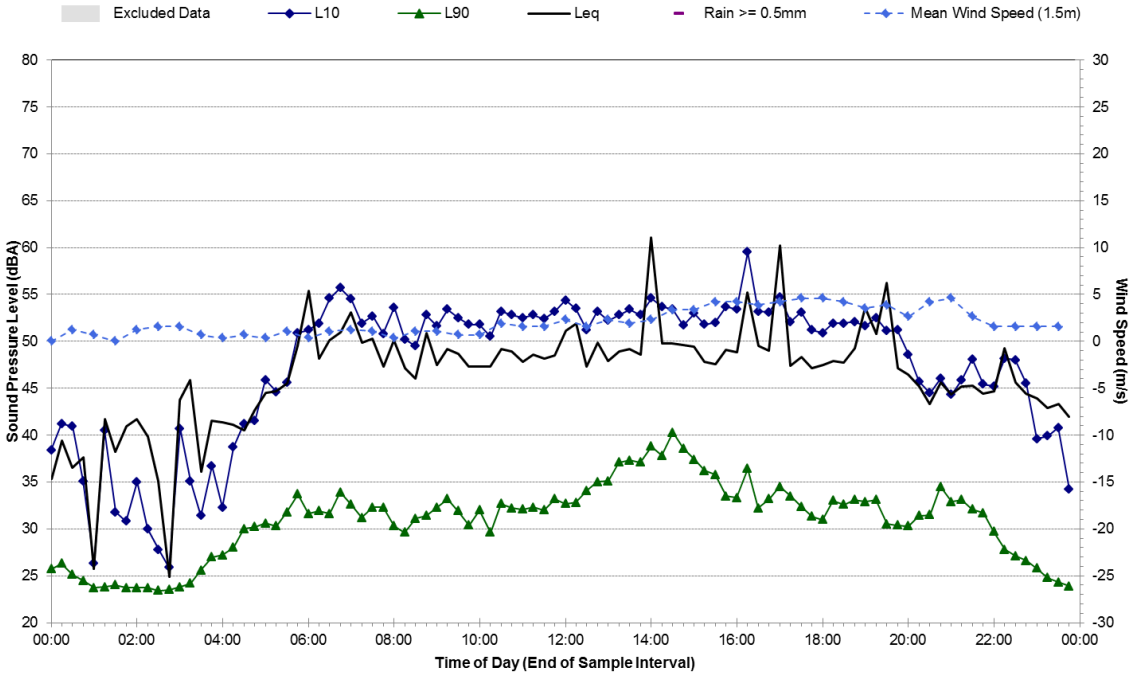
180 Drake Brockman Drive - Friday, December 06, 2013



Noise Monitoring Charts – Location 1 - 180 Drack Brockman Drive

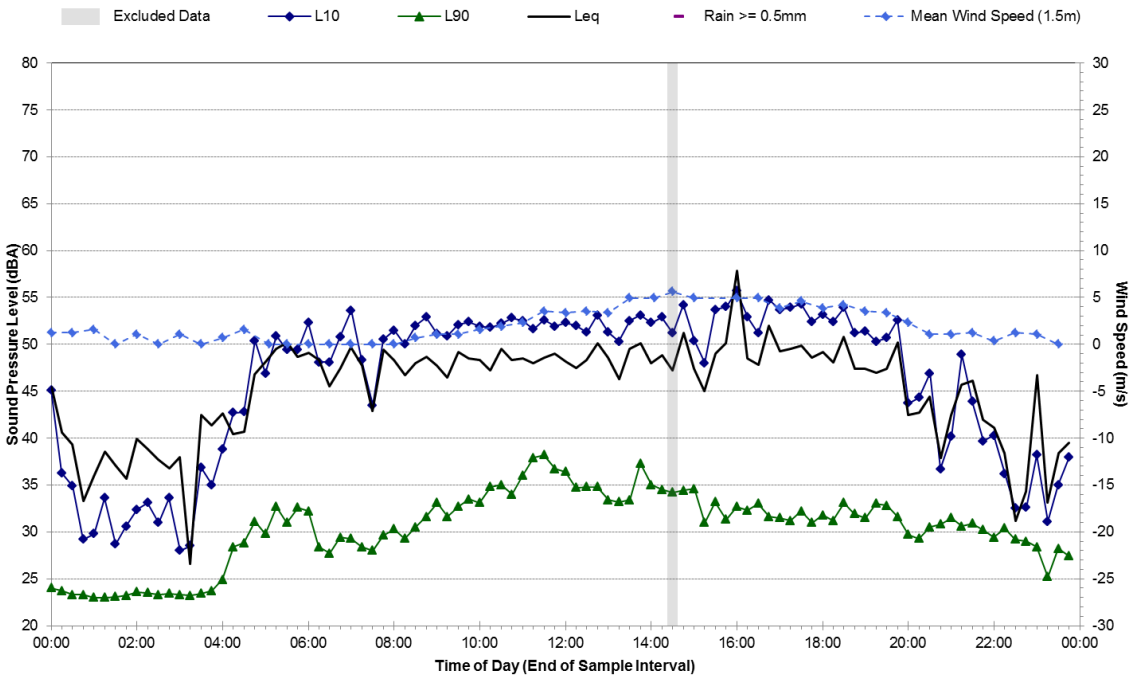
Statistical Ambient Noise Levels

180 Drake Brockman Drive - Saturday, December 07, 2013



Statistical Ambient Noise Levels

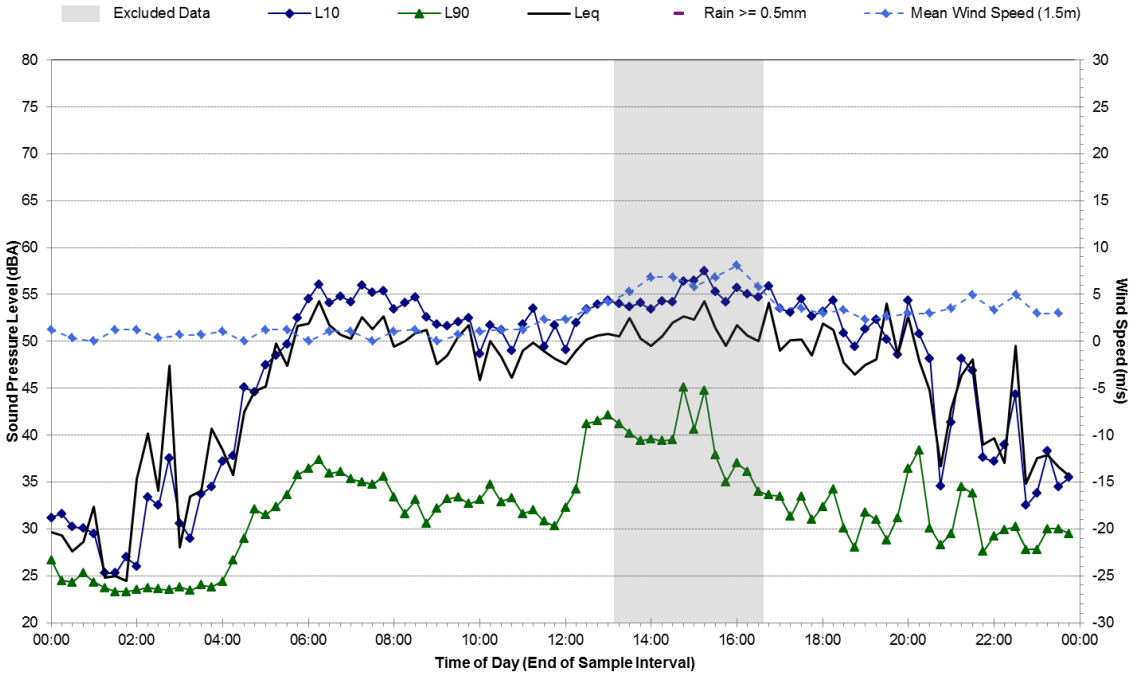
180 Drake Brockman Drive - Sunday, December 08, 2013



Noise Monitoring Charts – Location 1 - 180 Drack Brockman Drive

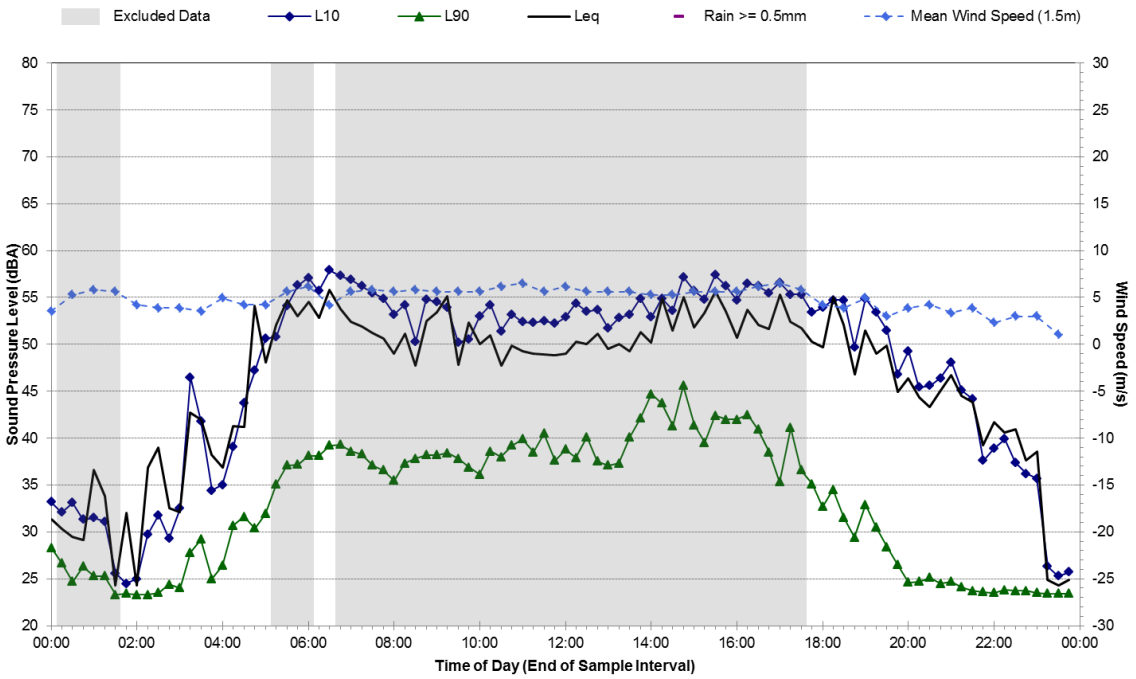
Statistical Ambient Noise Levels

180 Drake Brockman Drive - Monday, December 09, 2013



Statistical Ambient Noise Levels

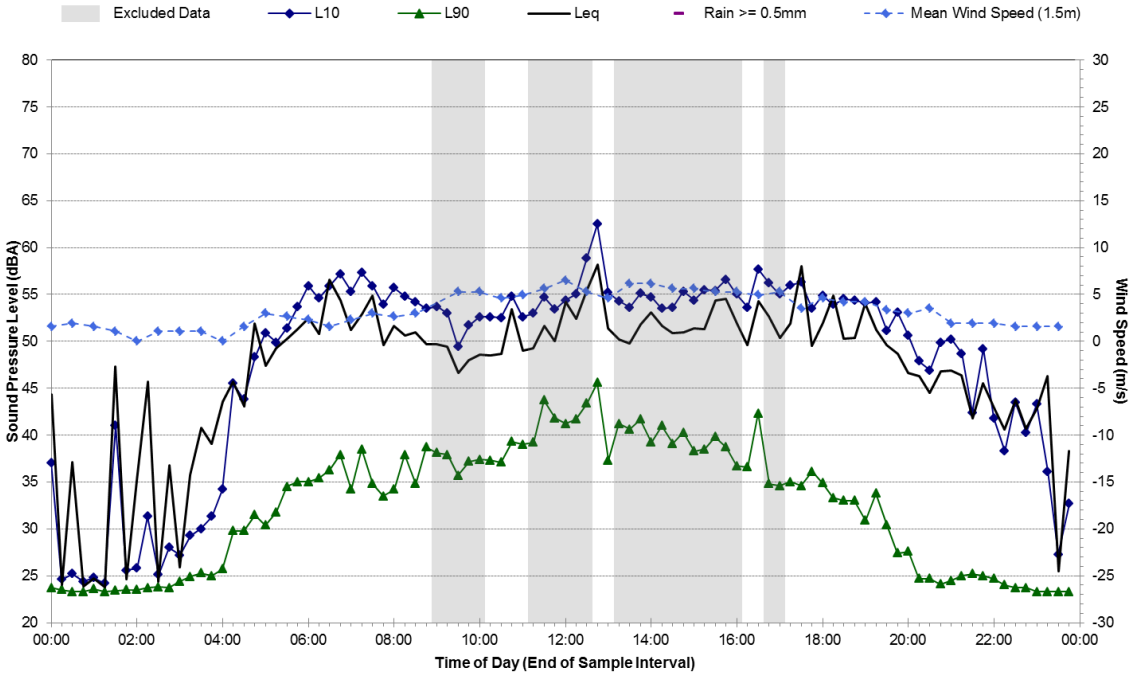
180 Drake Brockman Drive - Tuesday, December 10, 2013



Noise Monitoring Charts – Location 1 - 180 Drack Brockman Drive

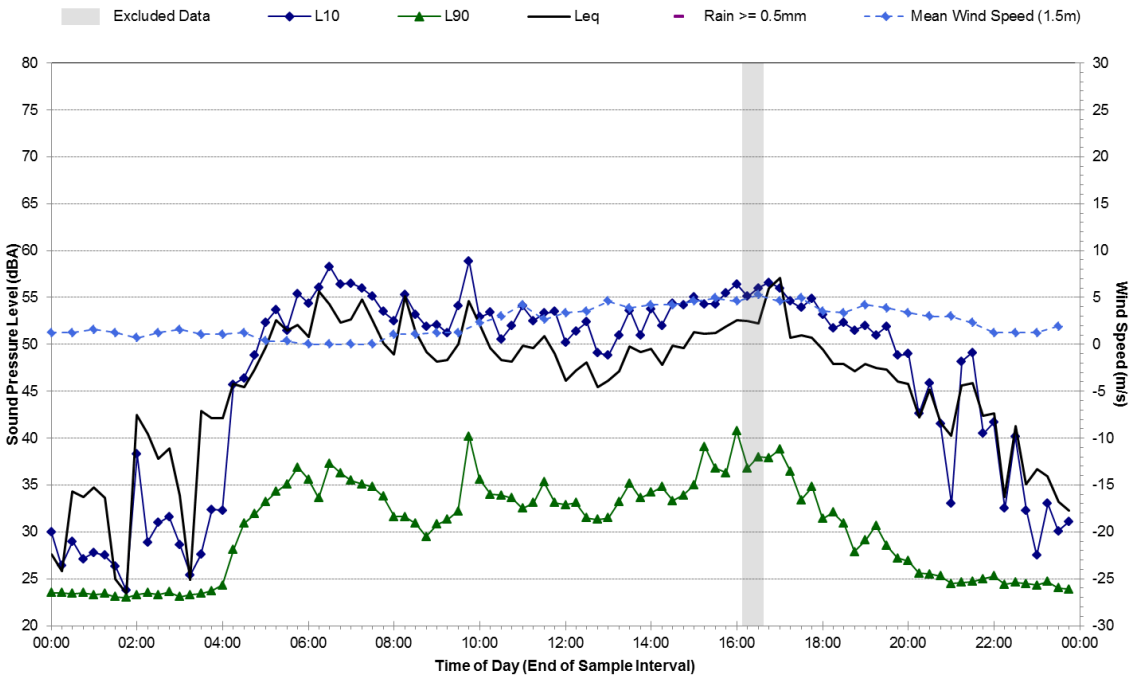
Statistical Ambient Noise Levels

180 Drake Brockman Drive - Wednesday, December 11, 2013



Statistical Ambient Noise Levels

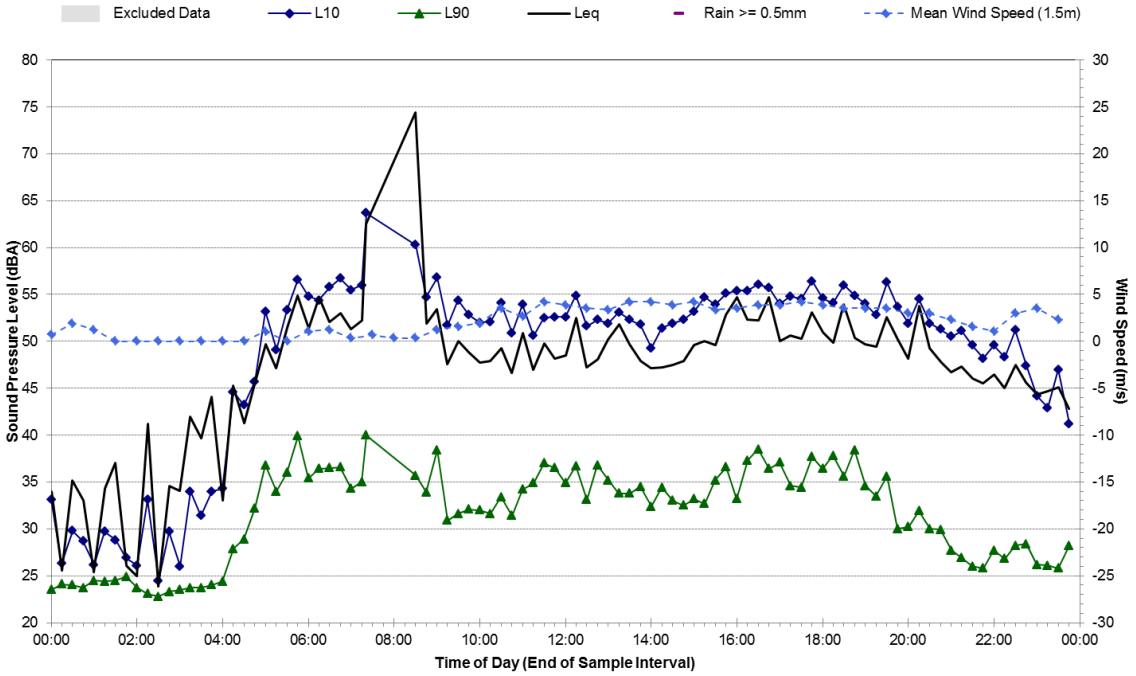
180 Drake Brockman Drive - Thursday, December 12, 2013



Noise Monitoring Charts – Location 1 - 180 Drack Brockman Drive

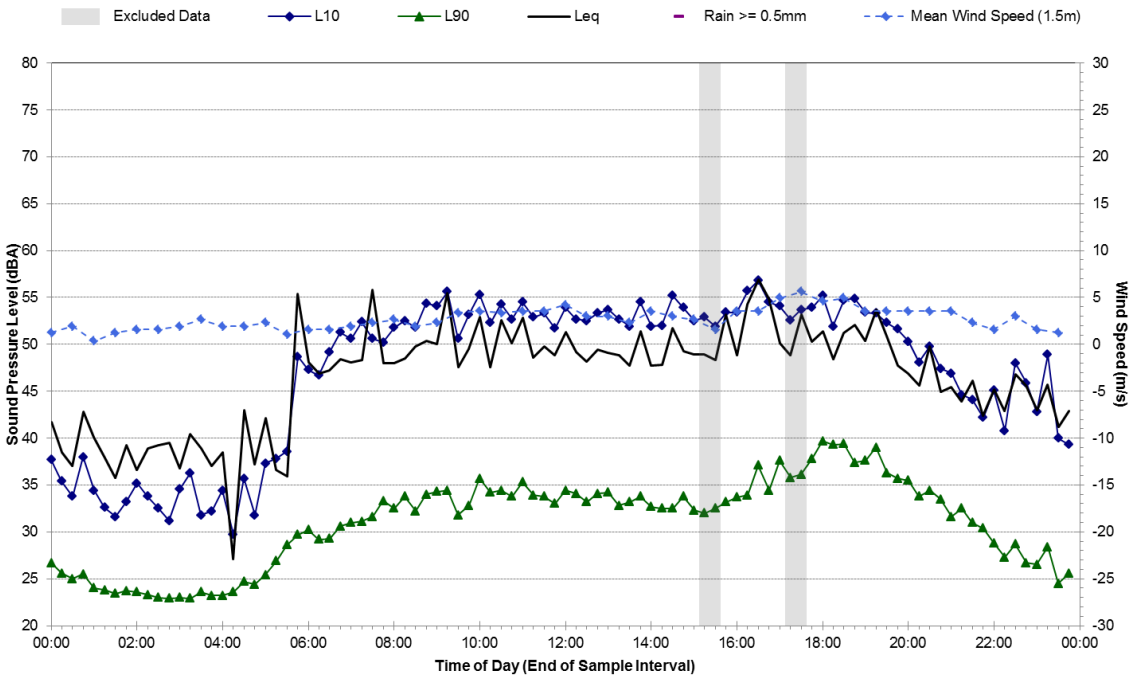
Statistical Ambient Noise Levels

180 Drake Brockman Drive - Friday, December 13, 2013



Statistical Ambient Noise Levels

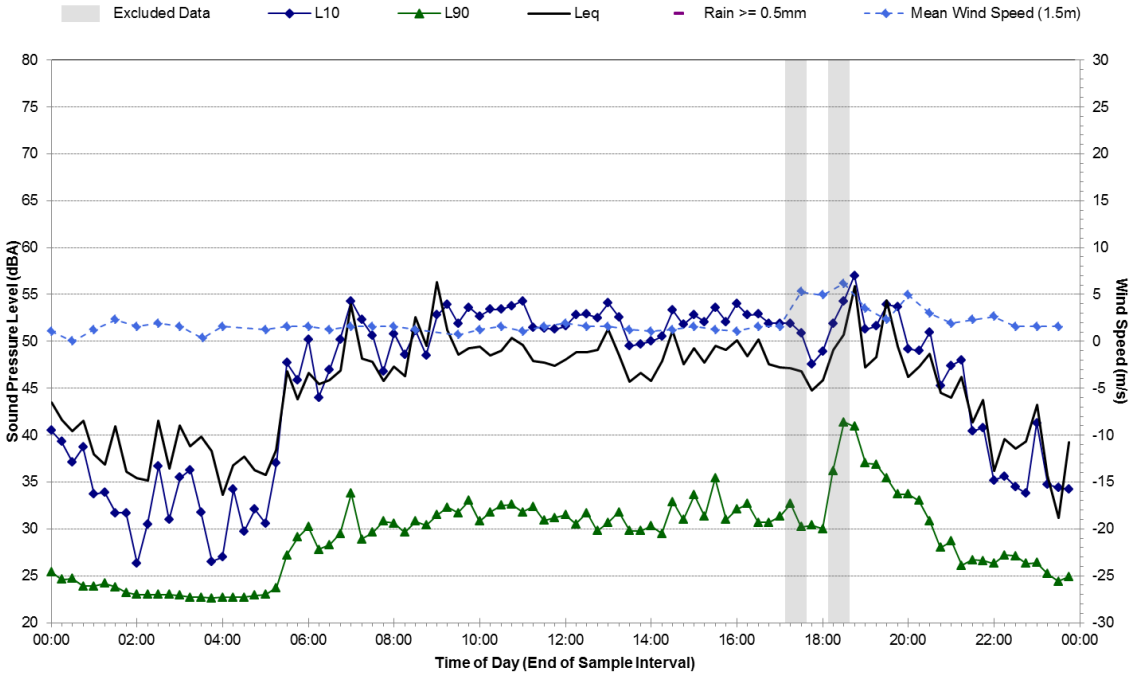
180 Drake Brockman Drive - Saturday, December 14, 2013



Noise Monitoring Charts – Location 1 - 180 Drack Brockman Drive

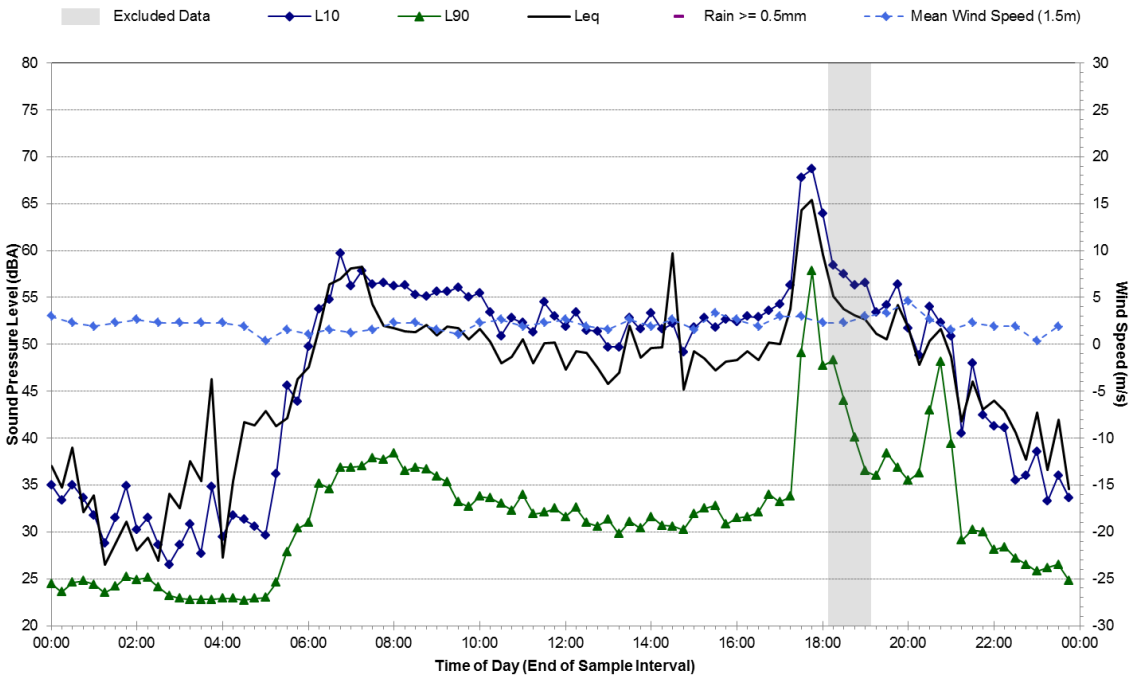
Statistical Ambient Noise Levels

180 Drake Brockman Drive - Sunday, December 15, 2013



Statistical Ambient Noise Levels

180 Drake Brockman Drive - Monday, December 16, 2013



Noise Monitoring Charts – Location 1 - 180 Drack Brockman Drive

Statistical Ambient Noise Levels

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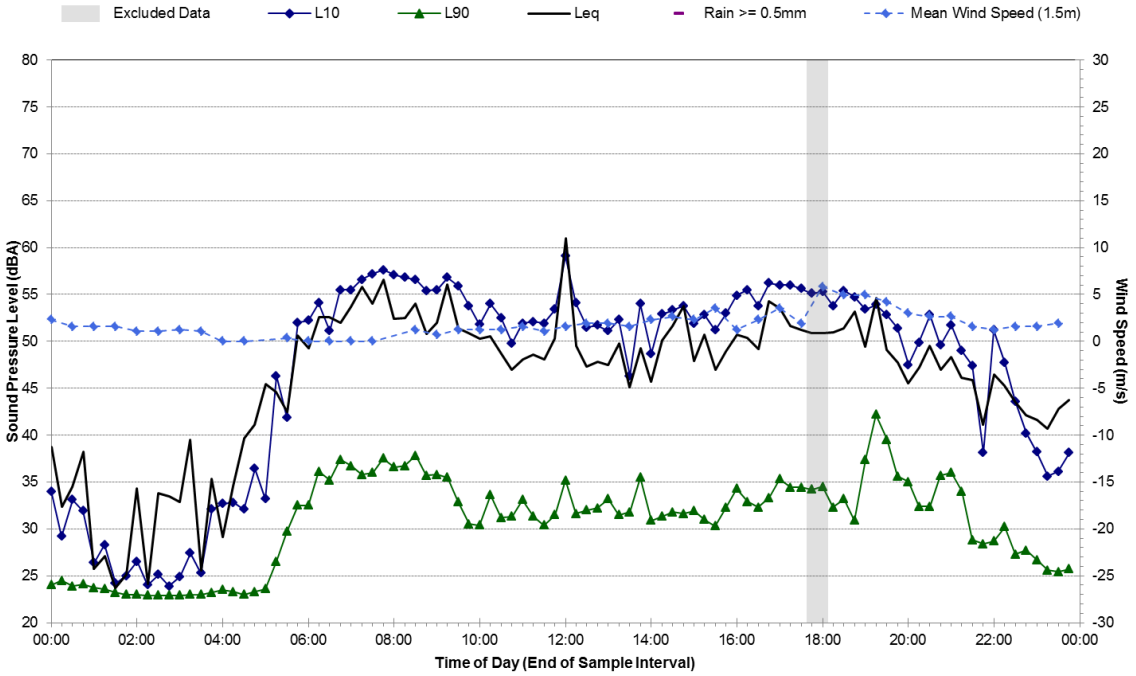
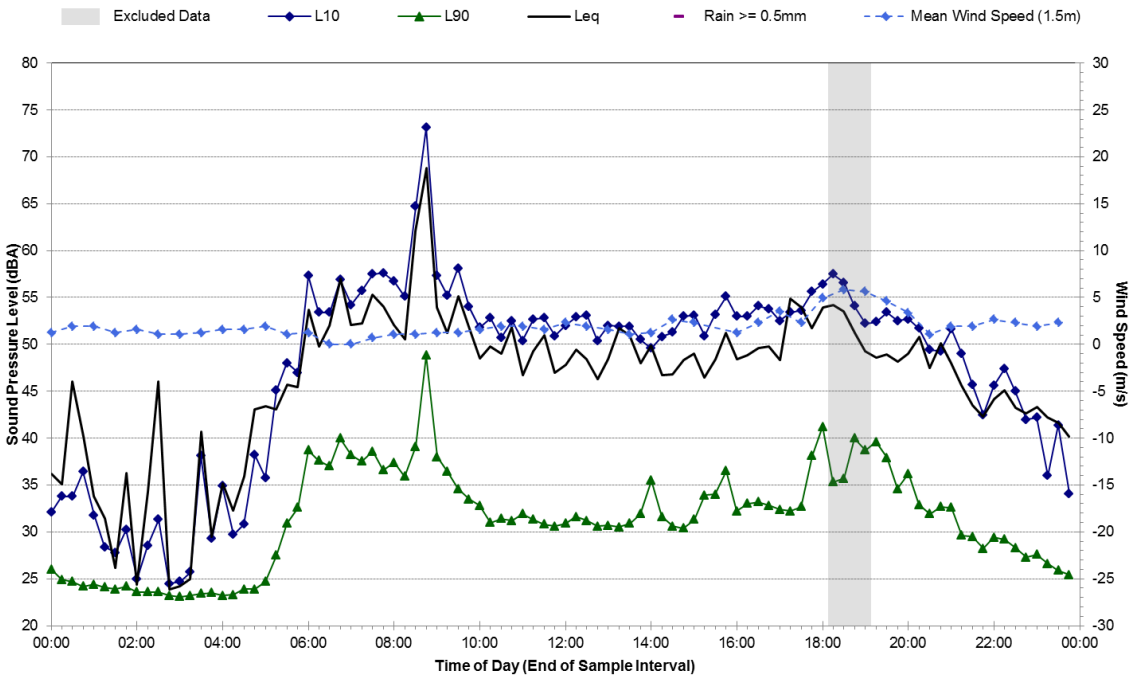


Statistical Ambient Noise Levels

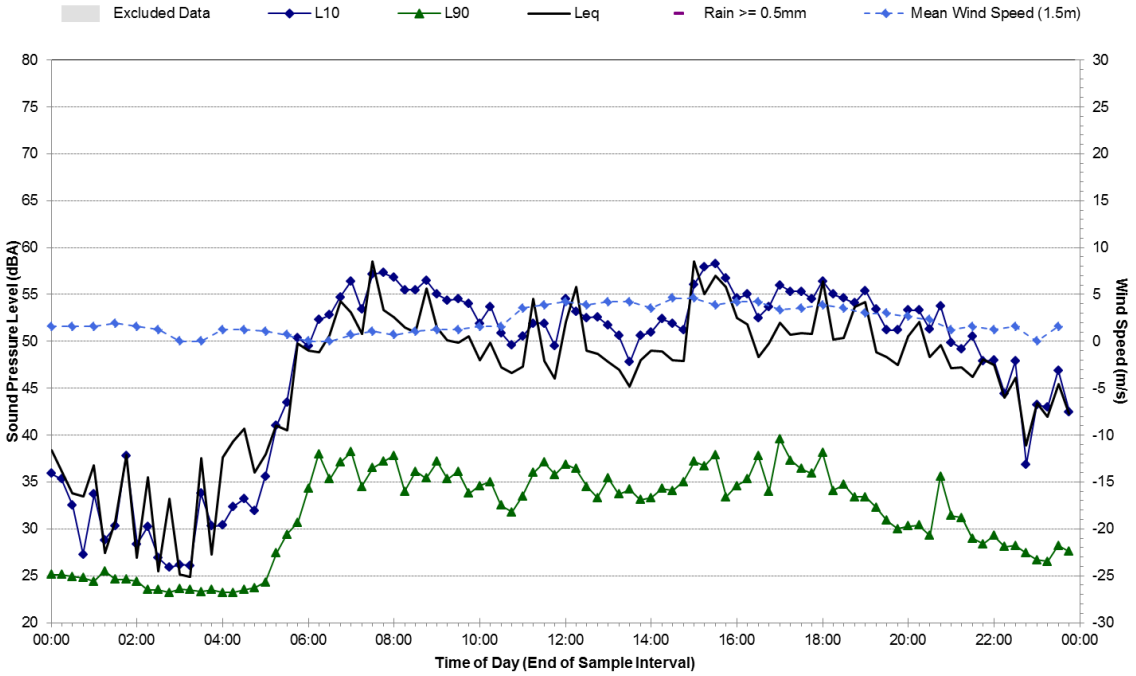
180 Drake Brockman Drive - Wednesday, December 18, 2013



Noise Monitoring Charts – Location 1 - 180 Drack Brockman Drive

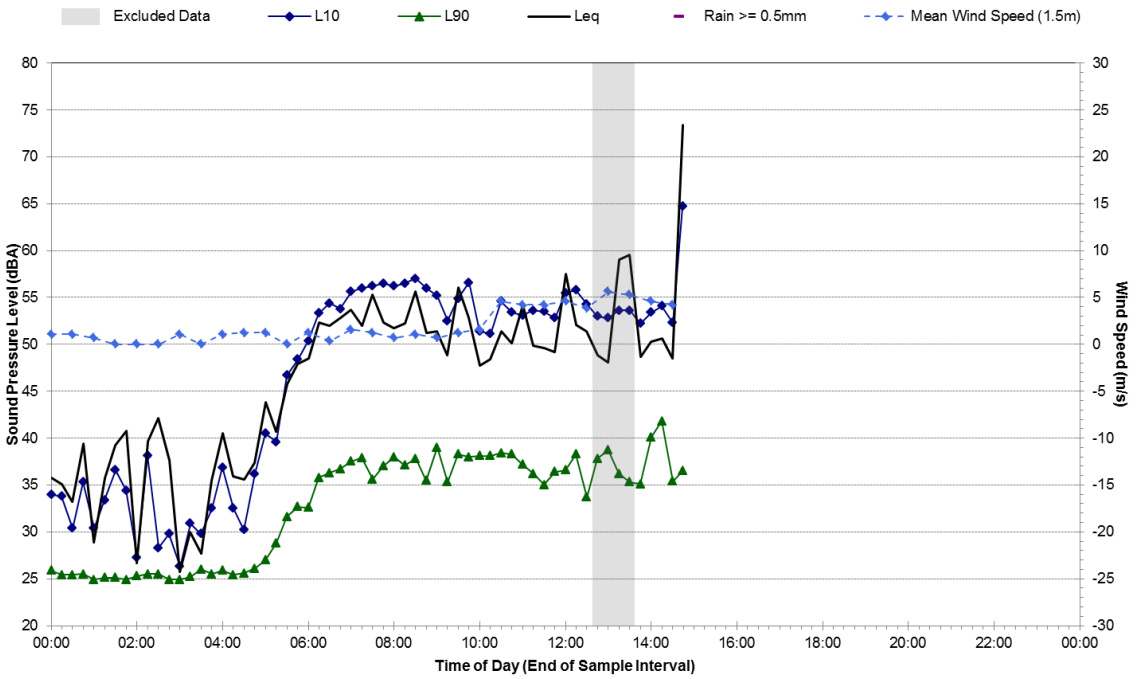
Statistical Ambient Noise Levels

180 Drake Brockman Drive - Thursday, December 19, 2013



Statistical Ambient Noise Levels

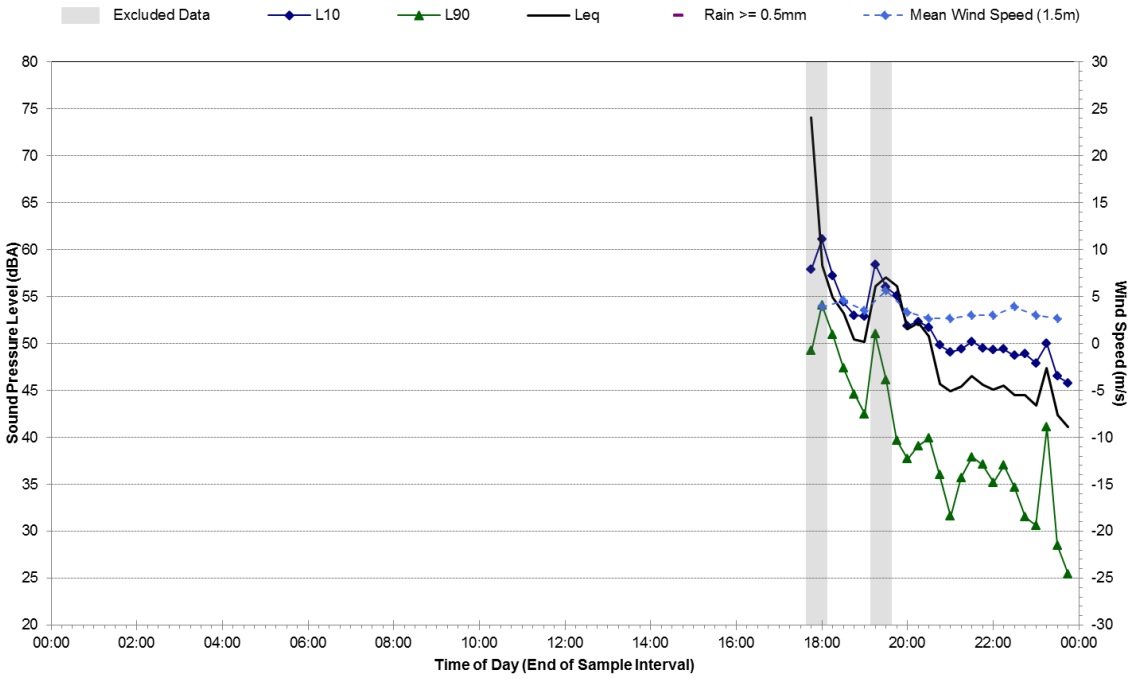
180 Drake Brockman Drive - Friday, December 20, 2013



Noise Monitoring Charts – Location 2 - 20 Davidson Street

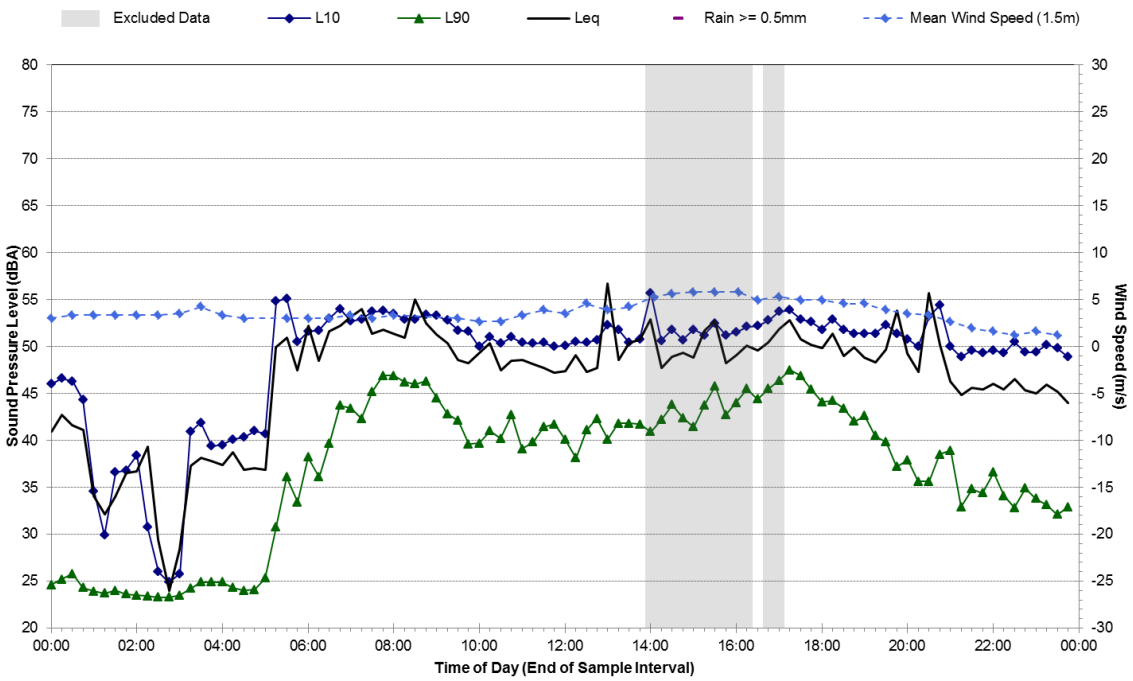
Statistical Ambient Noise Levels

20 Davidson Place, Higgins - Thursday, December 05, 2013



Statistical Ambient Noise Levels

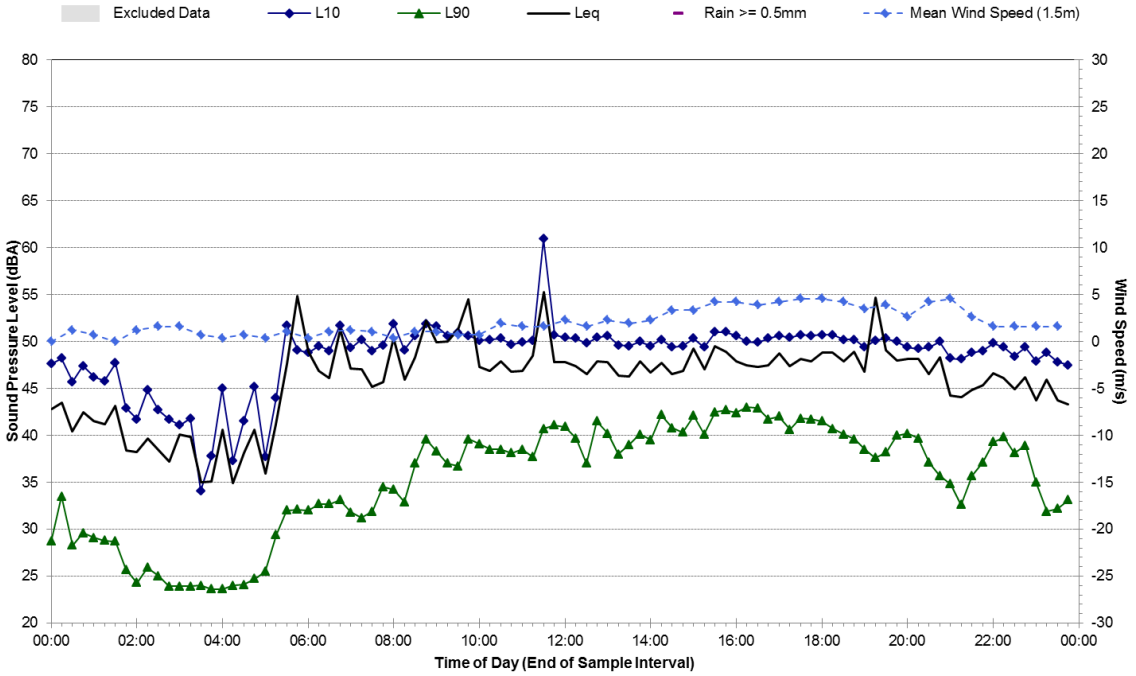
20 Davidson Place, Higgins - Friday, December 06, 2013



Noise Monitoring Charts – Location 2 - 20 Davidson Street

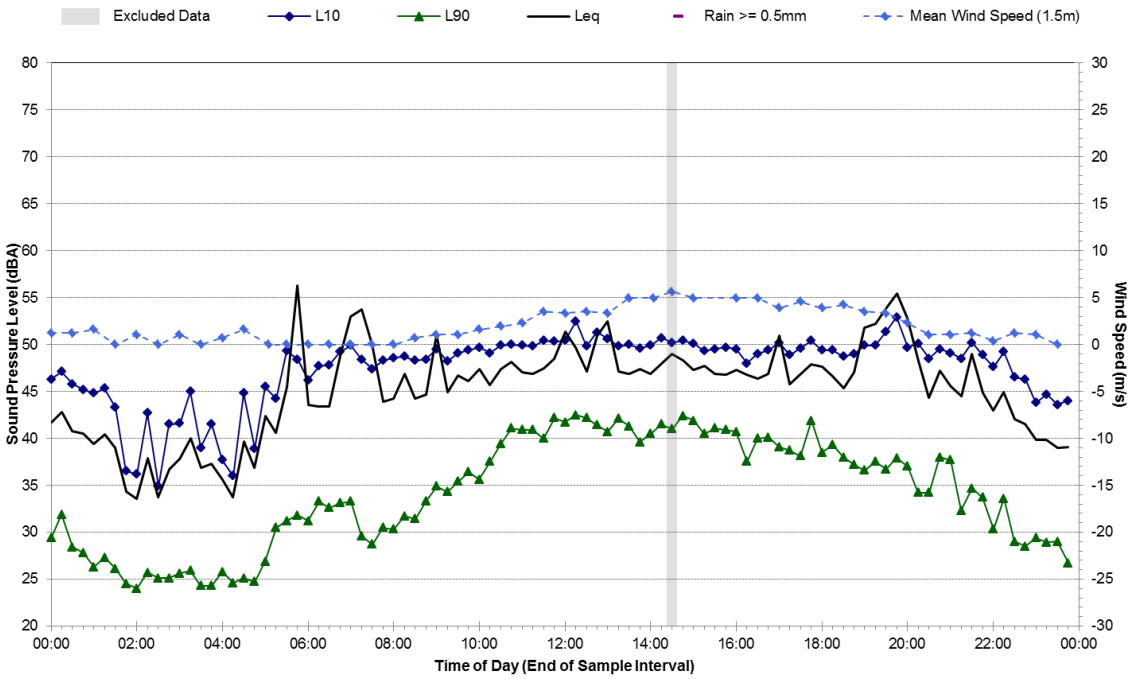
Statistical Ambient Noise Levels

20 Davidson Place, Higgins - Saturday, December 07, 2013



Statistical Ambient Noise Levels

20 Davidson Place, Higgins - Sunday, December 08, 2013



Noise Monitoring Charts – Location 2 - 20 Davidson Street

Statistical Ambient Noise Levels

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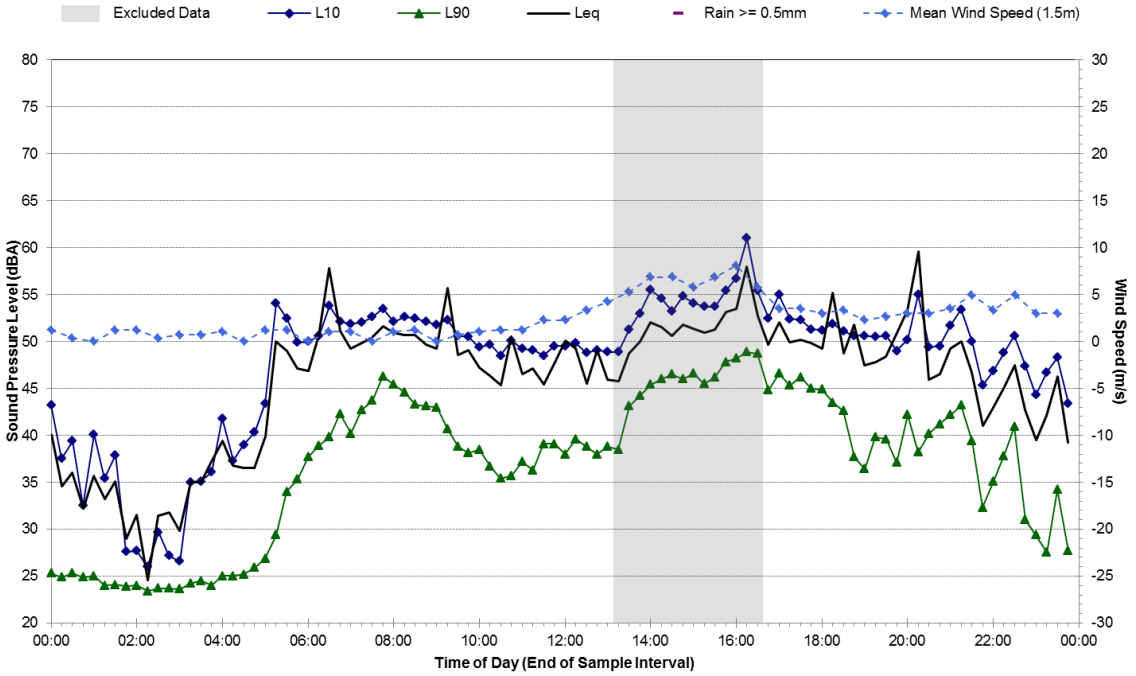
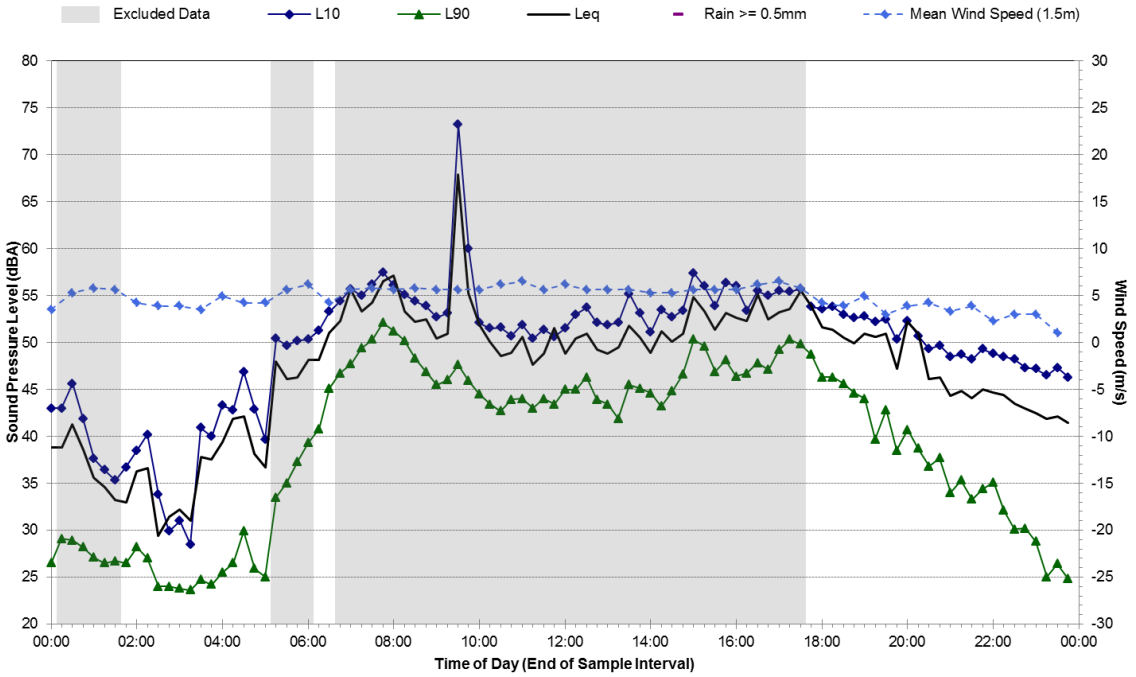


Statistical Ambient Noise Levels

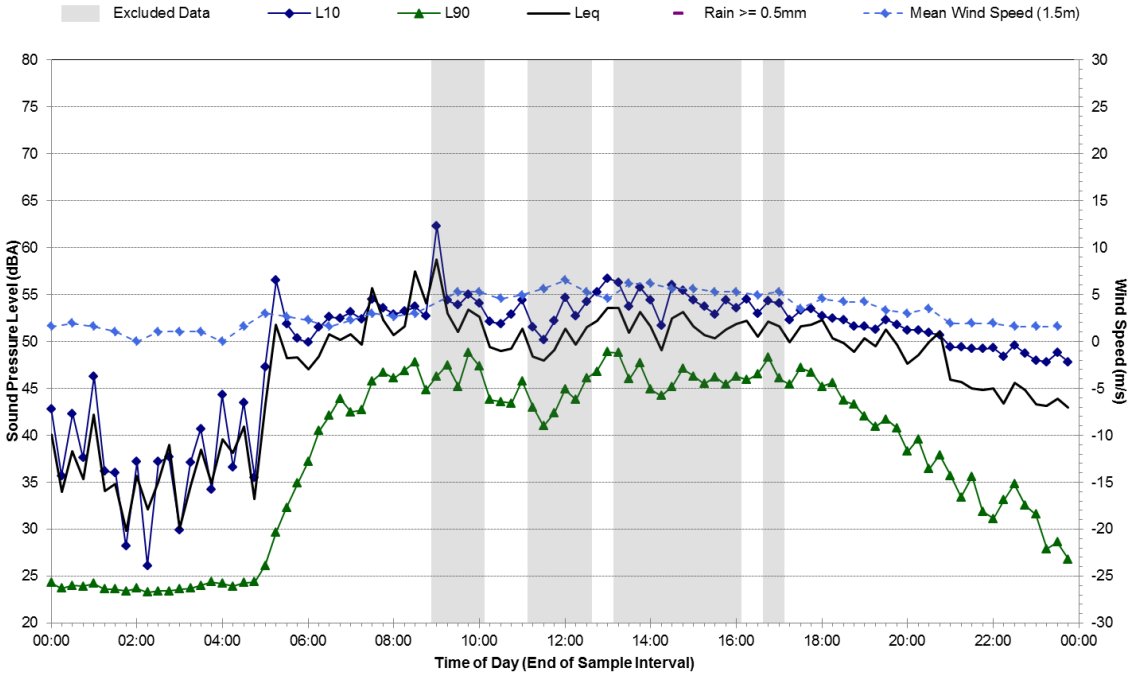
20 Davidson Place, Higgins - Tuesday, December 10, 2013



Noise Monitoring Charts – Location 2 - 20 Davidson Street

Statistical Ambient Noise Levels

20 Davidson Place, Higgins - Wednesday, December 11, 2013



Statistical Ambient Noise Levels

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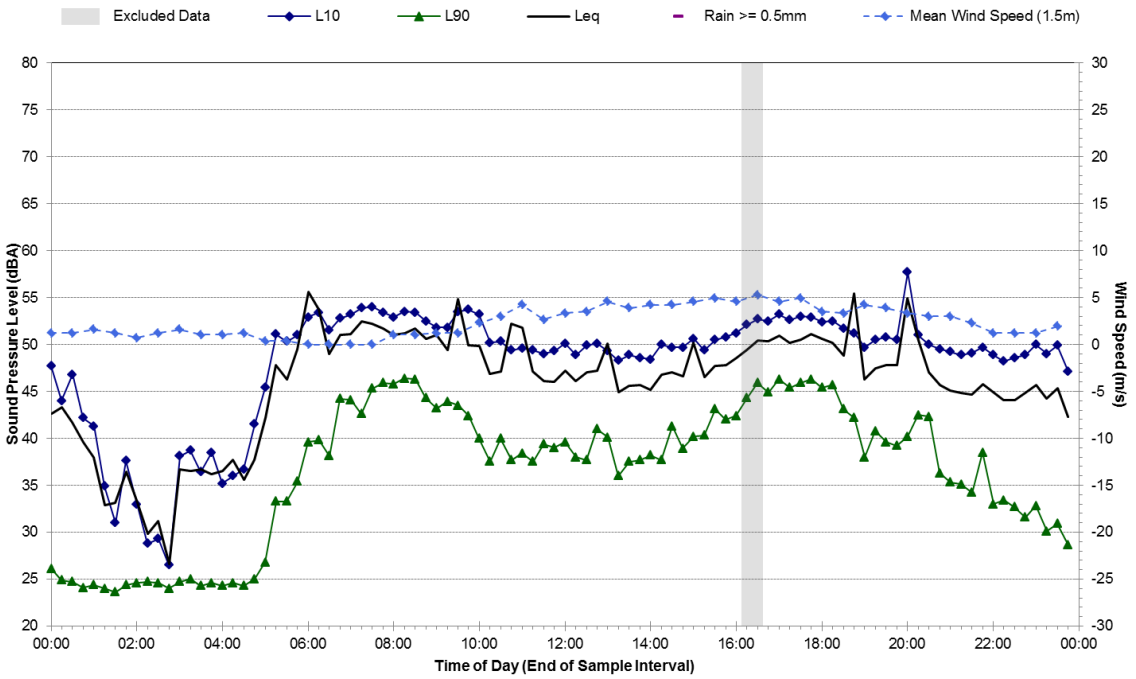

Noise Monitoring Charts – Location 2 - 20 Davidson Street

Statistical Ambient Noise Levels

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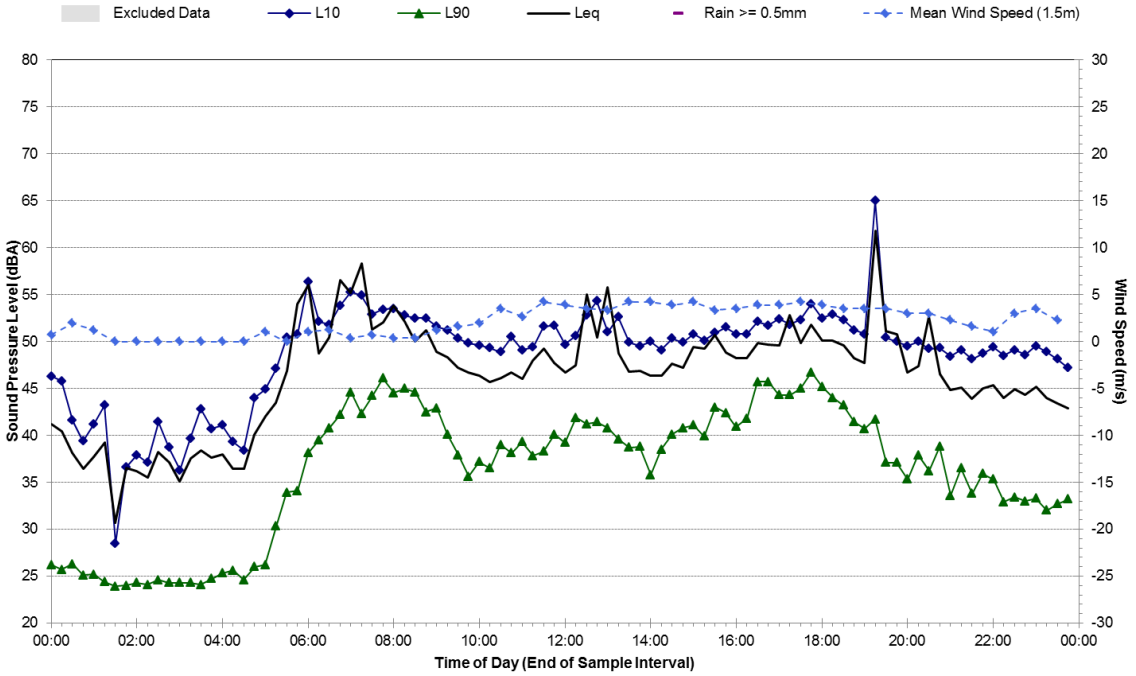
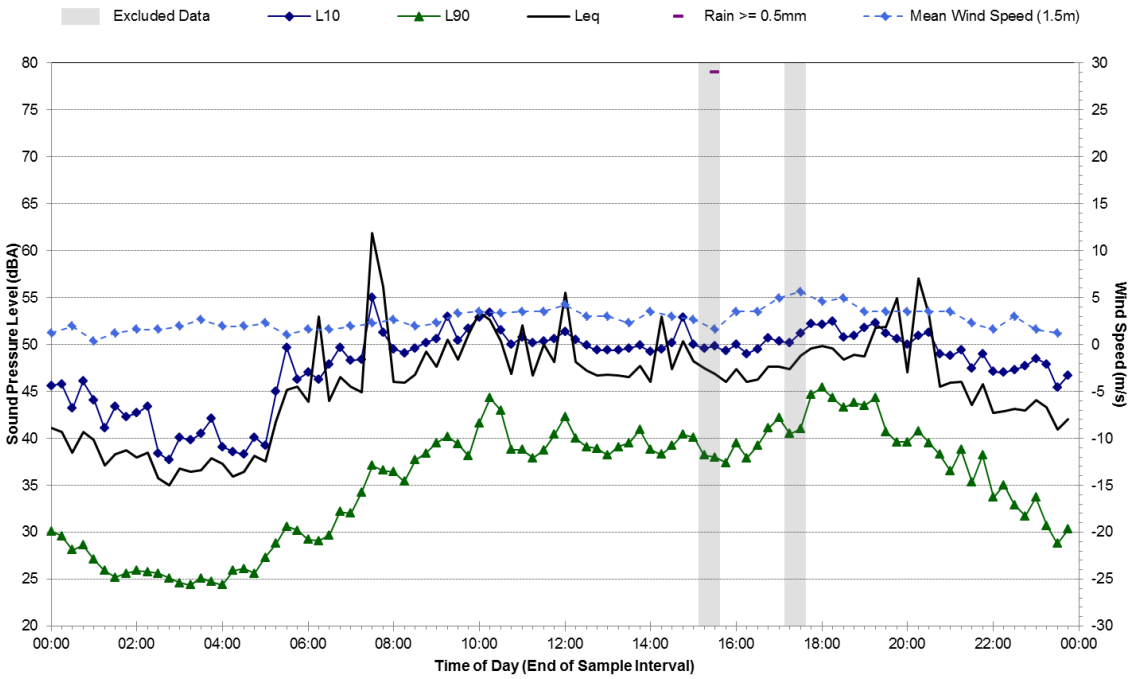


Statistical Ambient Noise Levels

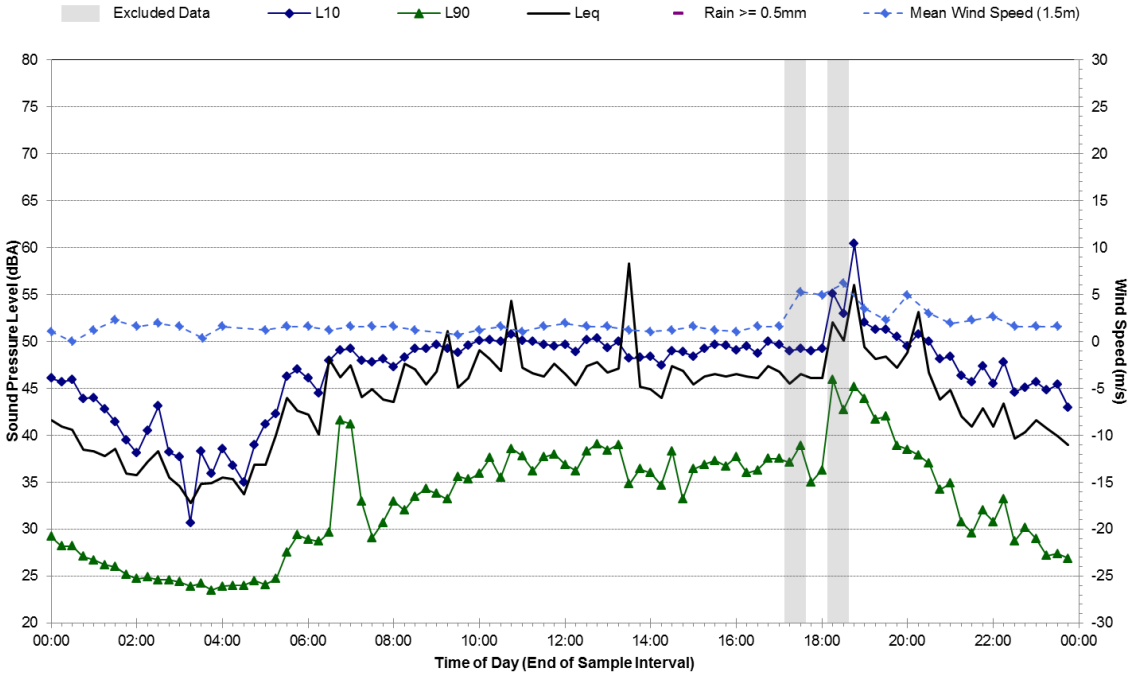
20 Davidson Place, Higgins - Saturday, December 14, 2013



Noise Monitoring Charts – Location 2 - 20 Davidson Street

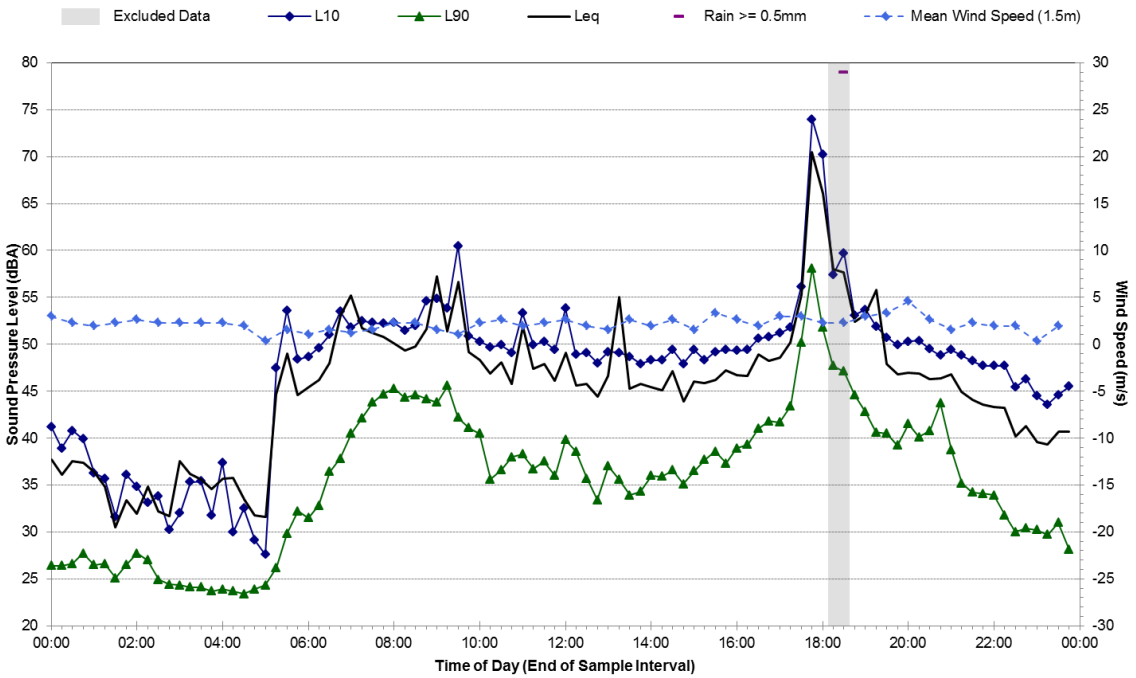
Statistical Ambient Noise Levels

20 Davidson Place, Higgins - Sunday, December 15, 2013



Statistical Ambient Noise Levels

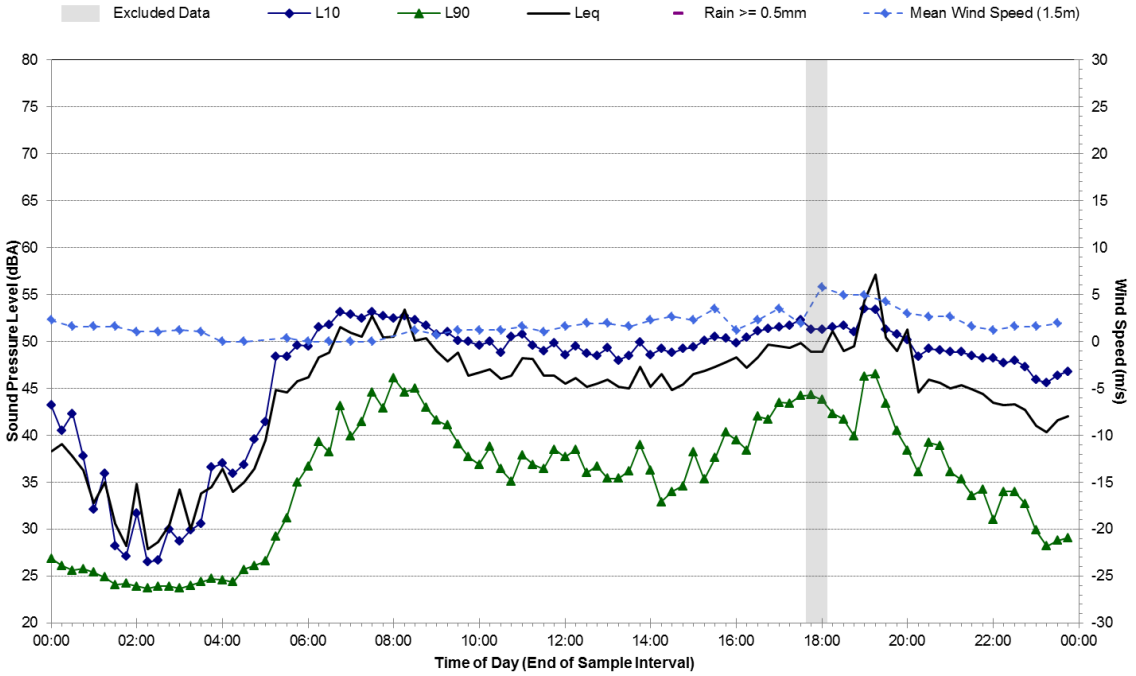
20 Davidson Place, Higgins - Monday, December 16, 2013



Noise Monitoring Charts – Location 2 - 20 Davidson Street

Statistical Ambient Noise Levels

20 Davidson Place, Higgins - Tuesday, December 17, 2013



Statistical Ambient Noise Levels

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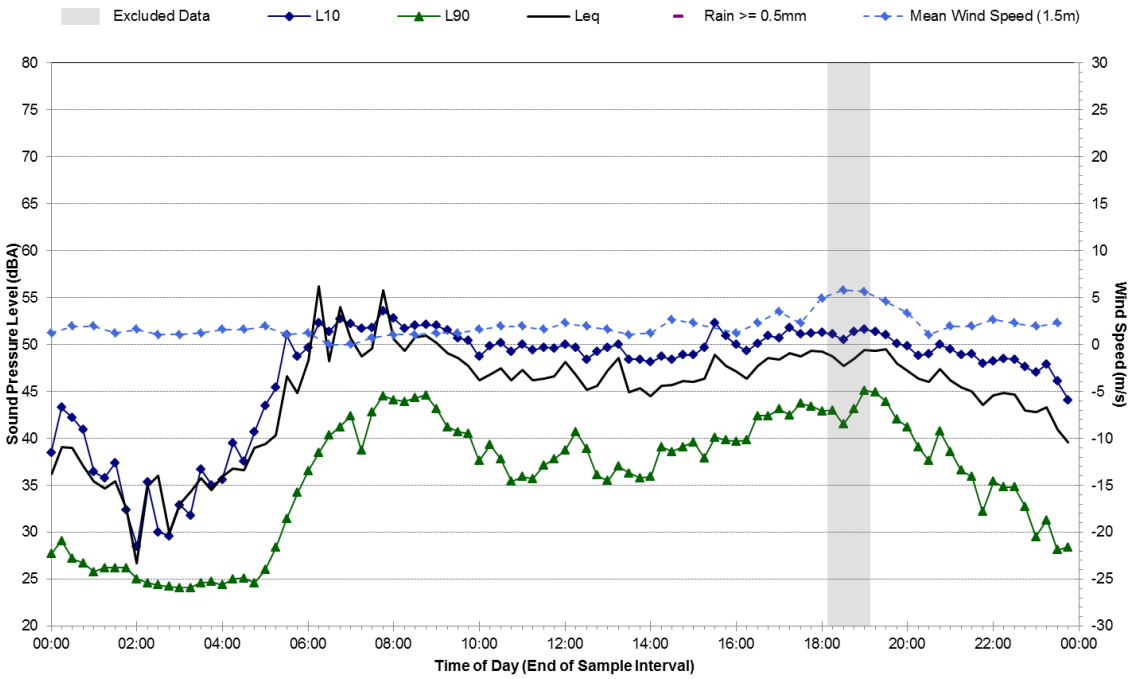
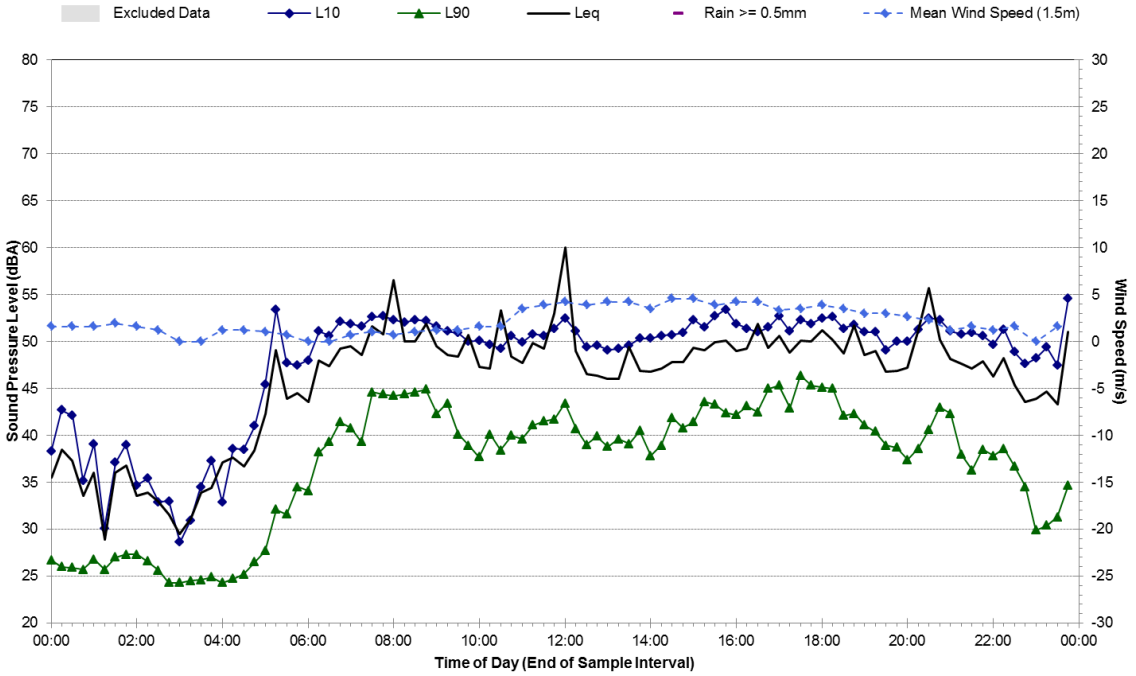


Noise Monitoring Charts – Location 2 - 20 Davidson Street

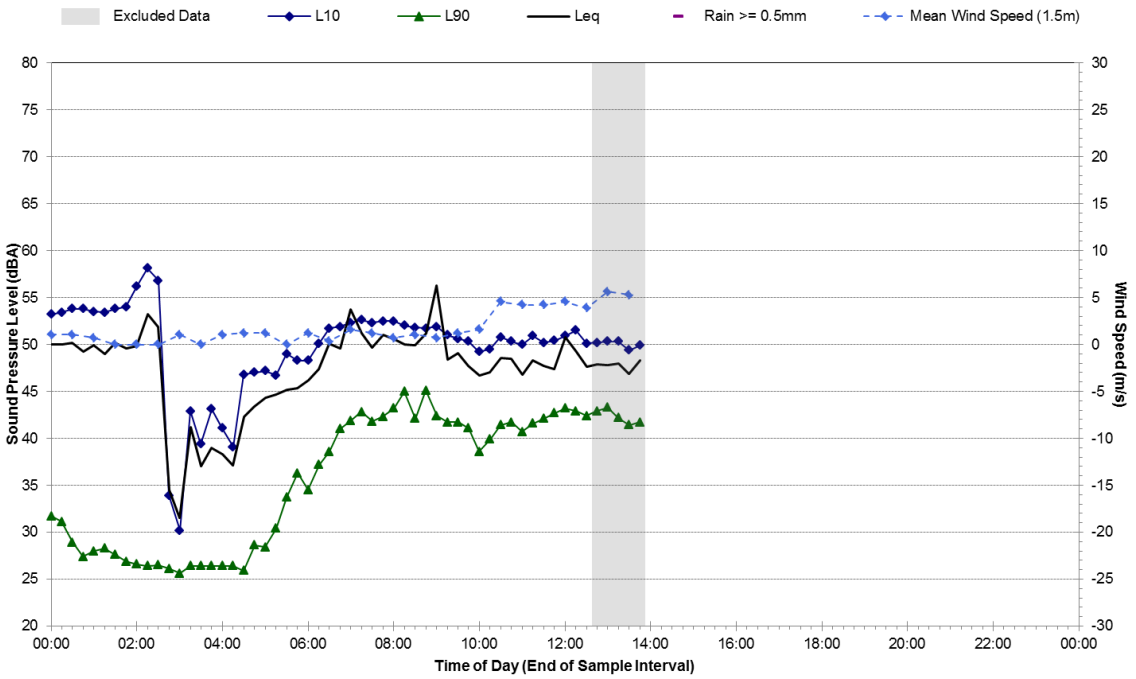
Statistical Ambient Noise Levels

20 Davidson Place, Higgins - Thursday, December 19, 2013



Statistical Ambient Noise Levels

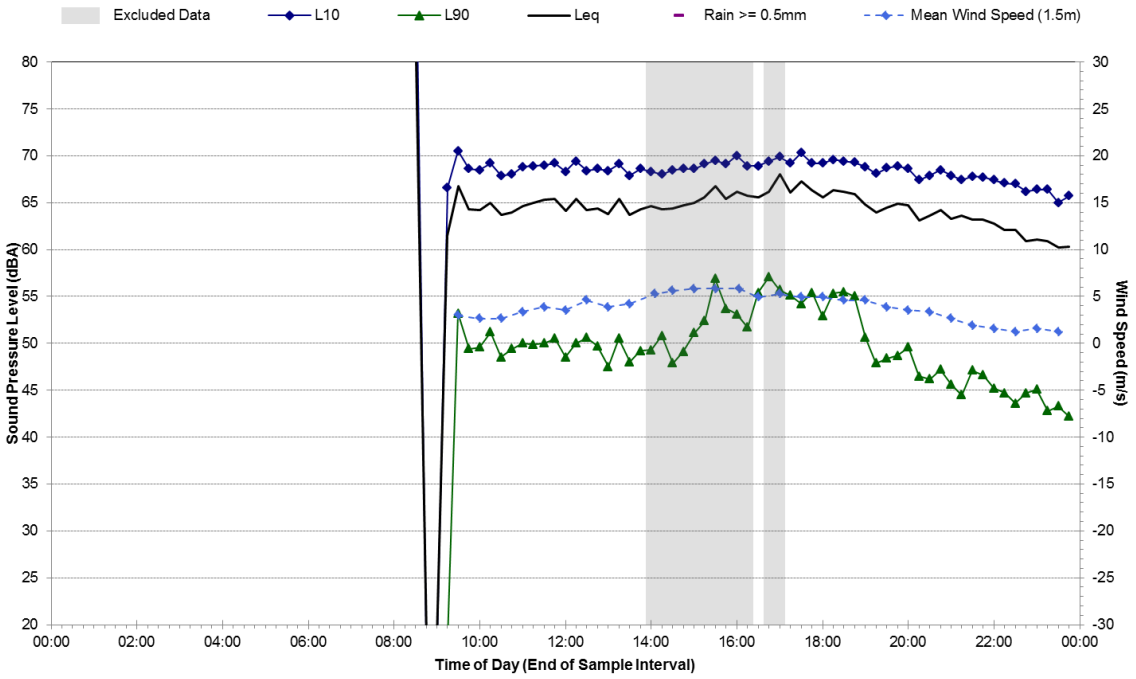
20 Davidson Place, Higgins - Friday, December 20, 2013



Noise Monitoring Charts – Location 3 - 341 Southern Cross Drive

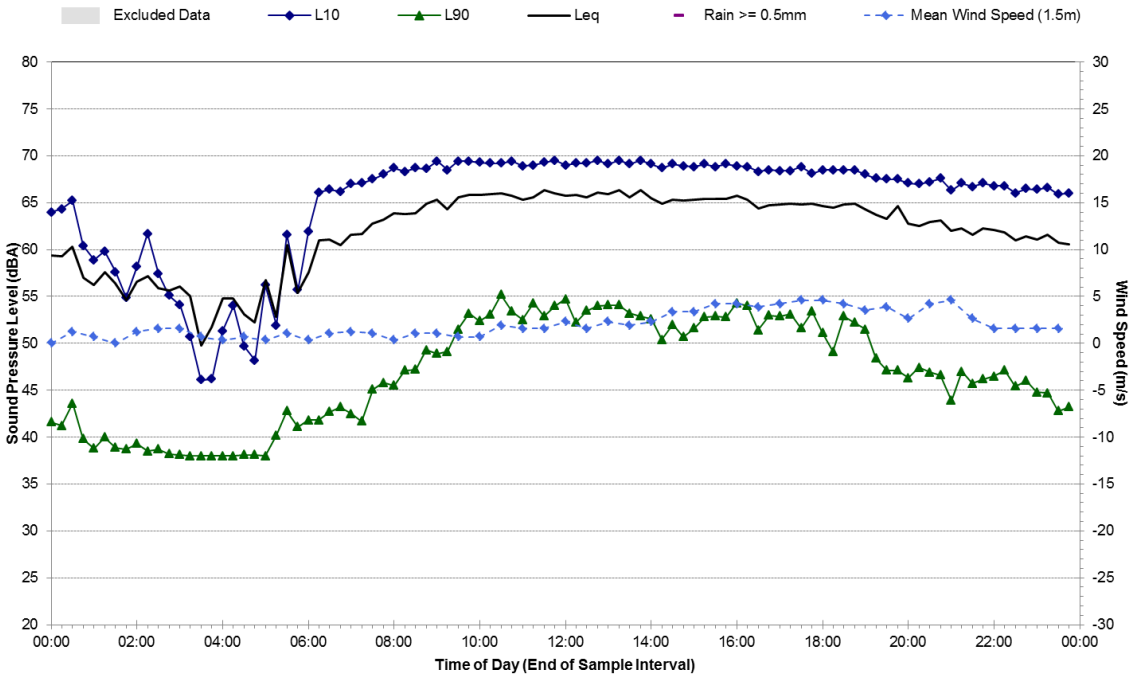
Statistical Ambient Noise Levels

341 Southern Cross Drive - Friday, December 06, 2013



Statistical Ambient Noise Levels

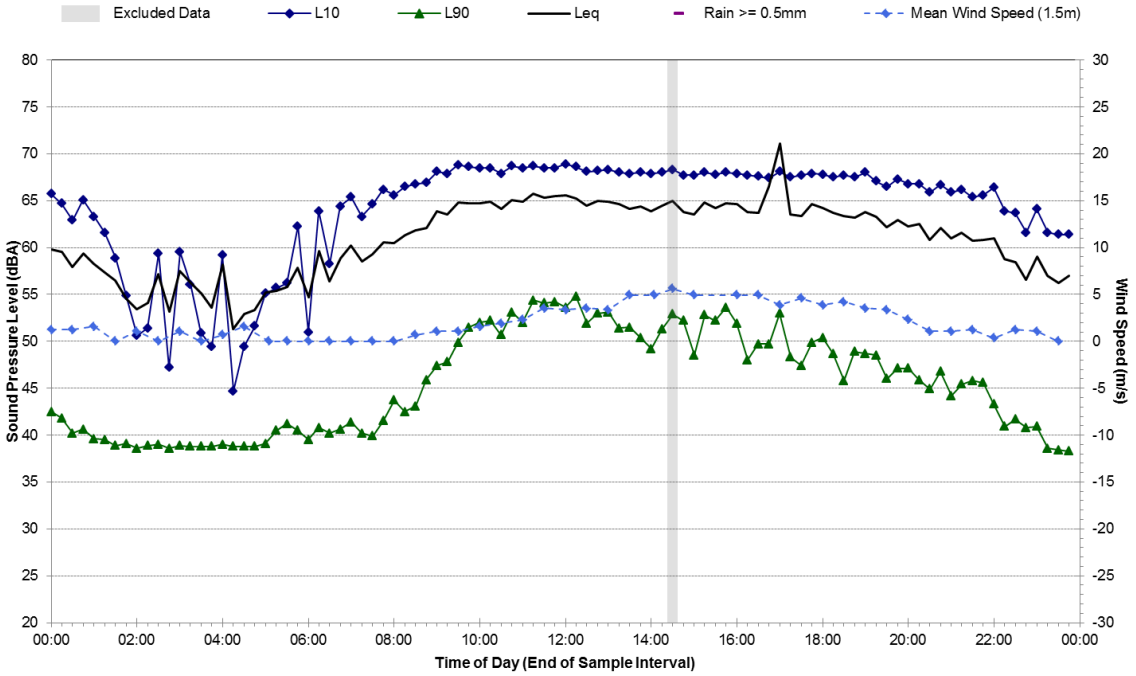
341 Southern Cross Drive - Saturday, December 07, 2013



Noise Monitoring Charts – Location 3 - 341 Southern Cross Drive

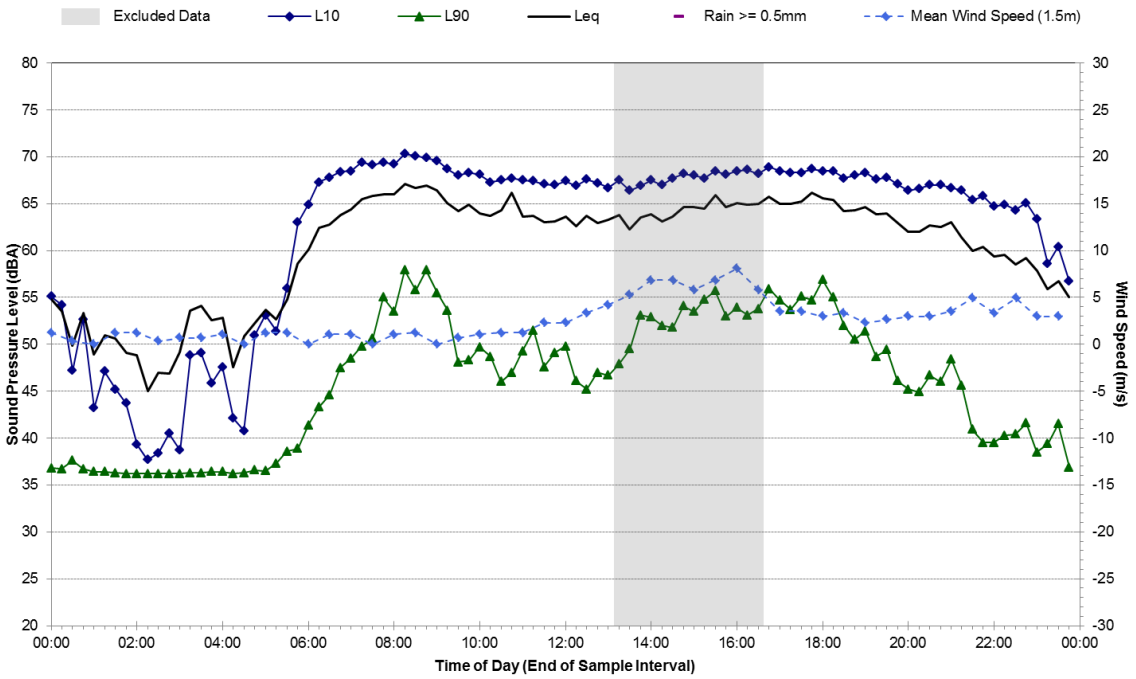
Statistical Ambient Noise Levels

341 Southern Cross Drive - Sunday, December 08, 2013



Statistical Ambient Noise Levels

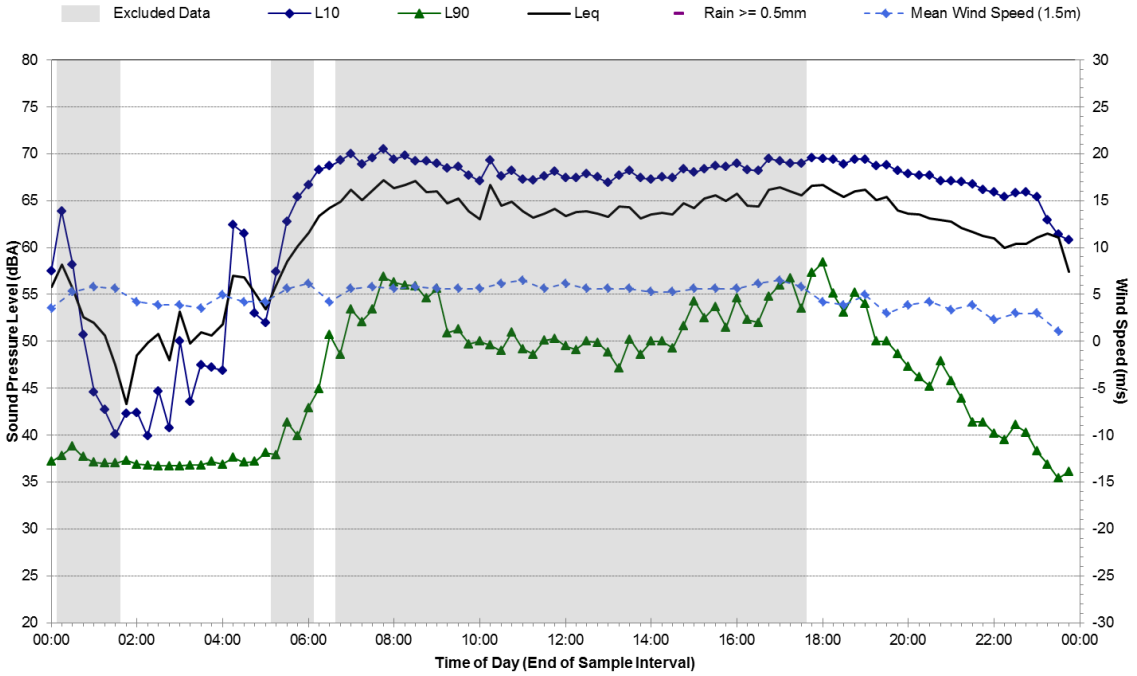
341 Southern Cross Drive - Monday, December 09, 2013



Noise Monitoring Charts – Location 3 - 341 Southern Cross Drive

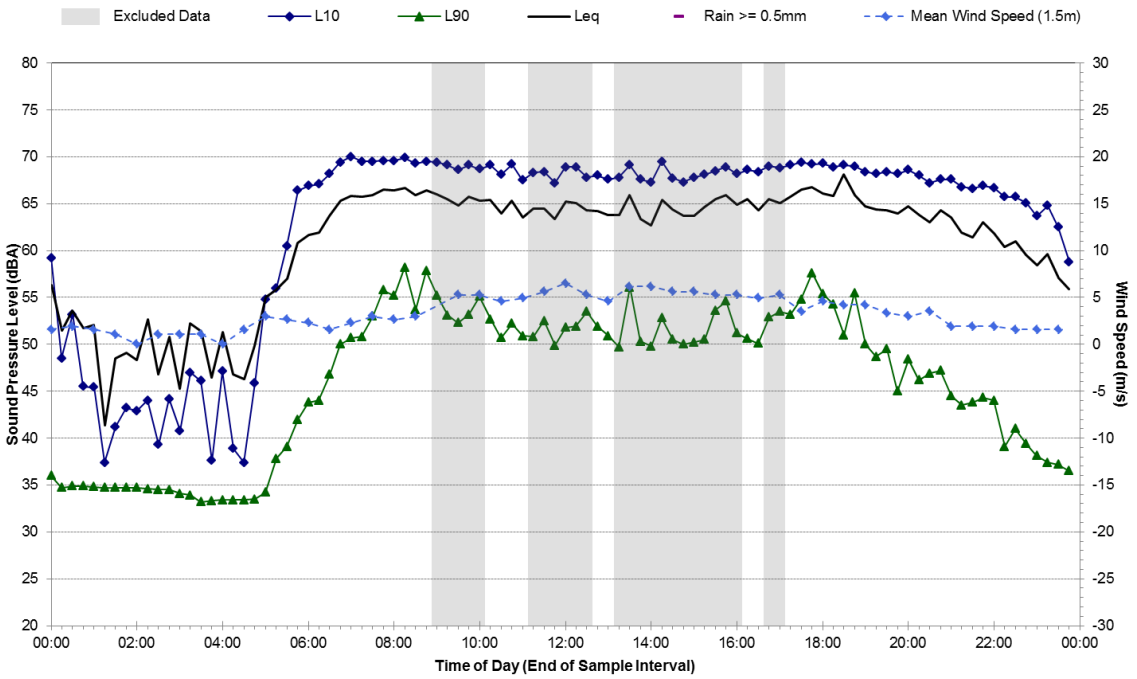
Statistical Ambient Noise Levels

341 Southern Cross Drive - Tuesday, December 10, 2013



Statistical Ambient Noise Levels

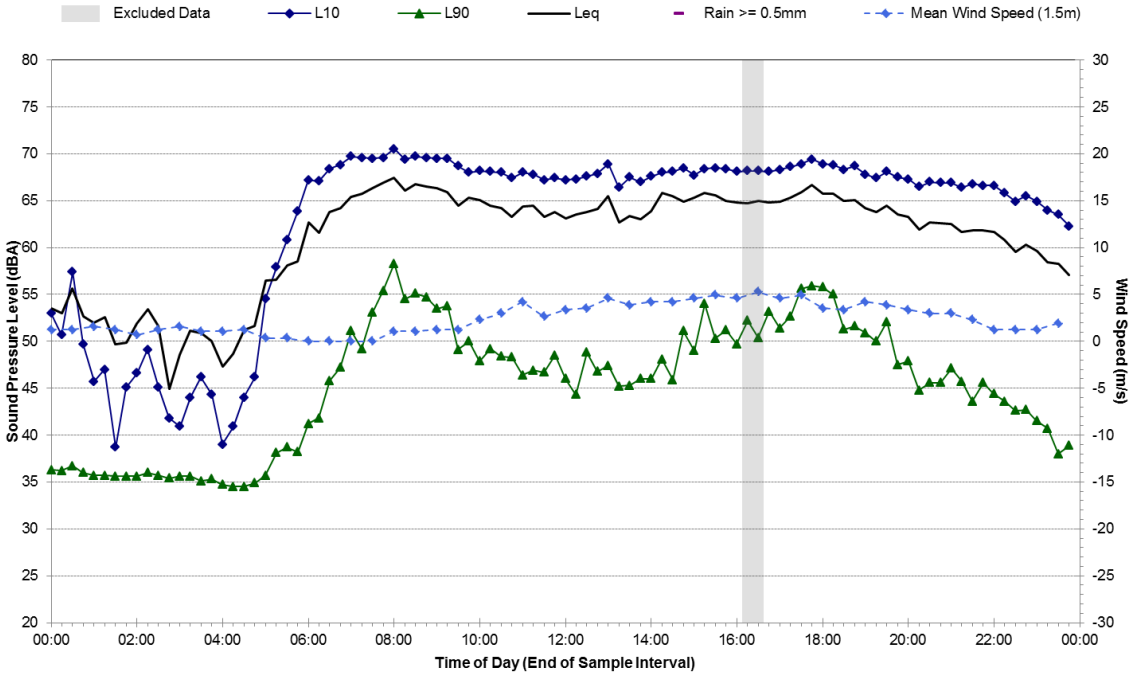
341 Southern Cross Drive - Wednesday, December 11, 2013



Noise Monitoring Charts – Location 3 - 341 Southern Cross Drive

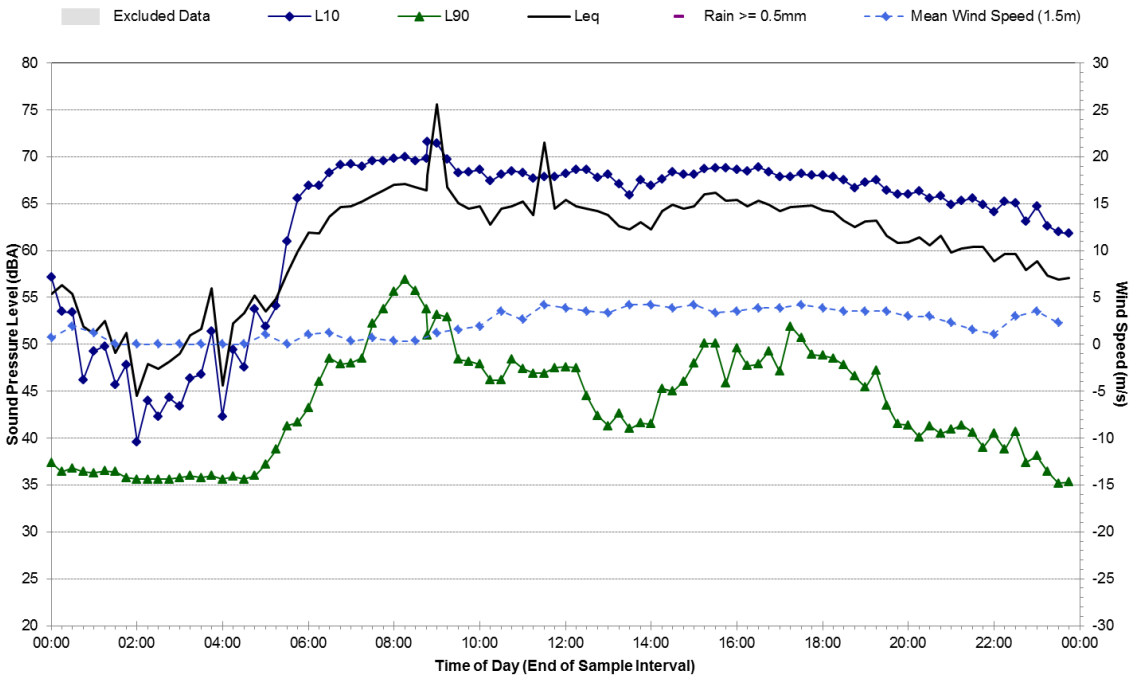
Statistical Ambient Noise Levels

341 Southern Cross Drive - Thursday, December 12, 2013



Statistical Ambient Noise Levels

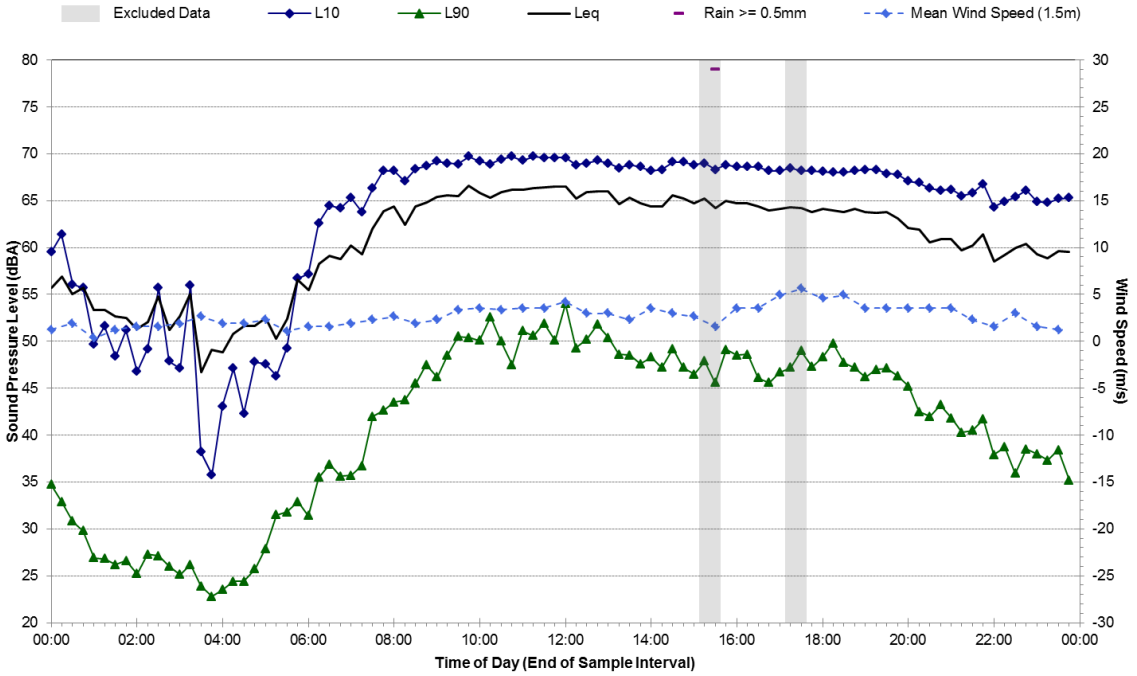
341 Southern Cross Drive - Friday, December 13, 2013



Noise Monitoring Charts – Location 3 - 341 Southern Cross Drive

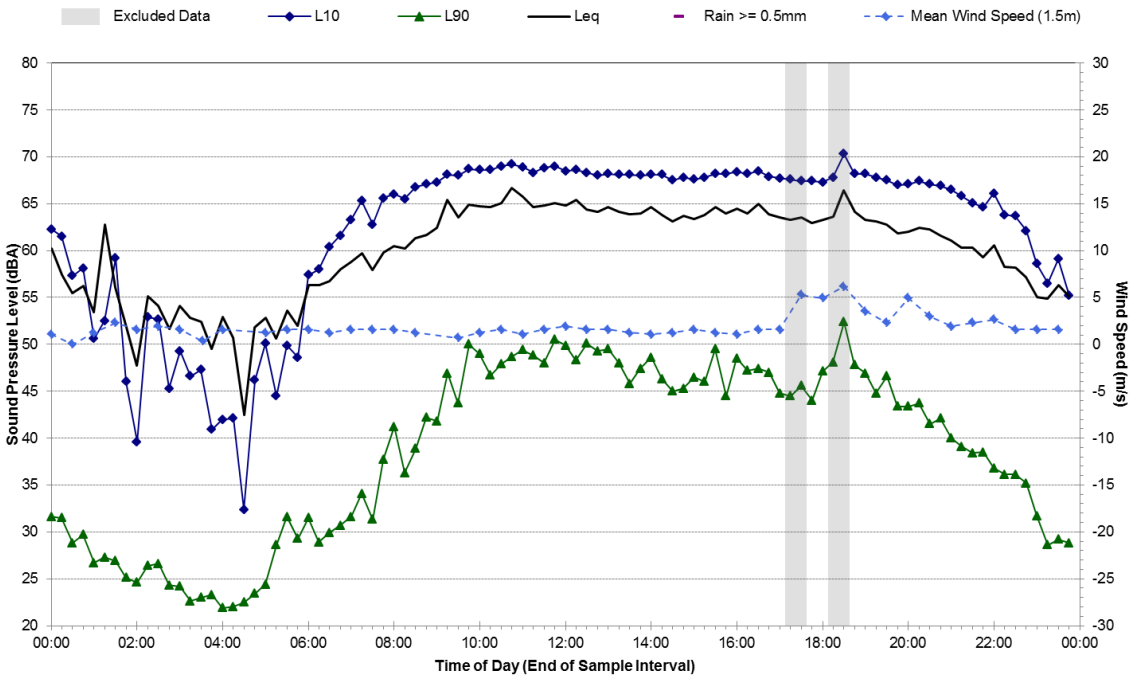
Statistical Ambient Noise Levels

341 Southern Cross Drive - Saturday, December 14, 2013



Statistical Ambient Noise Levels

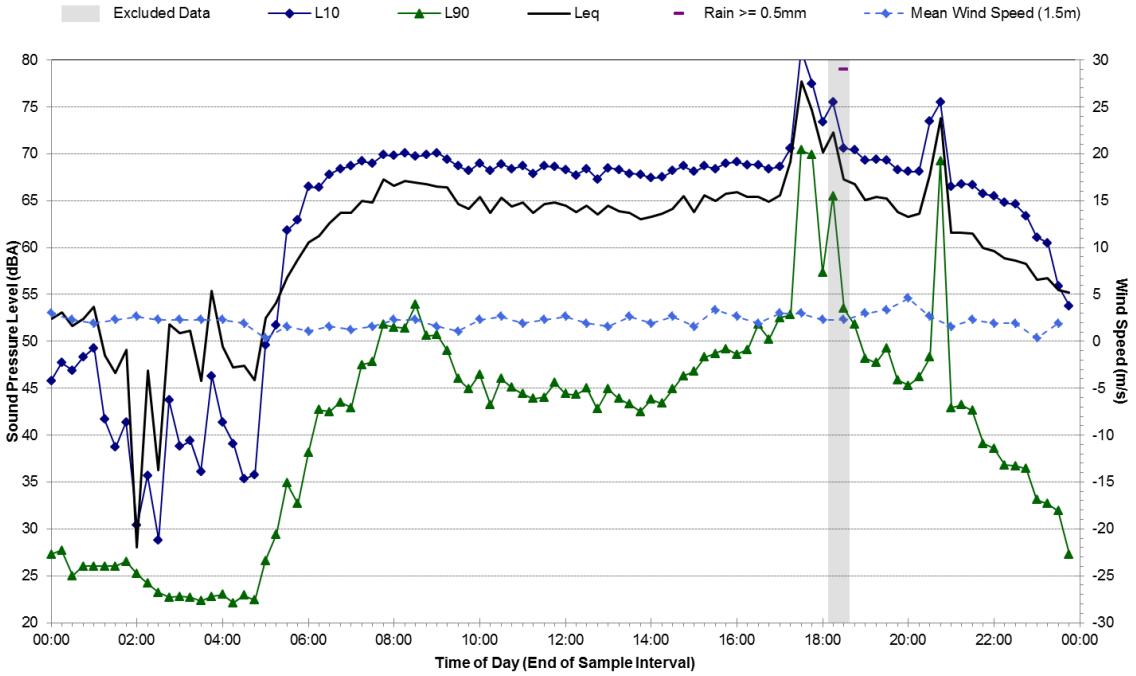
341 Southern Cross Drive - Sunday, December 15, 2013



Noise Monitoring Charts – Location 3 - 341 Southern Cross Drive

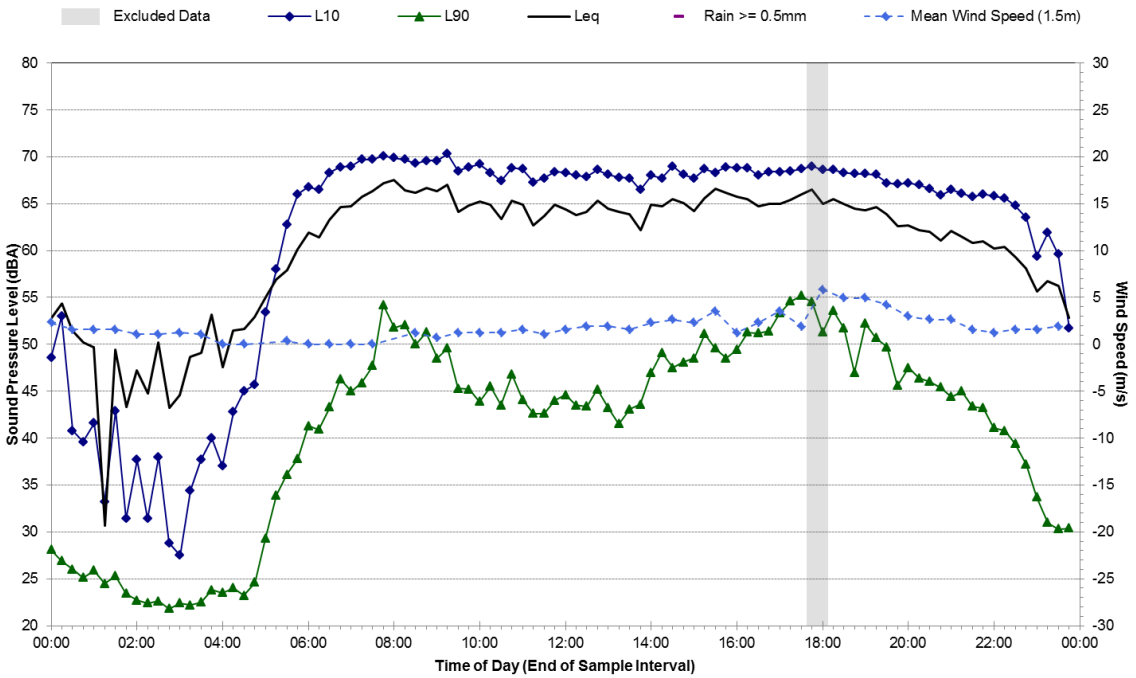
Statistical Ambient Noise Levels

341 Southern Cross Drive - Monday, December 16, 2013



Statistical Ambient Noise Levels

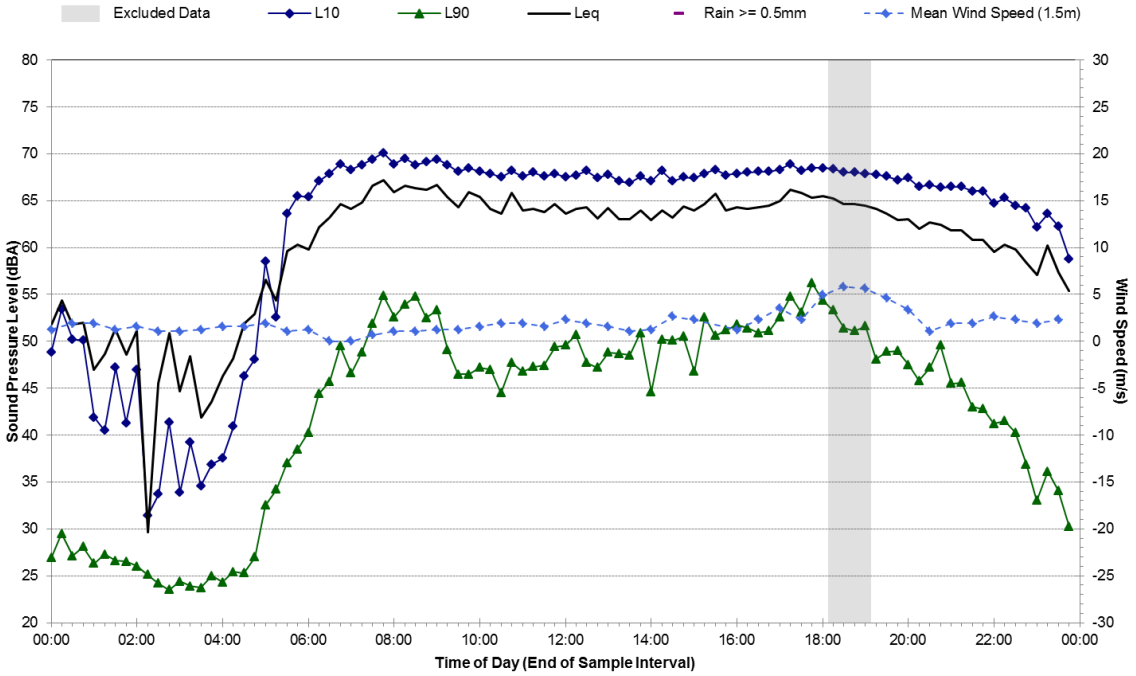
341 Southern Cross Drive - Tuesday, December 17, 2013



Noise Monitoring Charts – Location 3 - 341 Southern Cross Drive

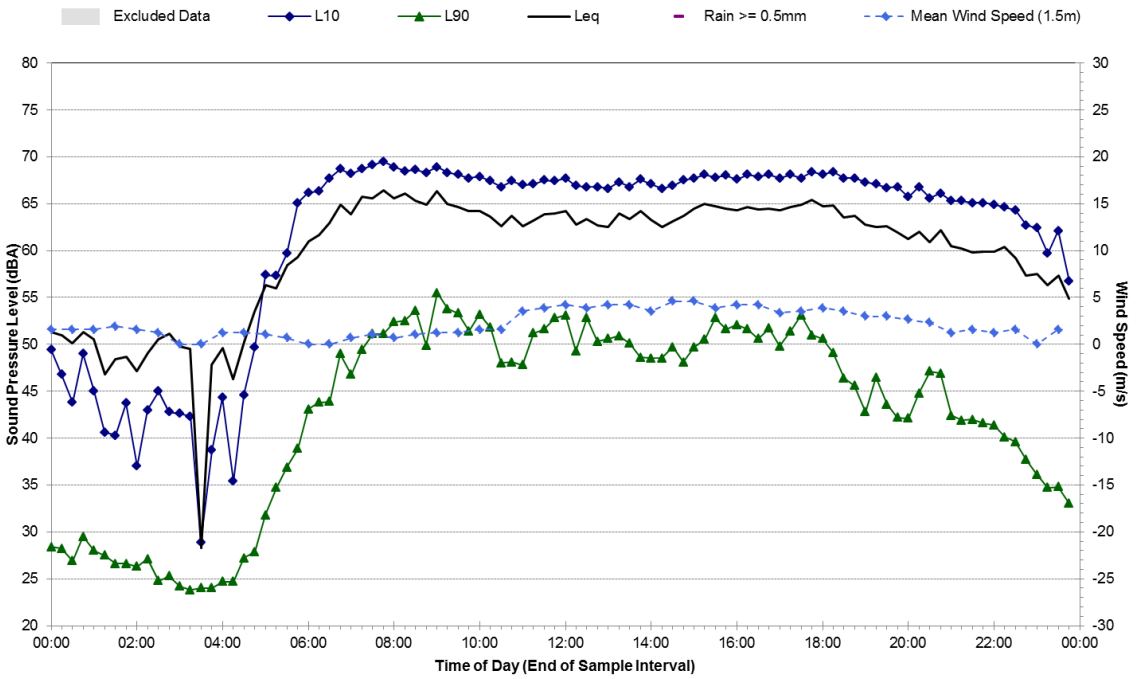
Statistical Ambient Noise Levels

341 Southern Cross Drive - Wednesday, December 18, 2013

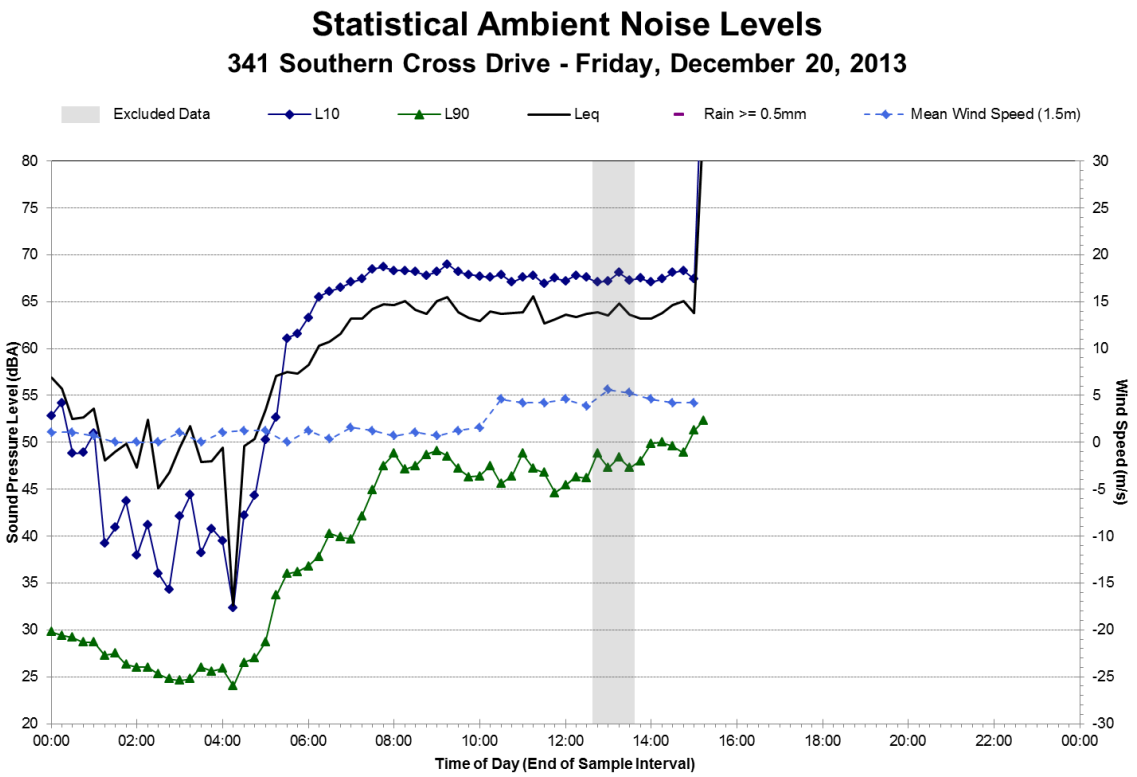


Statistical Ambient Noise Levels

341 Southern Cross Drive - Thursday, December 19, 2013



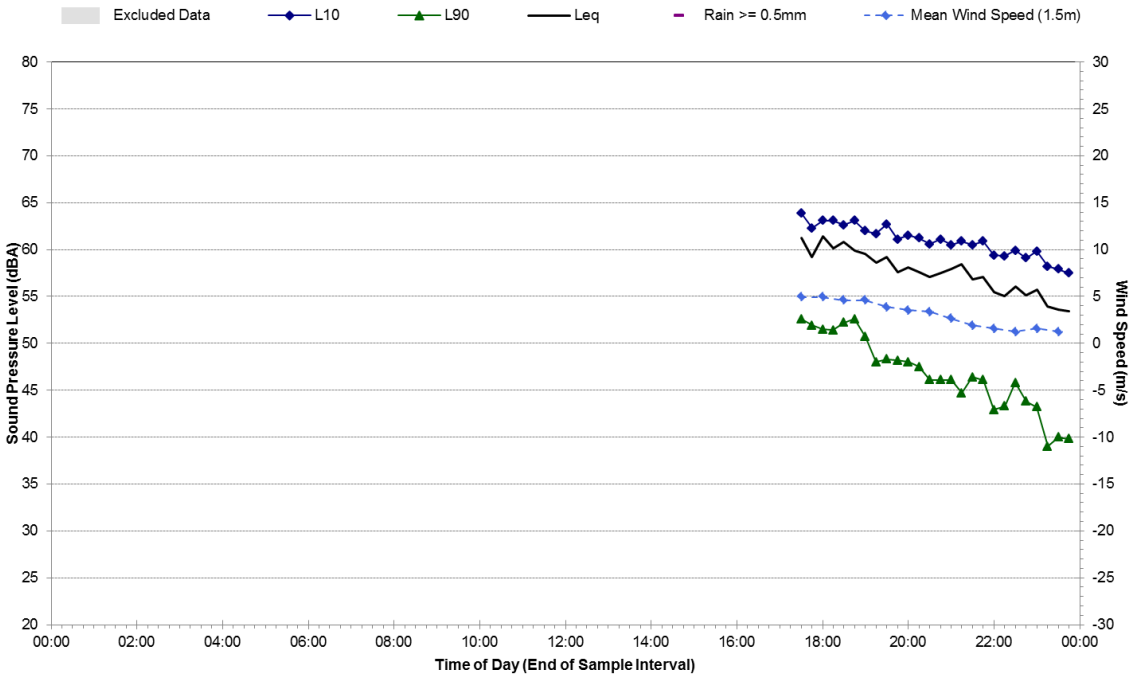
Noise Monitoring Charts – Location 3 - 341 Southern Cross Drive



Noise Monitoring Charts – Location 4 - 222 Southern Cross Drive

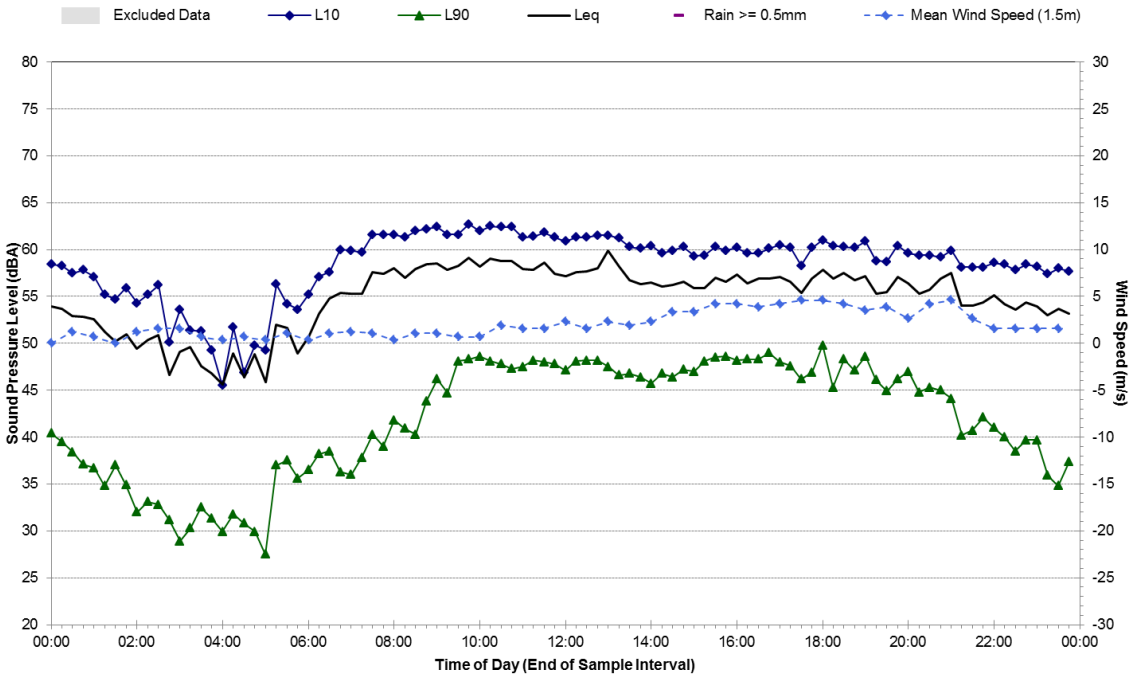
Statistical Ambient Noise Levels

222 Southern Cross Drive - Friday, December 06, 2013



Statistical Ambient Noise Levels

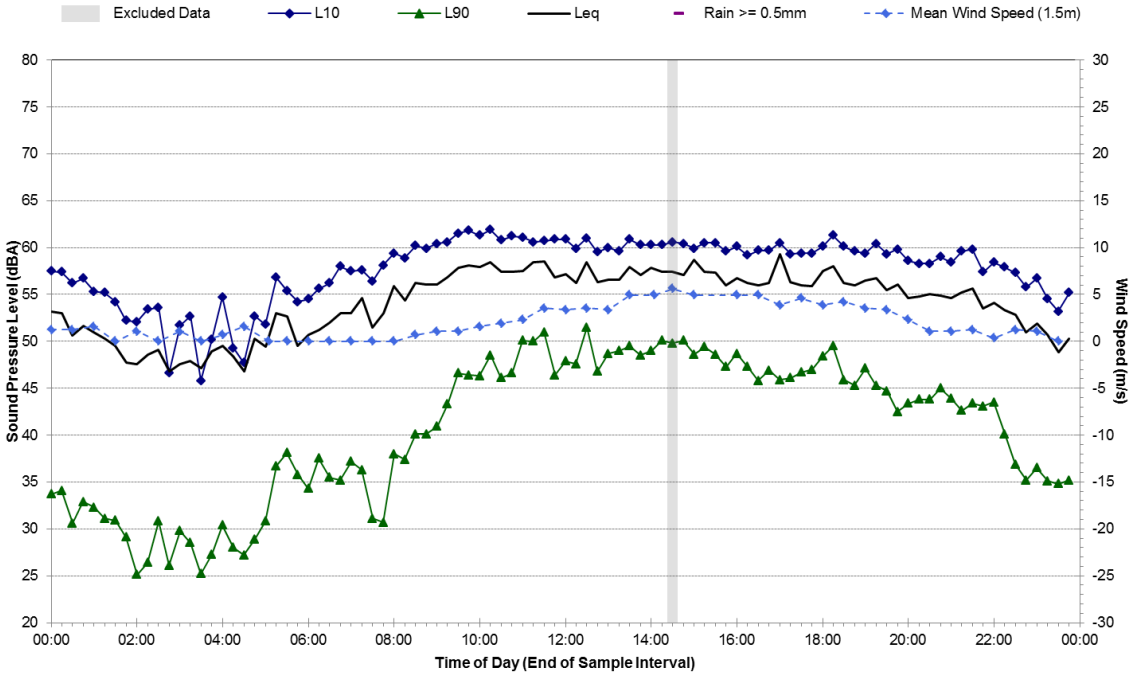
222 Southern Cross Drive - Saturday, December 07, 2013



Noise Monitoring Charts – Location 4 - 222 Southern Cross Drive

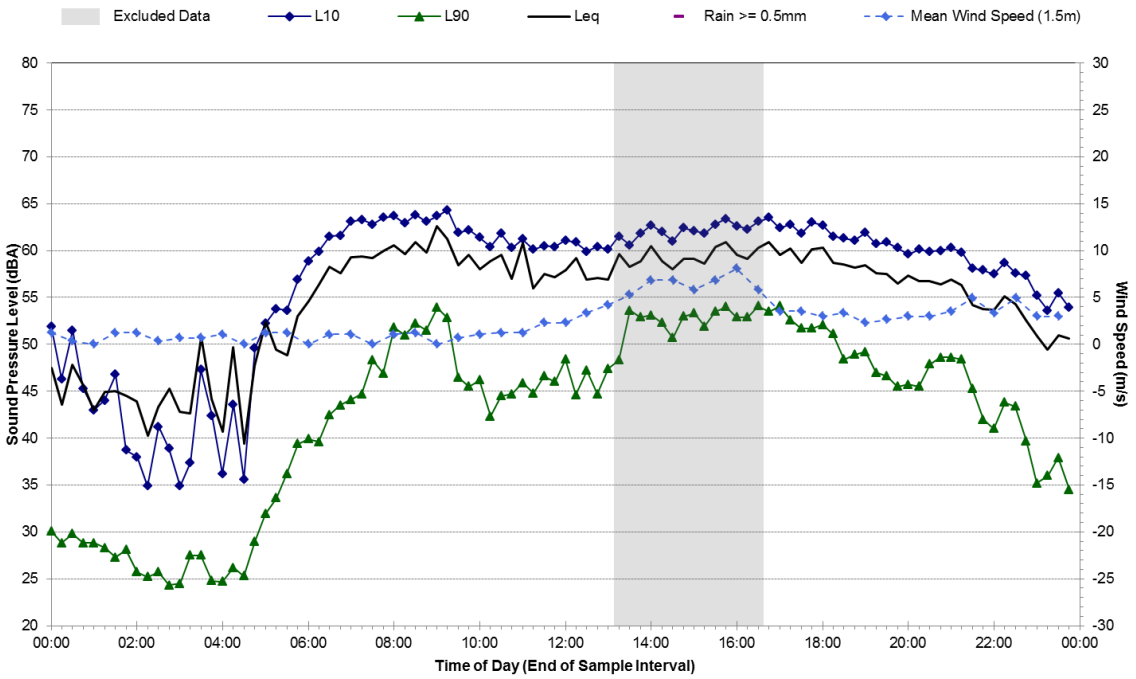
Statistical Ambient Noise Levels

222 Southern Cross Drive - Sunday, December 08, 2013



Statistical Ambient Noise Levels

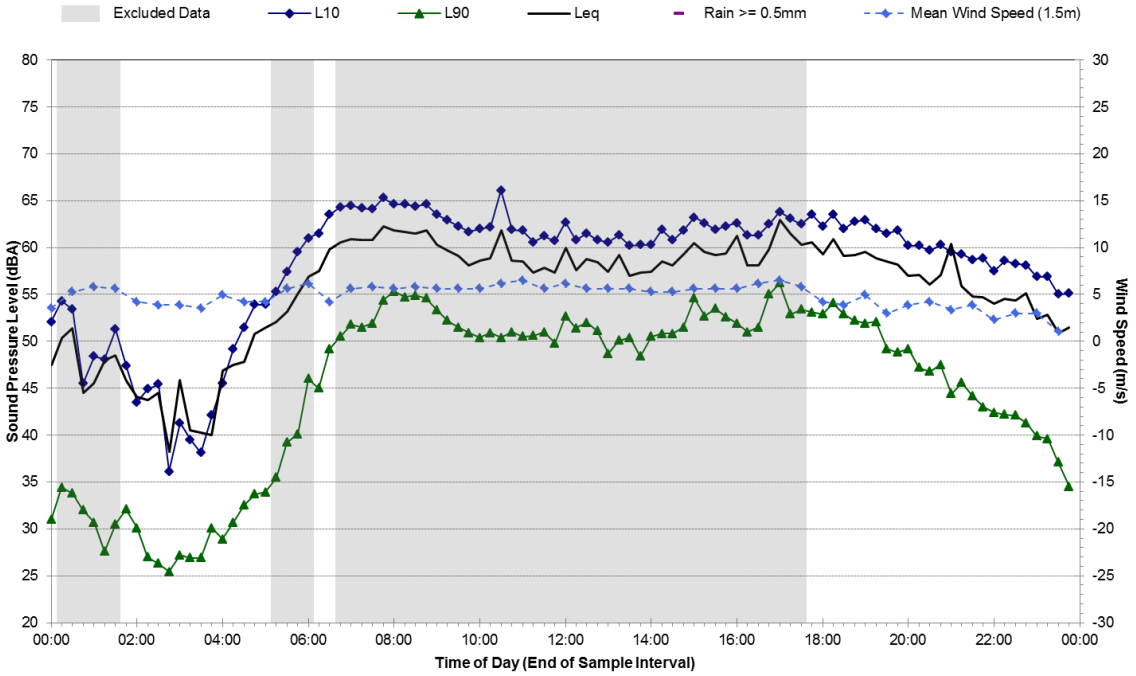
222 Southern Cross Drive - Monday, December 09, 2013



Noise Monitoring Charts – Location 4 - 222 Southern Cross Drive

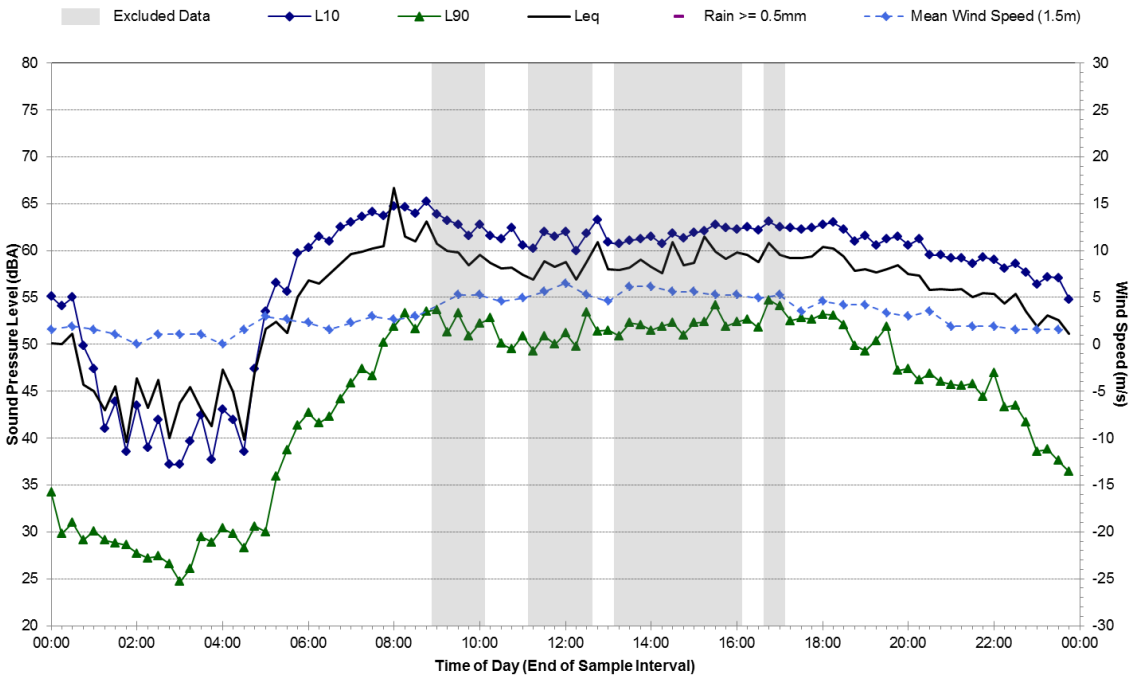
Statistical Ambient Noise Levels

222 Southern Cross Drive - Tuesday, December 10, 2013



Statistical Ambient Noise Levels

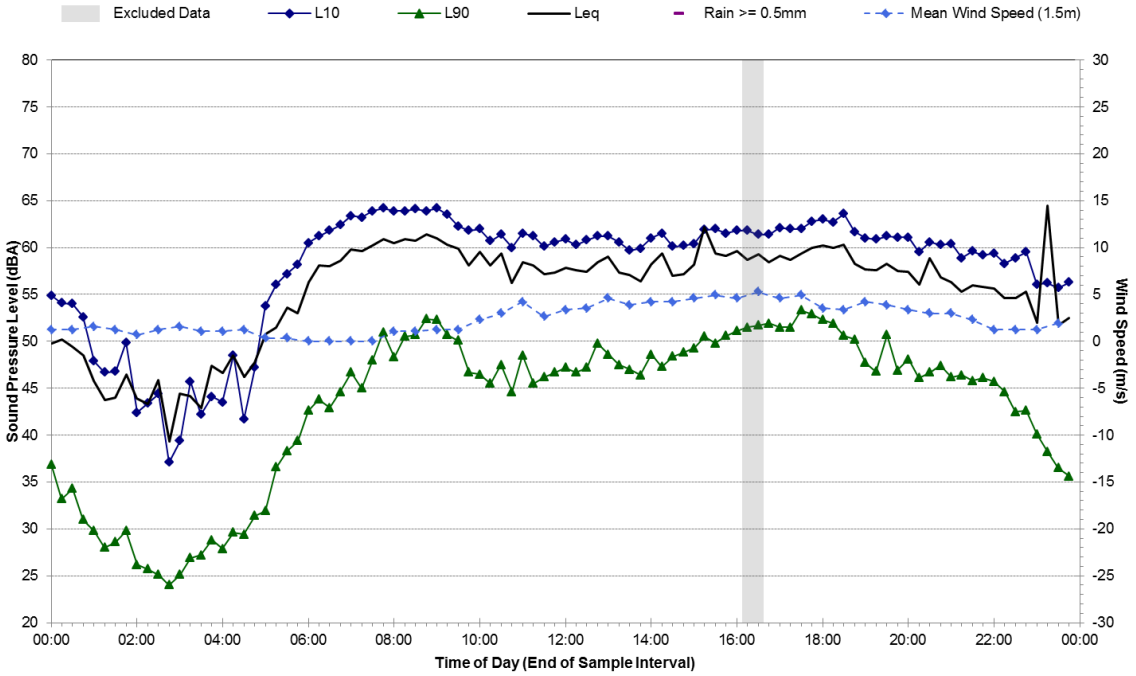
222 Southern Cross Drive - Wednesday, December 11, 2013



Noise Monitoring Charts – Location 4 - 222 Southern Cross Drive

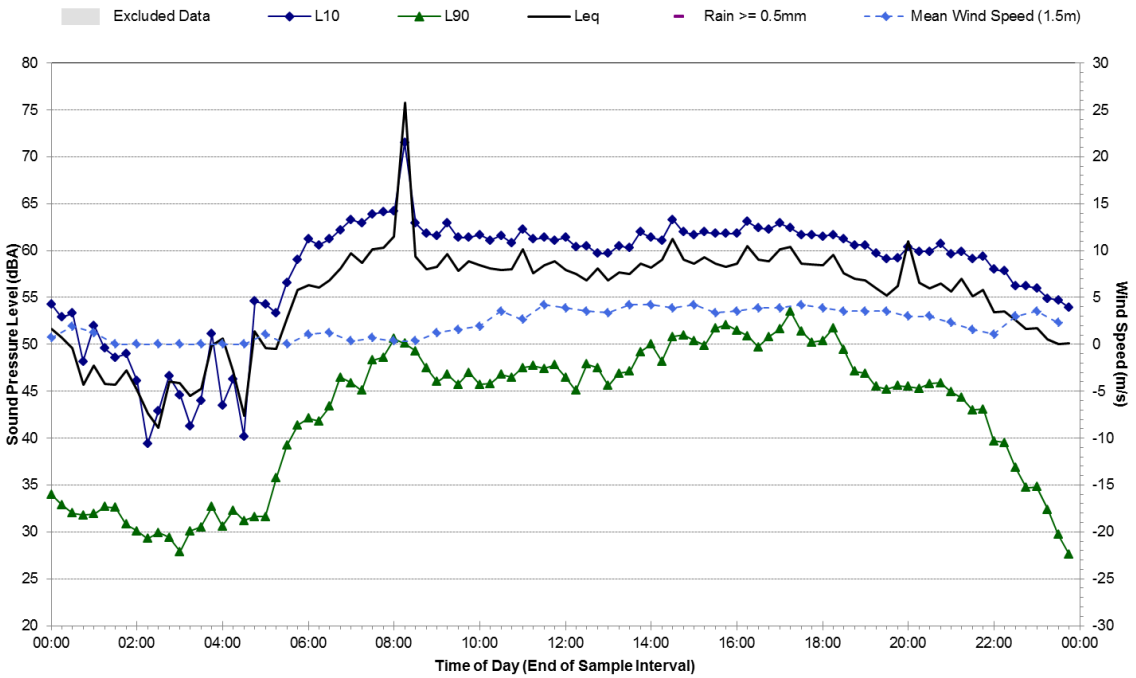
Statistical Ambient Noise Levels

222 Southern Cross Drive - Thursday, December 12, 2013



Statistical Ambient Noise Levels

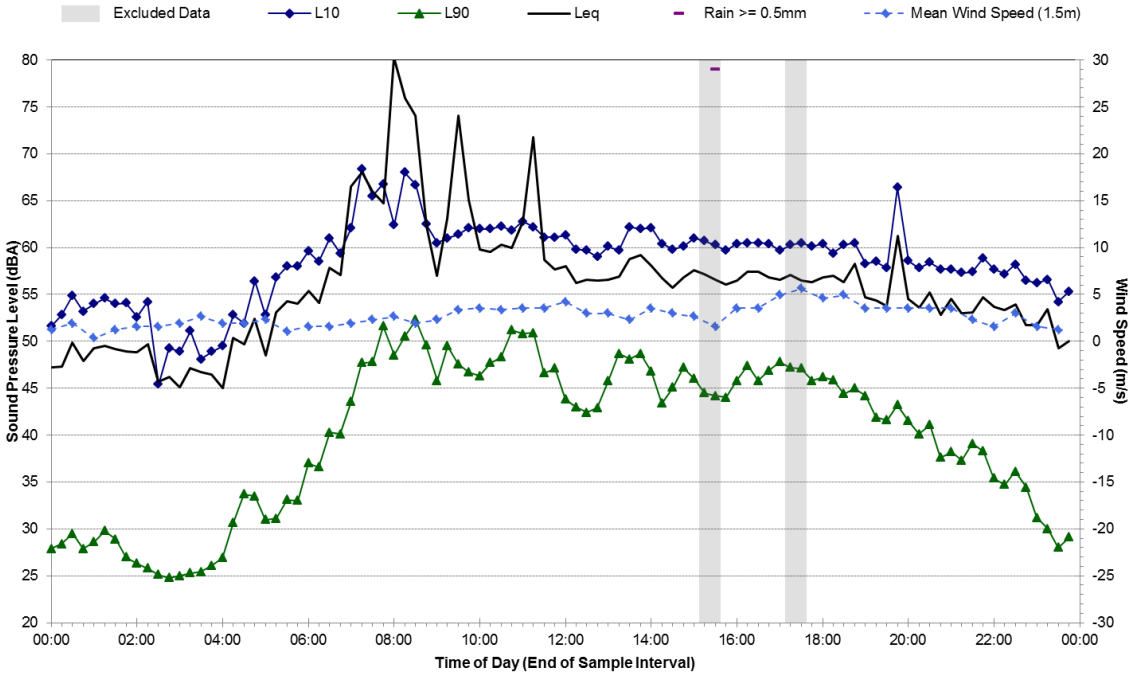
222 Southern Cross Drive - Friday, December 13, 2013



Noise Monitoring Charts – Location 4 - 222 Southern Cross Drive

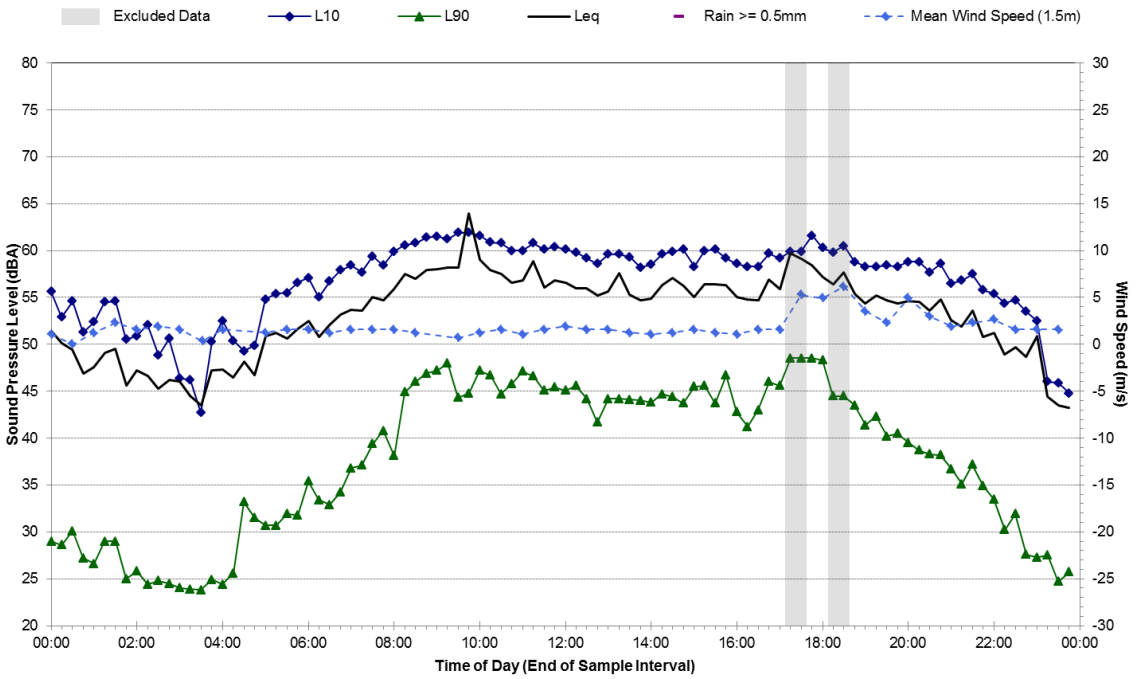
Statistical Ambient Noise Levels

222 Southern Cross Drive - Saturday, December 14, 2013



Statistical Ambient Noise Levels

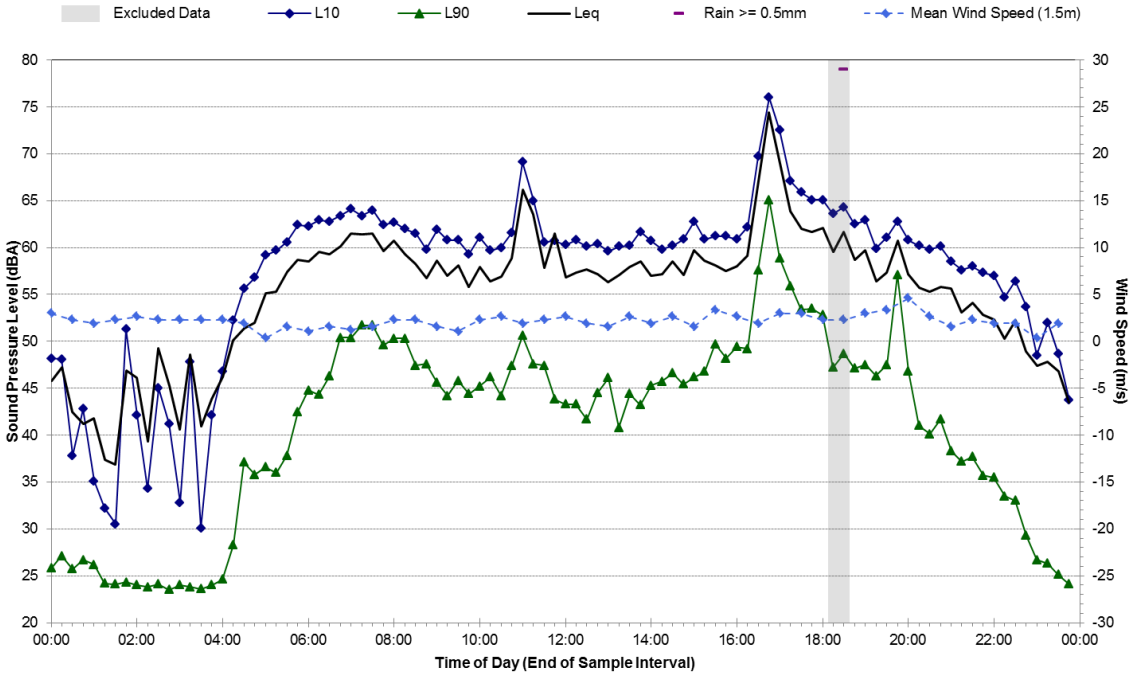
222 Southern Cross Drive - Sunday, December 15, 2013



Noise Monitoring Charts – Location 4 - 222 Southern Cross Drive

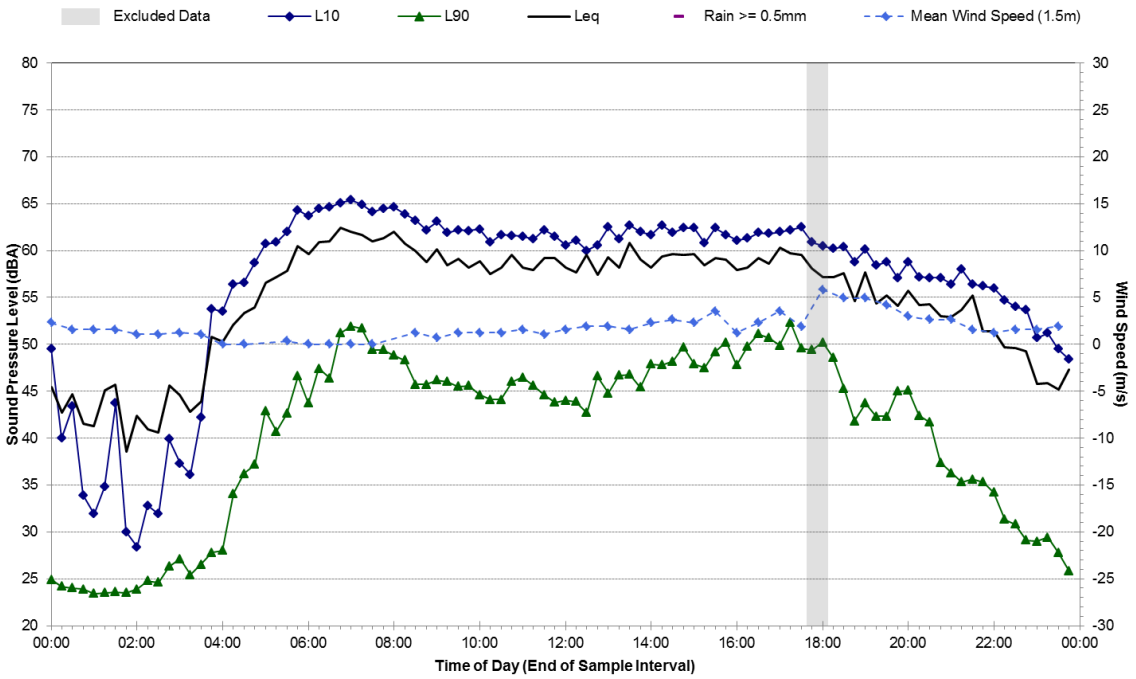
Statistical Ambient Noise Levels

222 Southern Cross Drive - Monday, December 16, 2013



Statistical Ambient Noise Levels

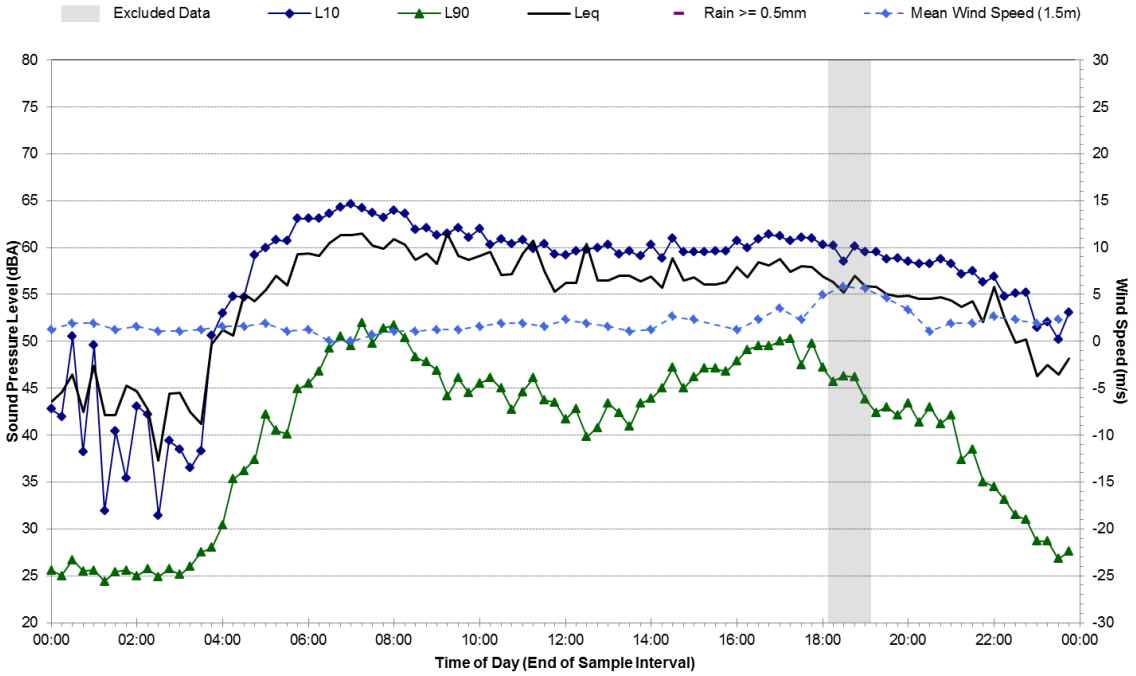
222 Southern Cross Drive - Tuesday, December 17, 2013



Noise Monitoring Charts – Location 4 - 222 Southern Cross Drive

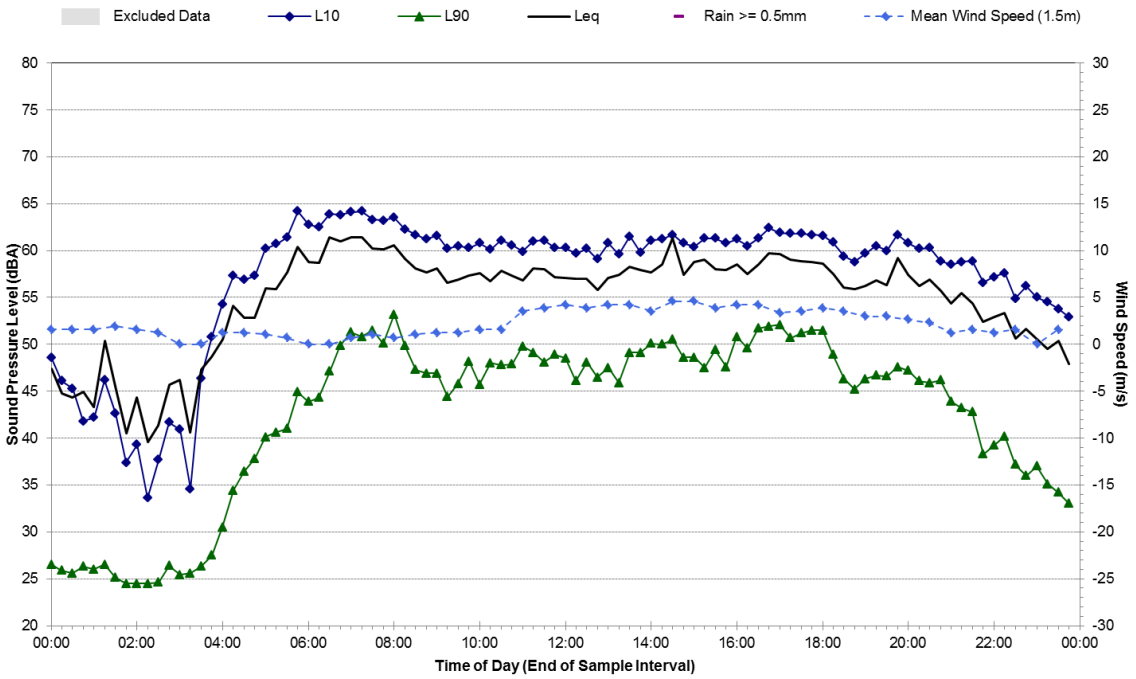
Statistical Ambient Noise Levels

222 Southern Cross Drive - Wednesday, December 18, 2013



Statistical Ambient Noise Levels

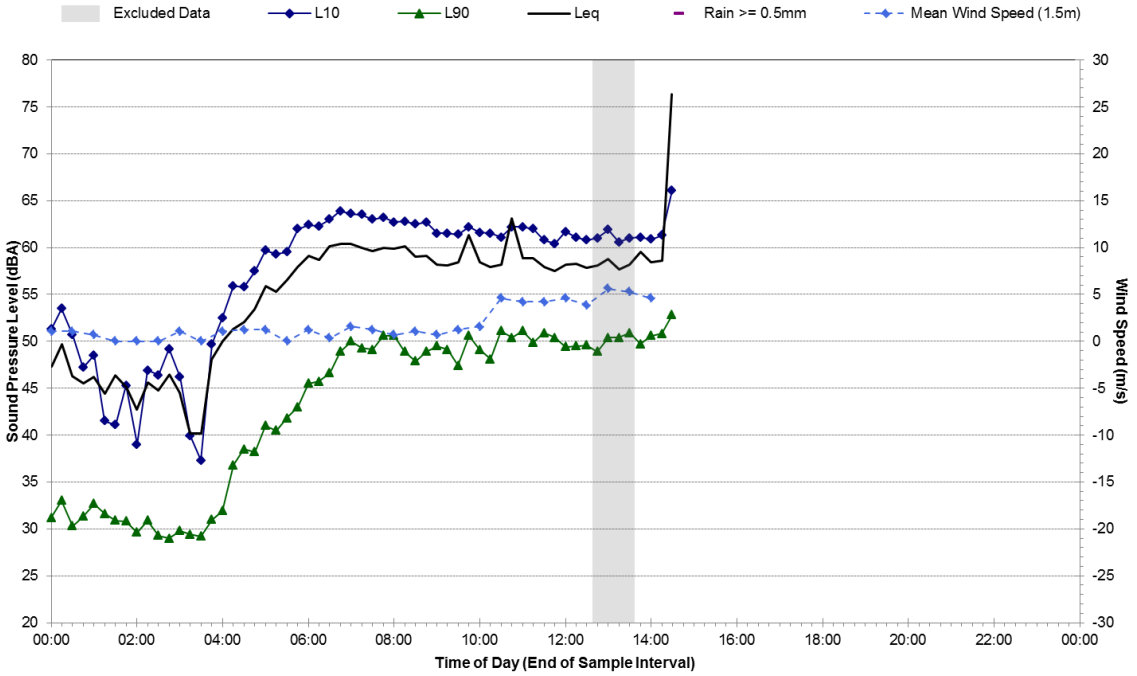
222 Southern Cross Drive - Thursday, December 19, 2013



Noise Monitoring Charts – Location 4 - 222 Southern Cross Drive

Statistical Ambient Noise Levels

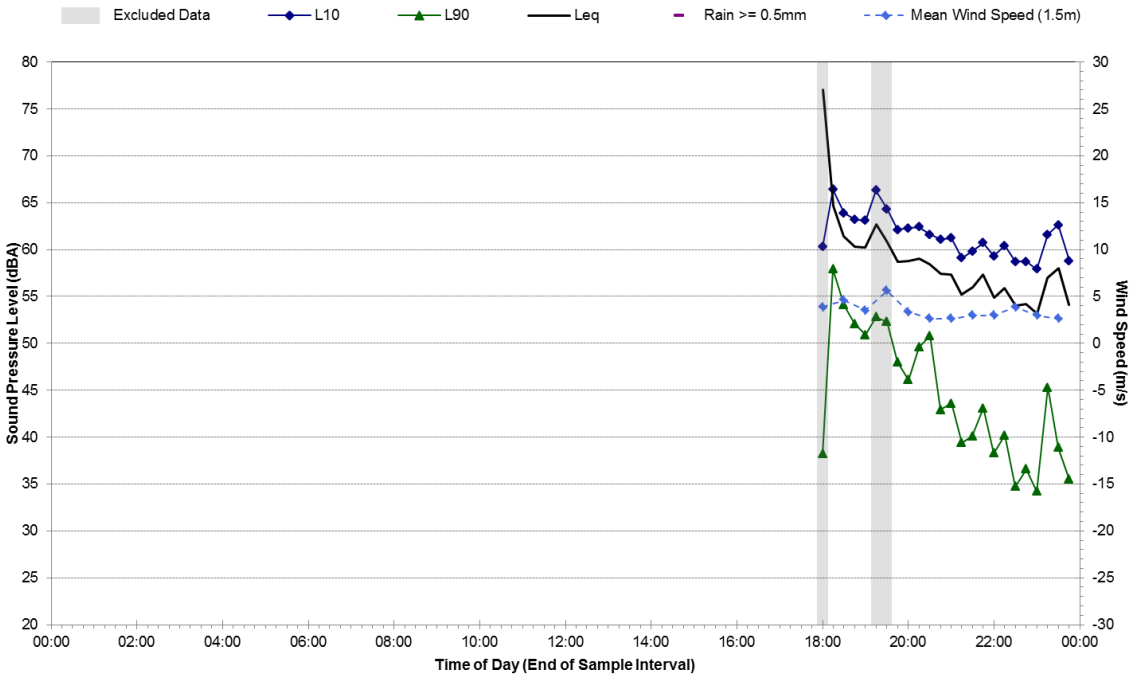
222 Southern Cross Drive - Friday, December 20, 2013



Noise Monitoring Charts – Location 5 - Public Land outside 39 Buckmaster Crescent

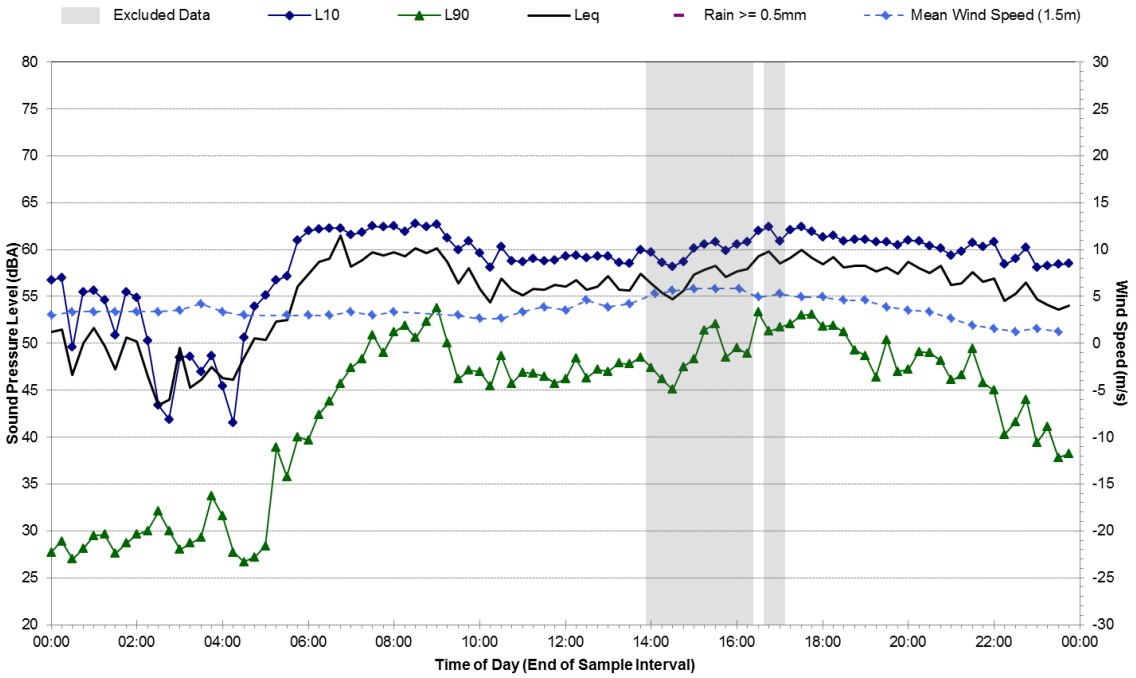
Statistical Ambient Noise Levels

Public Land outside 39 Buckmaster Crescent - Thursday, December 05, 2013



Statistical Ambient Noise Levels

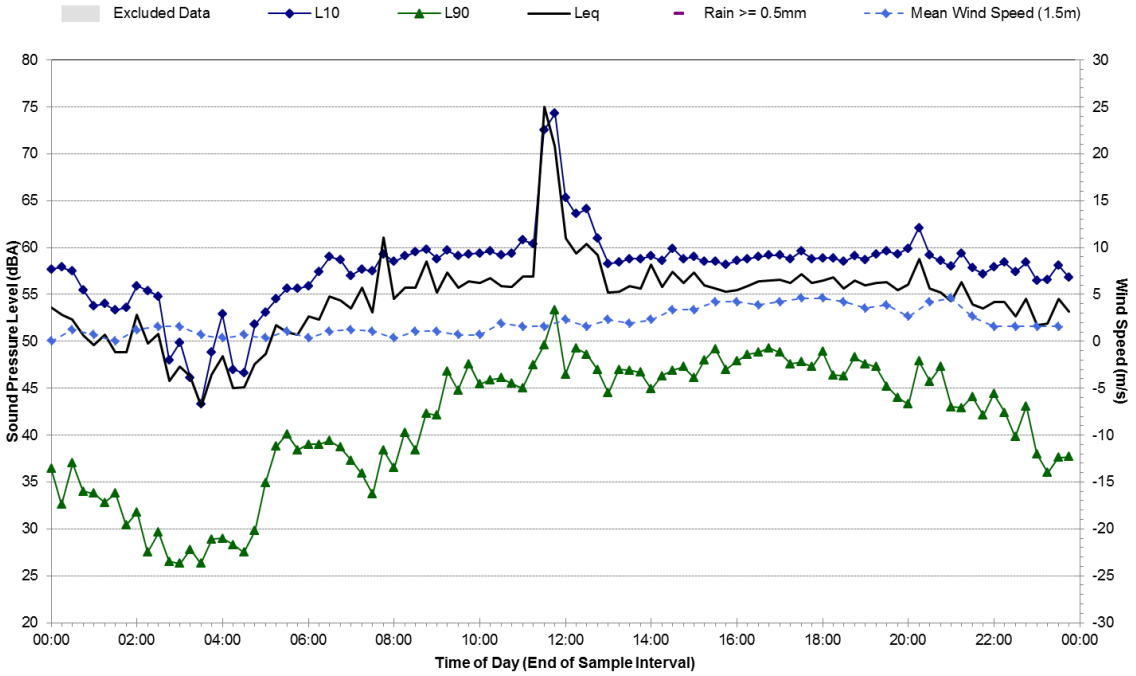
Public Land outside 39 Buckmaster Crescent - Friday, December 06, 2013



Noise Monitoring Charts – Location 5 - Public Land outside 39 Buckmaster Crescent

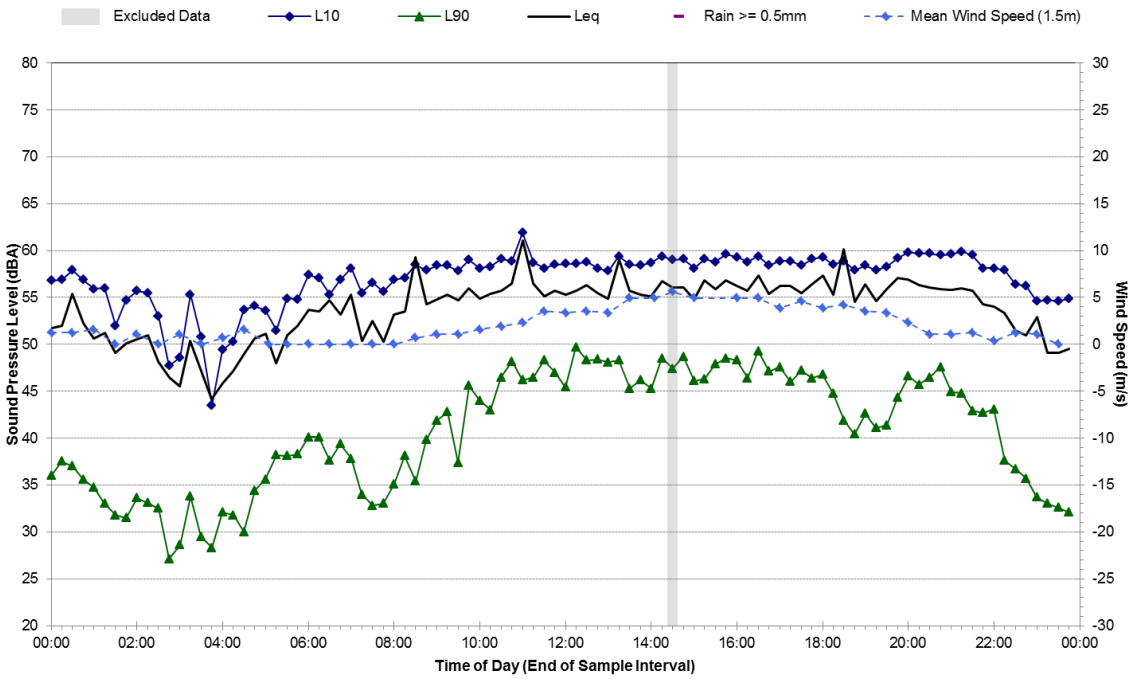
Statistical Ambient Noise Levels

Public Land outside 39 Buckmaster Crescent - Saturday, December 07, 2013



Statistical Ambient Noise Levels

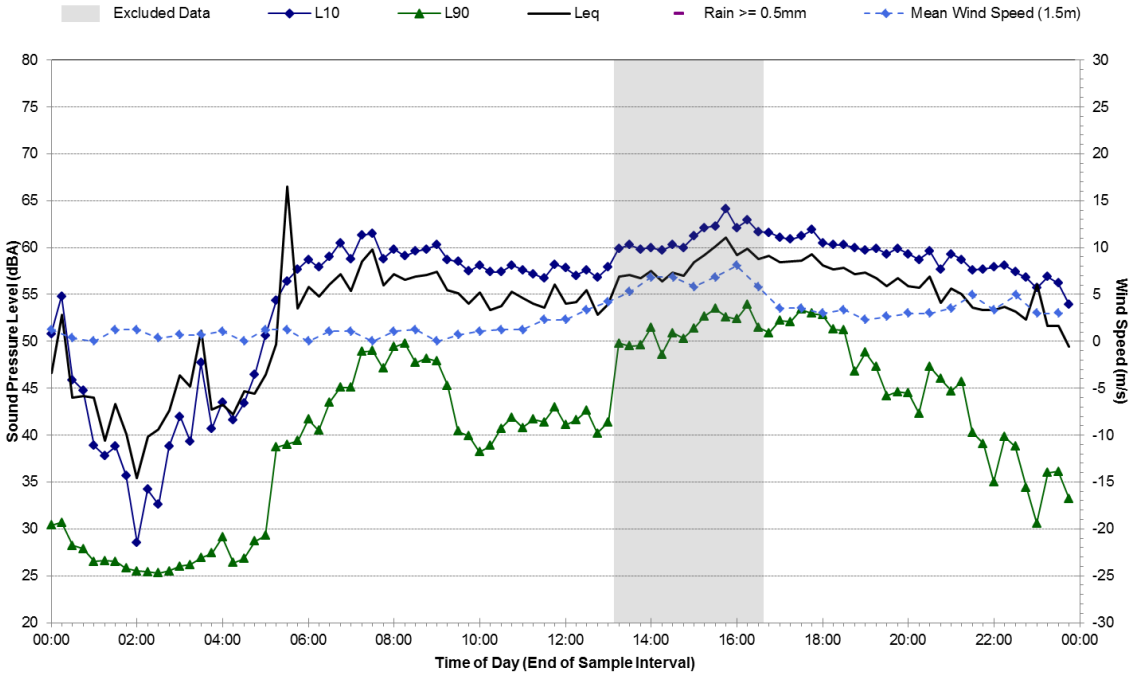
Public Land outside 39 Buckmaster Crescent - Sunday, December 08, 2013



Noise Monitoring Charts – Location 5 - Public Land outside 39 Buckmaster Crescent

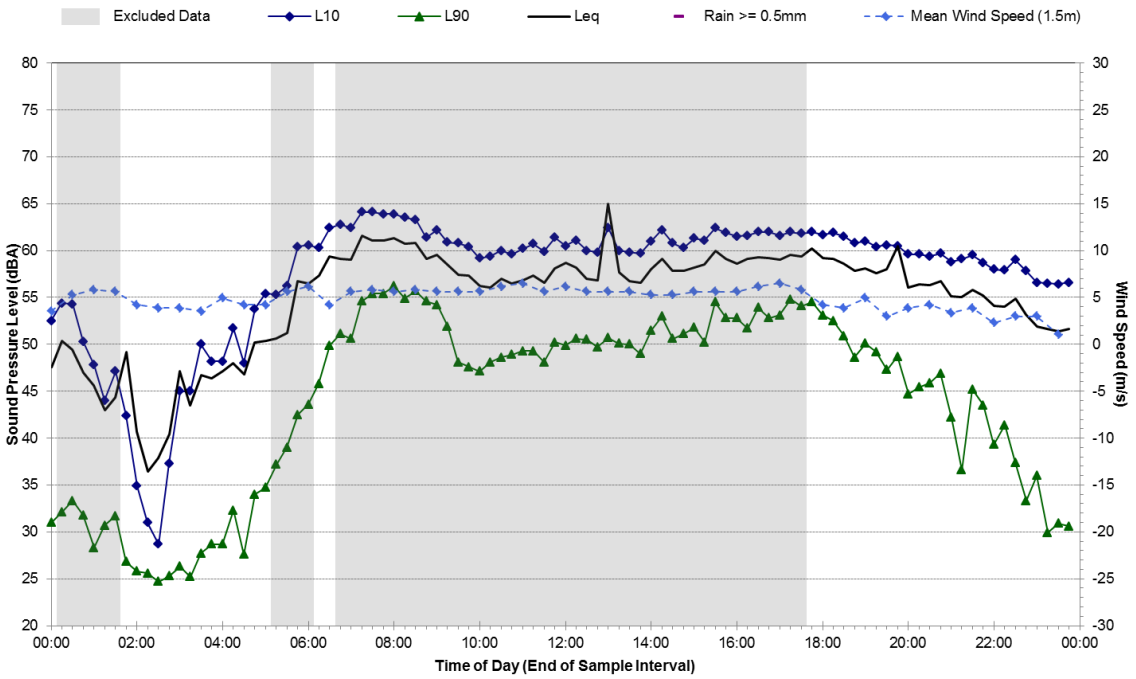
Statistical Ambient Noise Levels

Public Land outside 39 Buckmaster Crescent - Monday, December 09, 2013



Statistical Ambient Noise Levels

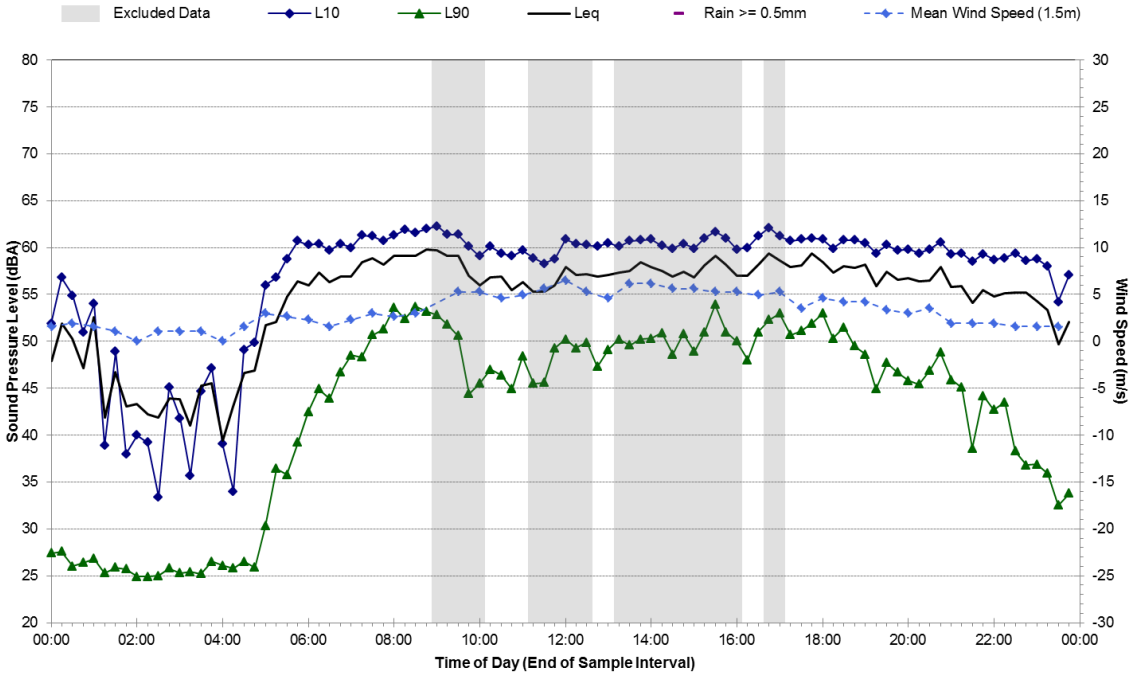
Public Land outside 39 Buckmaster Crescent - Tuesday, December 10, 2013



Noise Monitoring Charts – Location 5 - Public Land outside 39 Buckmaster Crescent

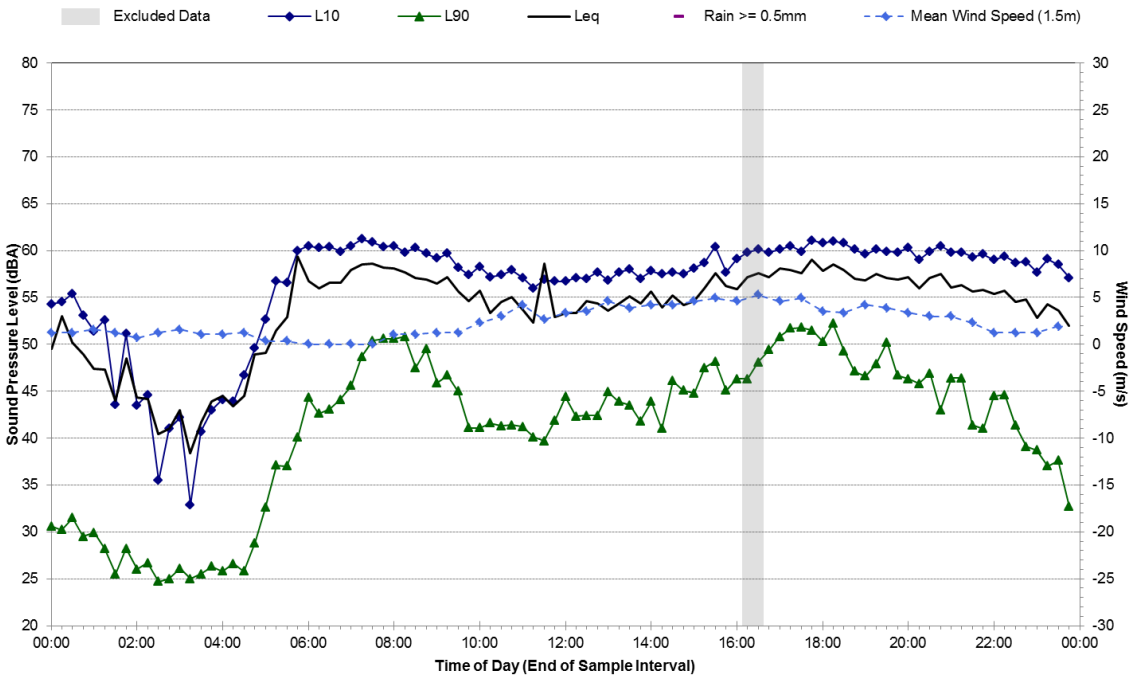
Statistical Ambient Noise Levels

Public Land outside 39 Buckmaster Crescent - Wednesday, December 11, 2013



Statistical Ambient Noise Levels

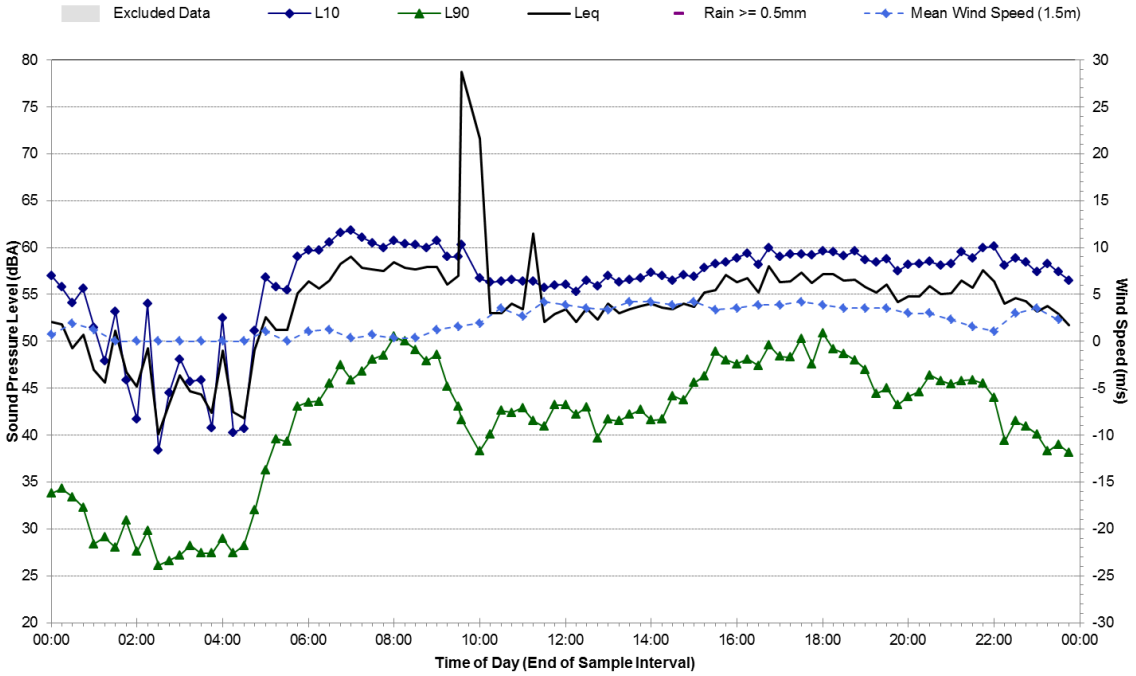
Public Land outside 39 Buckmaster Crescent - Thursday, December 12, 2013



Noise Monitoring Charts – Location 5 - Public Land outside 39 Buckmaster Crescent

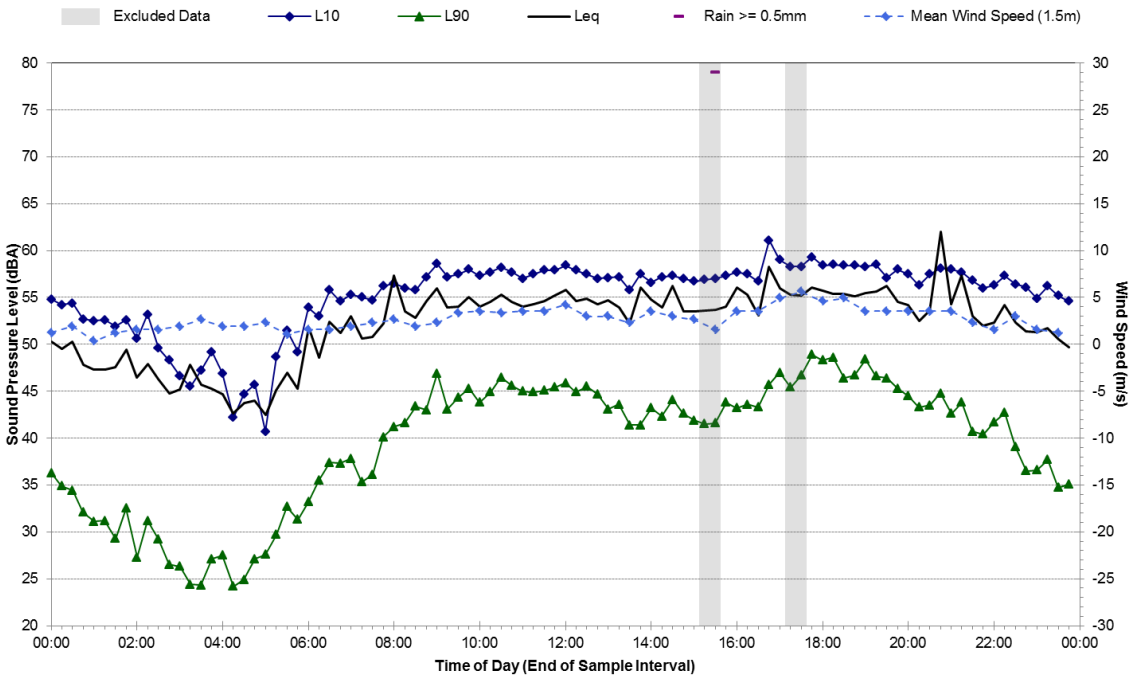
Statistical Ambient Noise Levels

Public Land outside 39 Buckmaster Crescent - Friday, December 13, 2013



Statistical Ambient Noise Levels

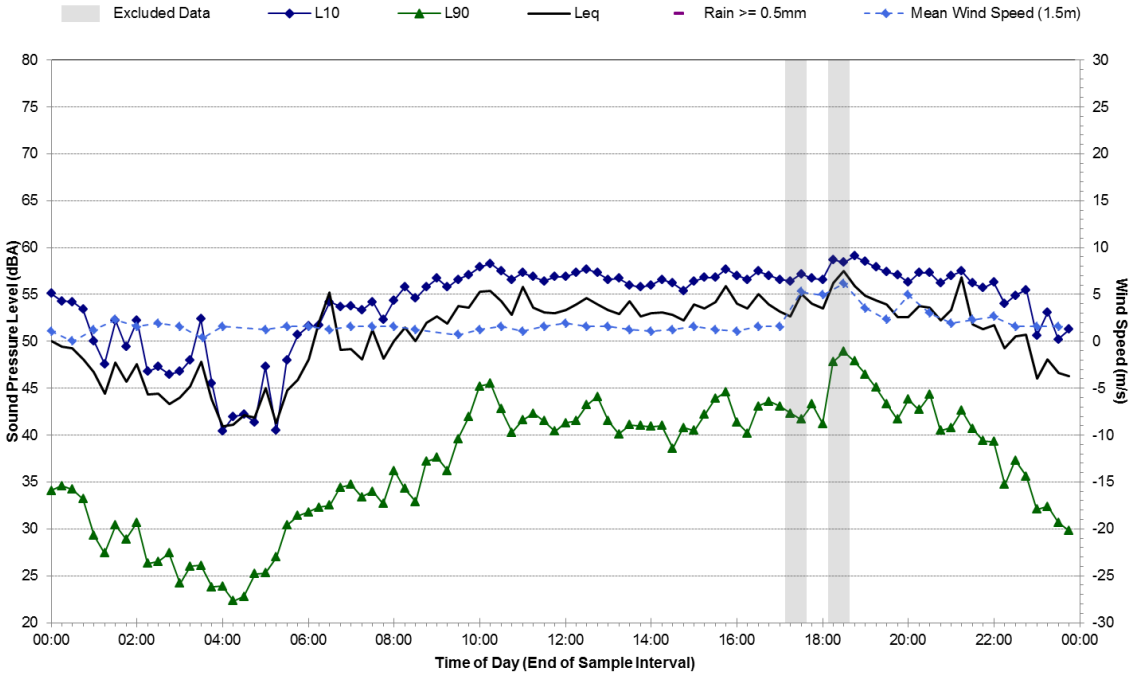
Public Land outside 39 Buckmaster Crescent - Saturday, December 14, 2013



Noise Monitoring Charts – Location 5 - Public Land outside 39 Buckmaster Crescent

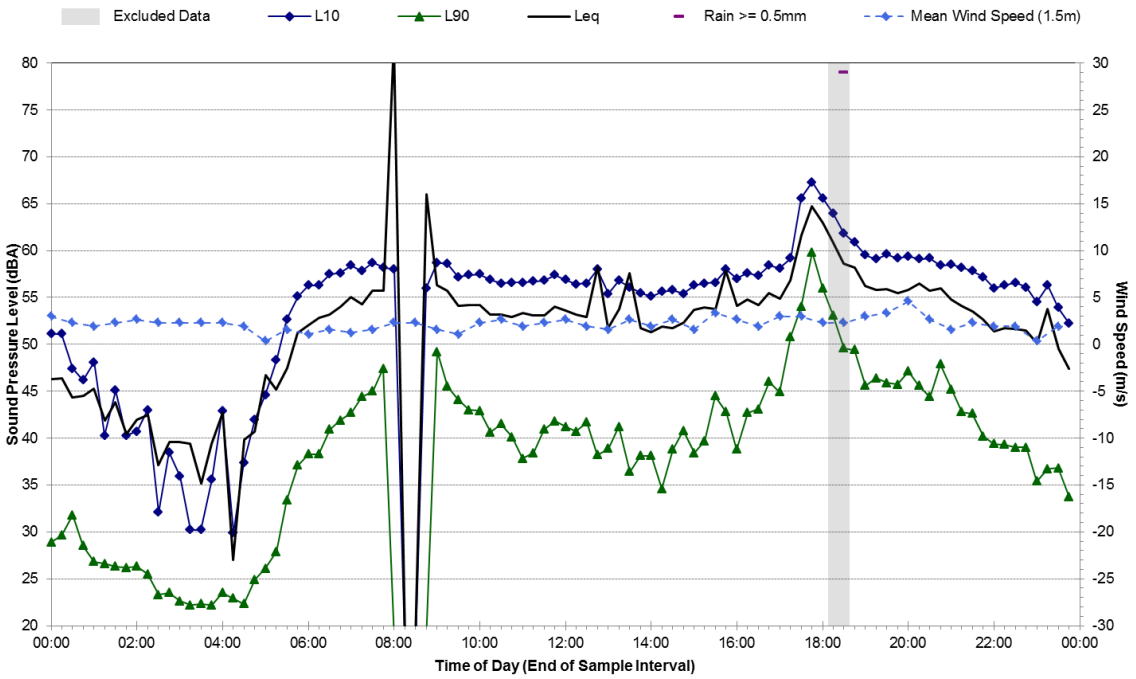
Statistical Ambient Noise Levels

Public Land outside 39 Buckmaster Crescent - Sunday, December 15, 2013



Statistical Ambient Noise Levels

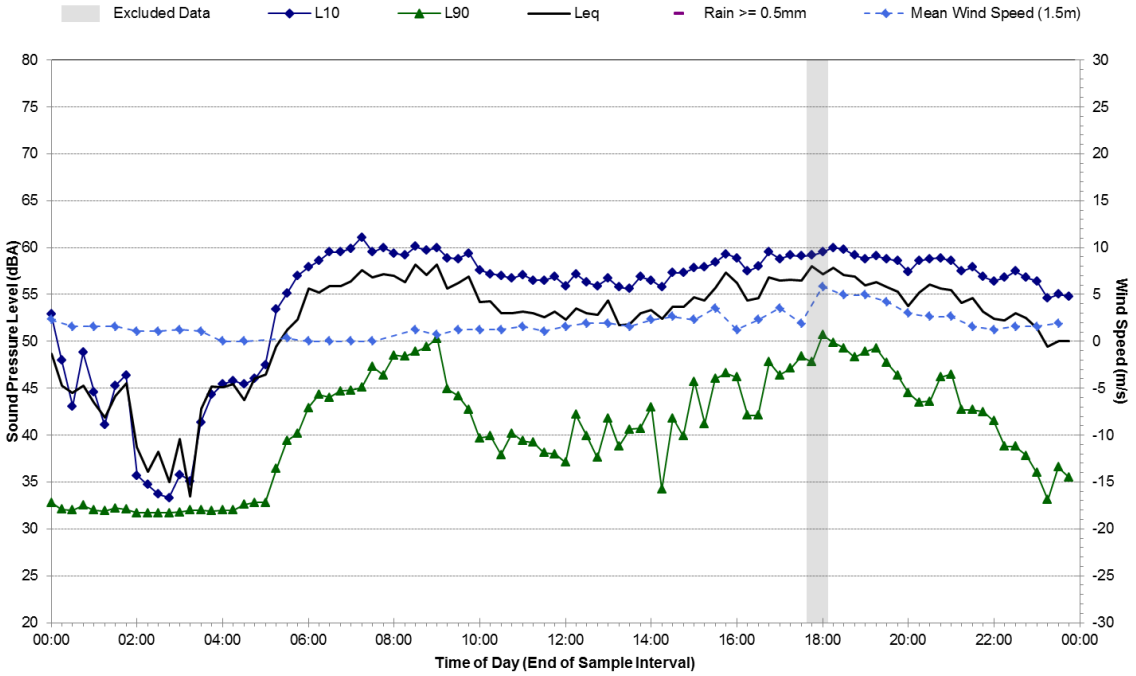
Public Land outside 39 Buckmaster Crescent - Monday, December 16, 2013



Noise Monitoring Charts – Location 5 - Public Land outside 39 Buckmaster Crescent

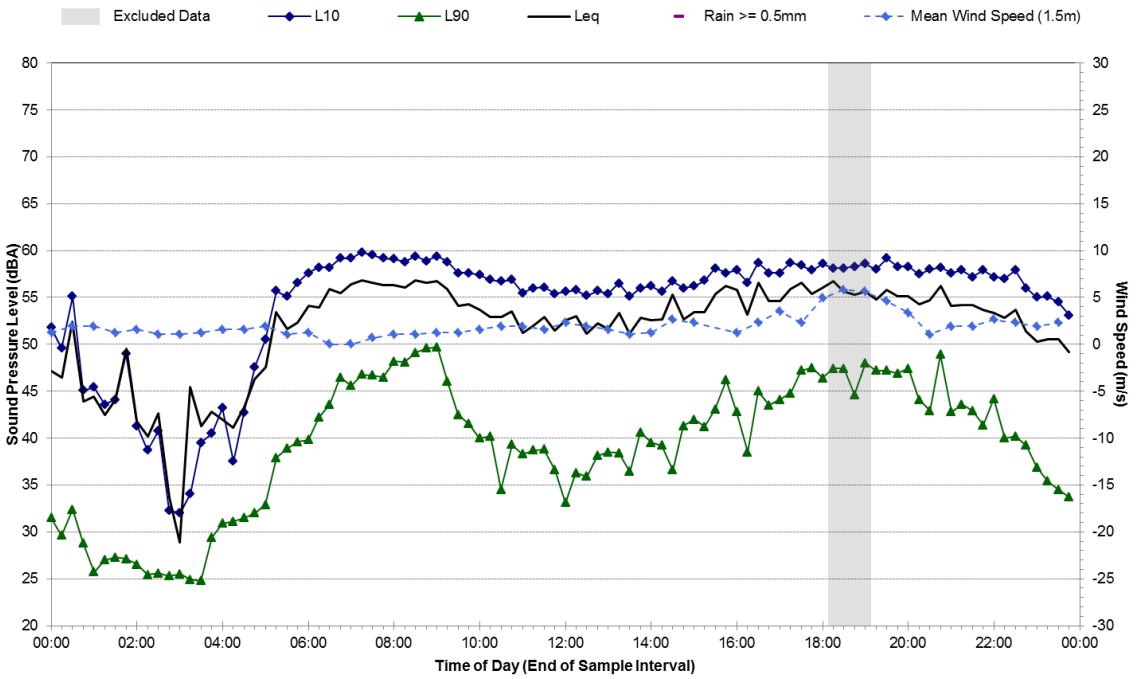
Statistical Ambient Noise Levels

Public Land outside 39 Buckmaster Crescent - Tuesday, December 17, 2013



Statistical Ambient Noise Levels

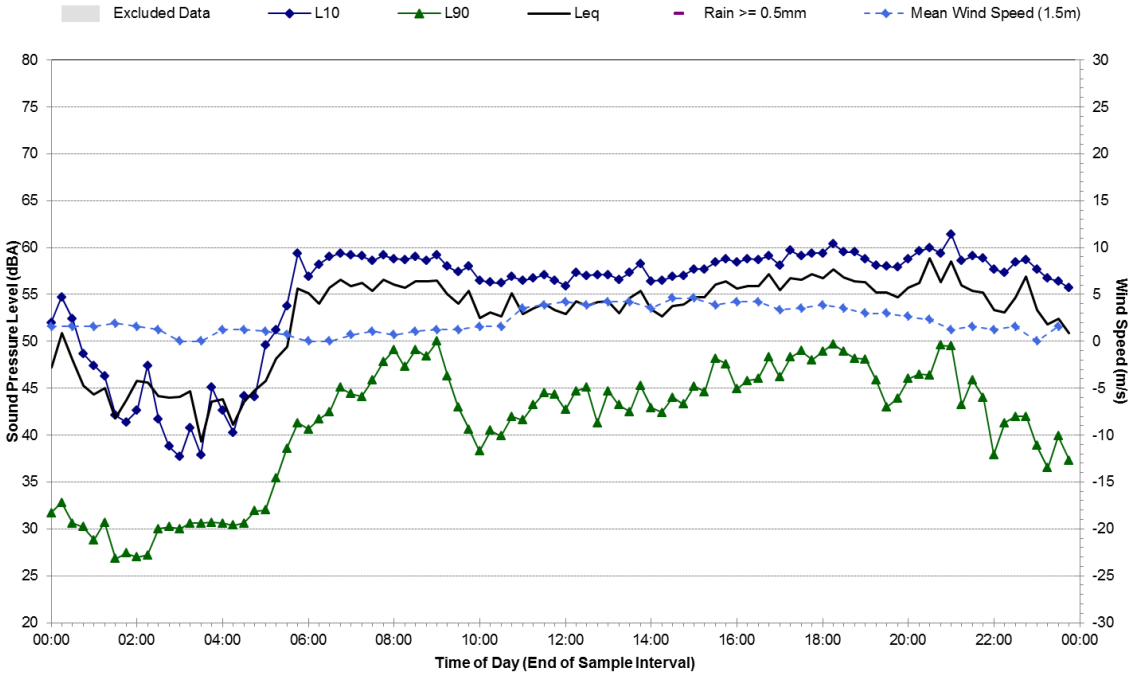
Public Land outside 39 Buckmaster Crescent - Wednesday, December 18, 2013



Noise Monitoring Charts – Location 5 - Public Land outside 39 Buckmaster Crescent

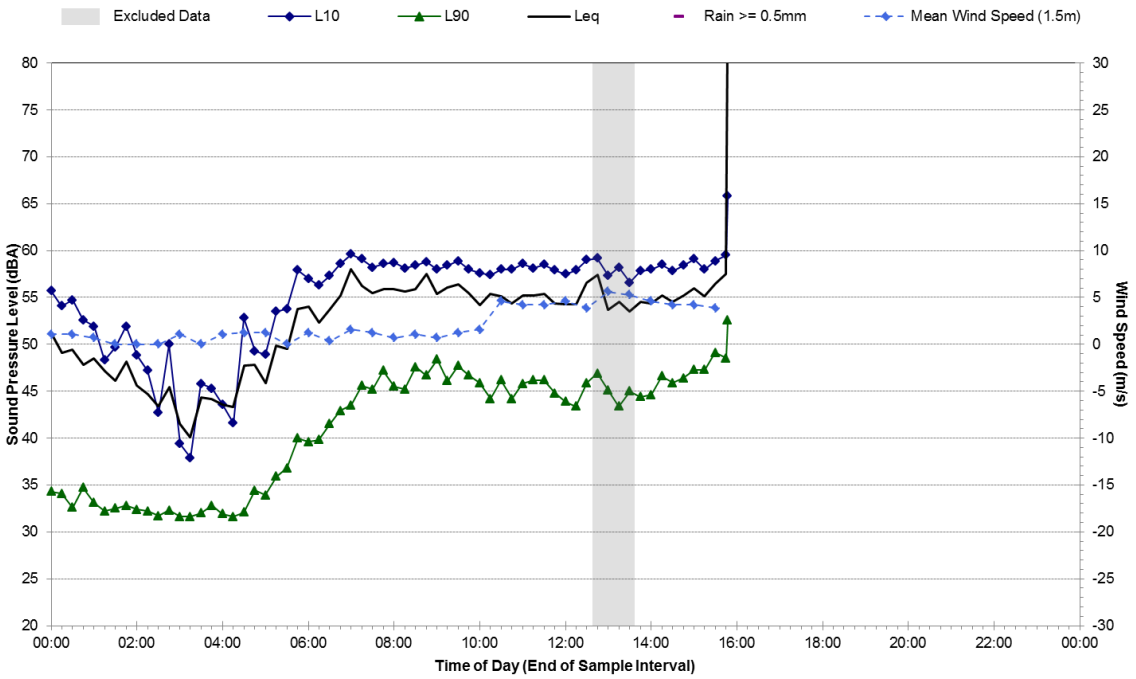
Statistical Ambient Noise Levels

Public Land outside 39 Buckmaster Crescent - Thursday, December 19, 2013



Statistical Ambient Noise Levels

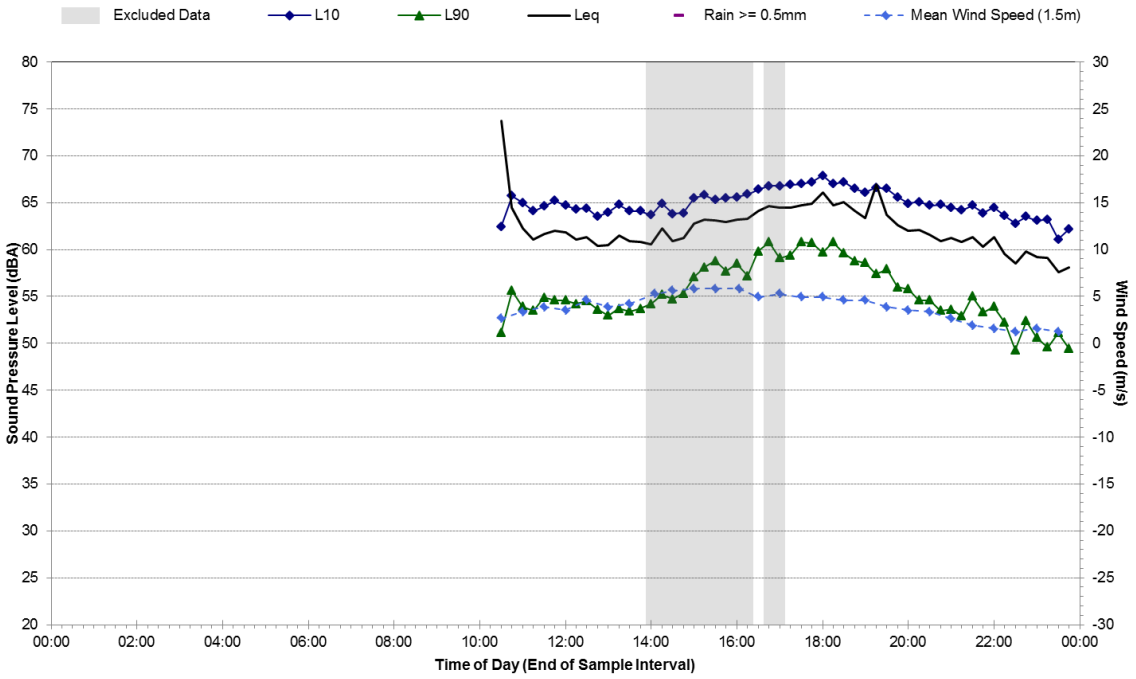
Public Land outside 39 Buckmaster Crescent - Friday, December 20, 2013



Noise Monitoring Charts – Location 6 - Public Land outside 14 Dobinson Place

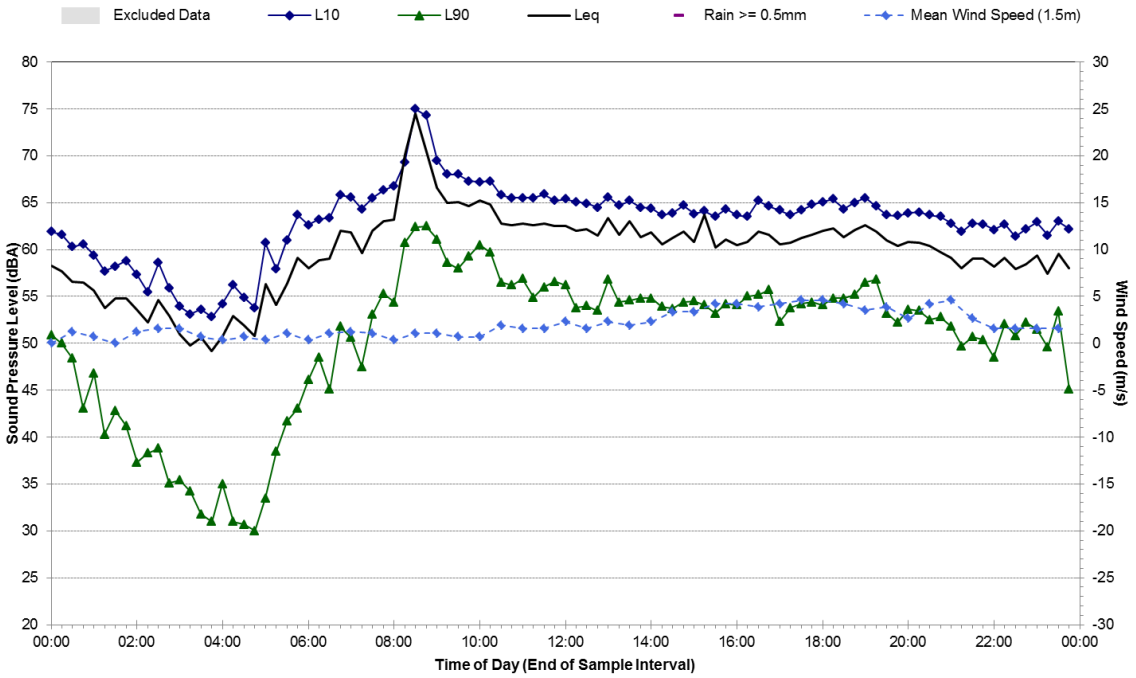
Statistical Ambient Noise Levels

Public Land outside 14 Dobinson Place - Friday, December 06, 2013



Statistical Ambient Noise Levels

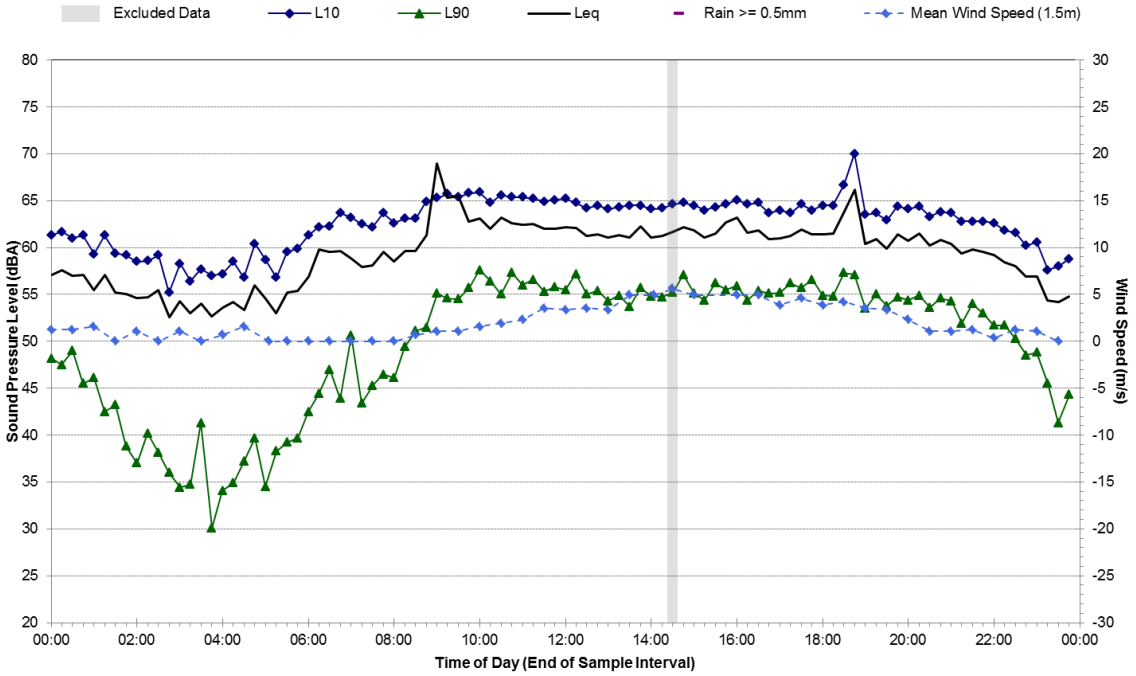
Public Land outside 14 Dobinson Place - Saturday, December 07, 2013



Noise Monitoring Charts – Location 6 - Public Land outside 14 Dobinson Place

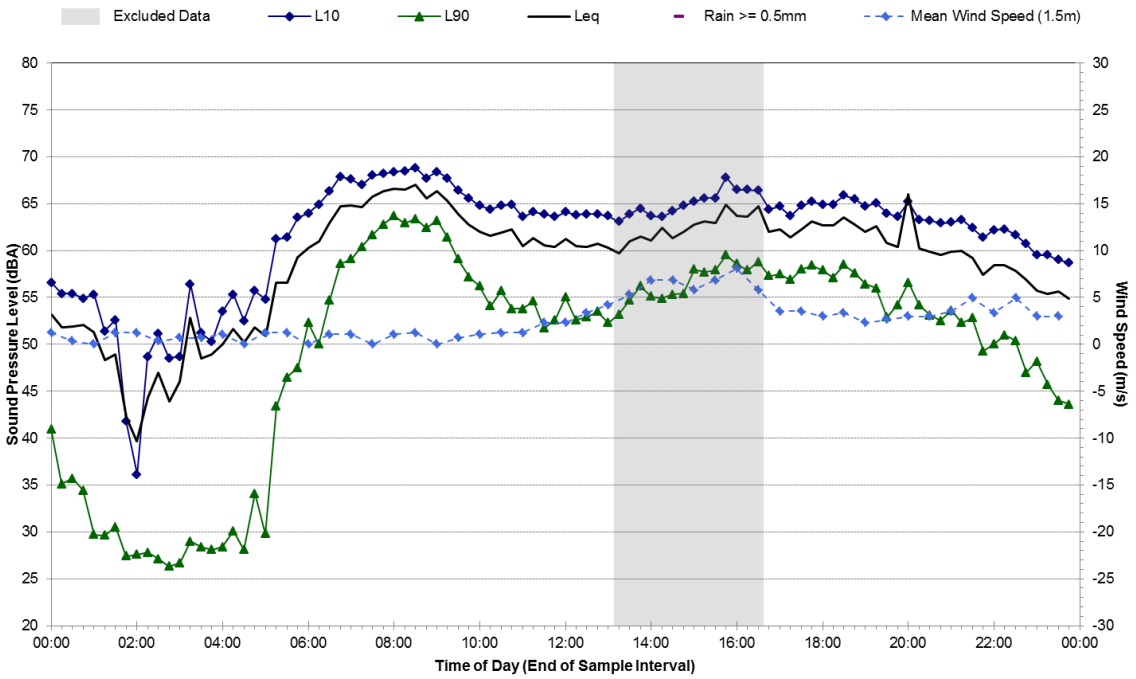
Statistical Ambient Noise Levels

Public Land outside 14 Dobinson Place - Sunday, December 08, 2013



Statistical Ambient Noise Levels

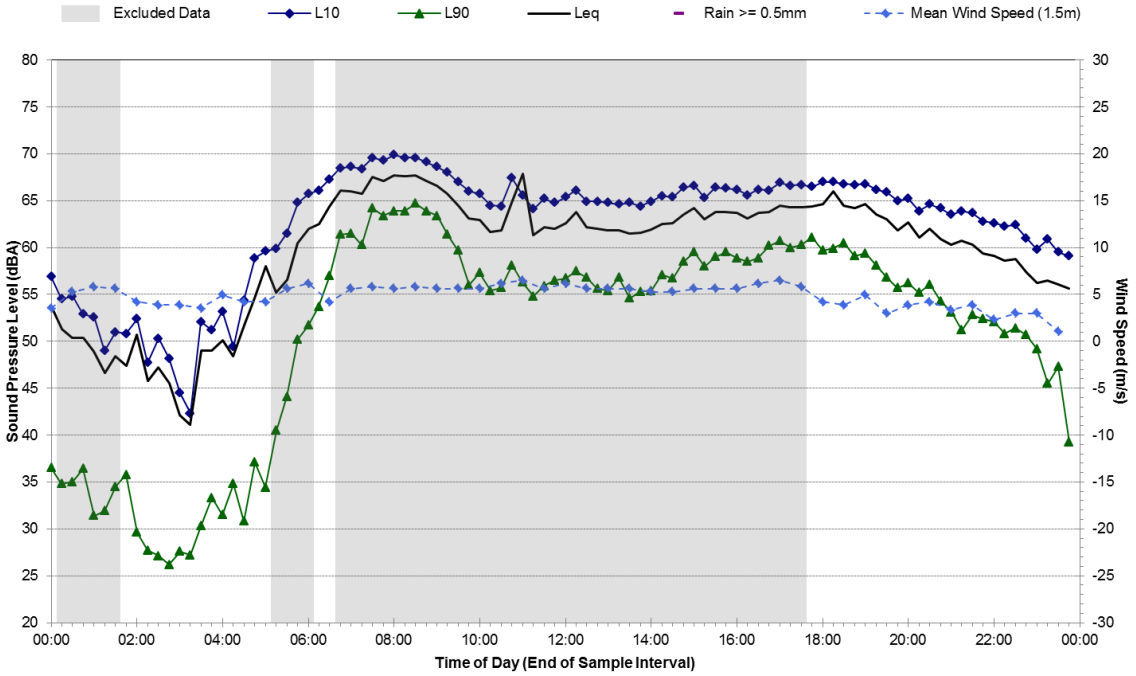
Public Land outside 14 Dobinson Place - Monday, December 09, 2013



Noise Monitoring Charts – Location 6 - Public Land outside 14 Dobinson Place

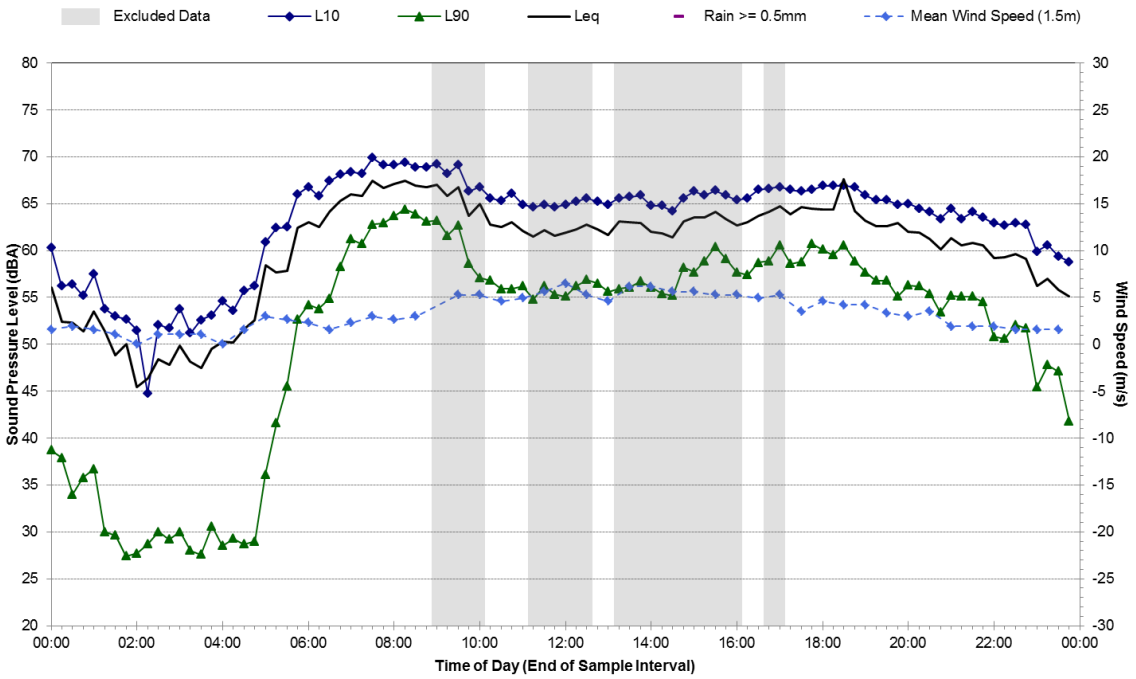
Statistical Ambient Noise Levels

Public Land outside 14 Dobinson Place - Tuesday, December 10, 2013



Statistical Ambient Noise Levels

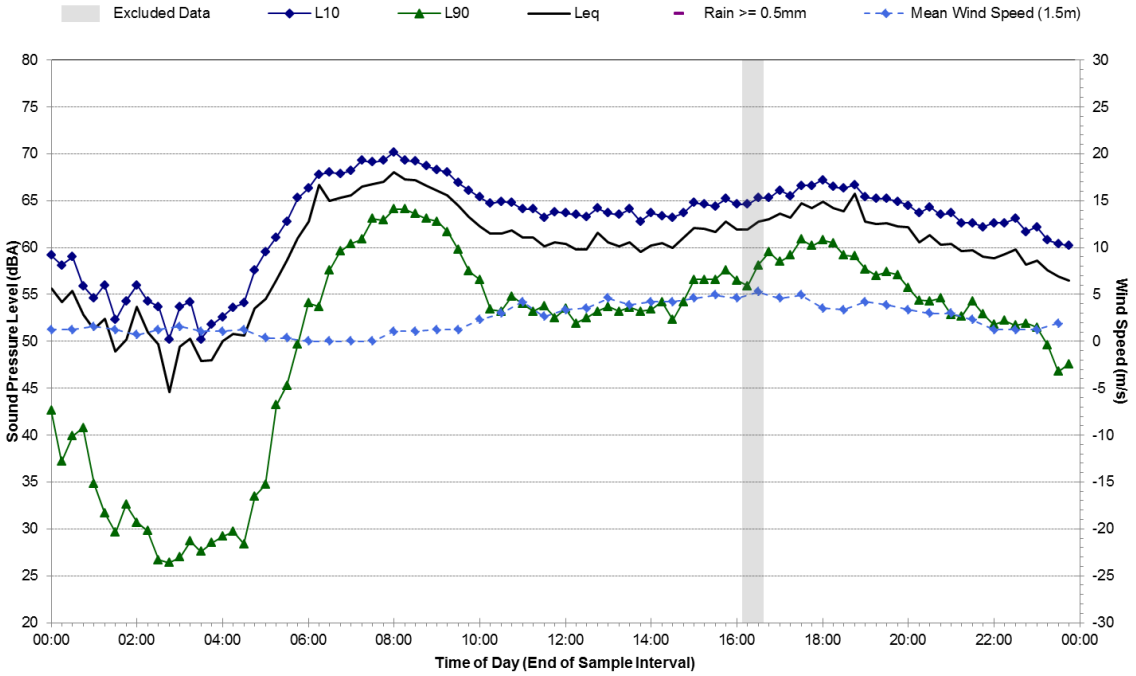
Public Land outside 14 Dobinson Place - Wednesday, December 11, 2013



Noise Monitoring Charts – Location 6 - Public Land outside 14 Dobinson Place

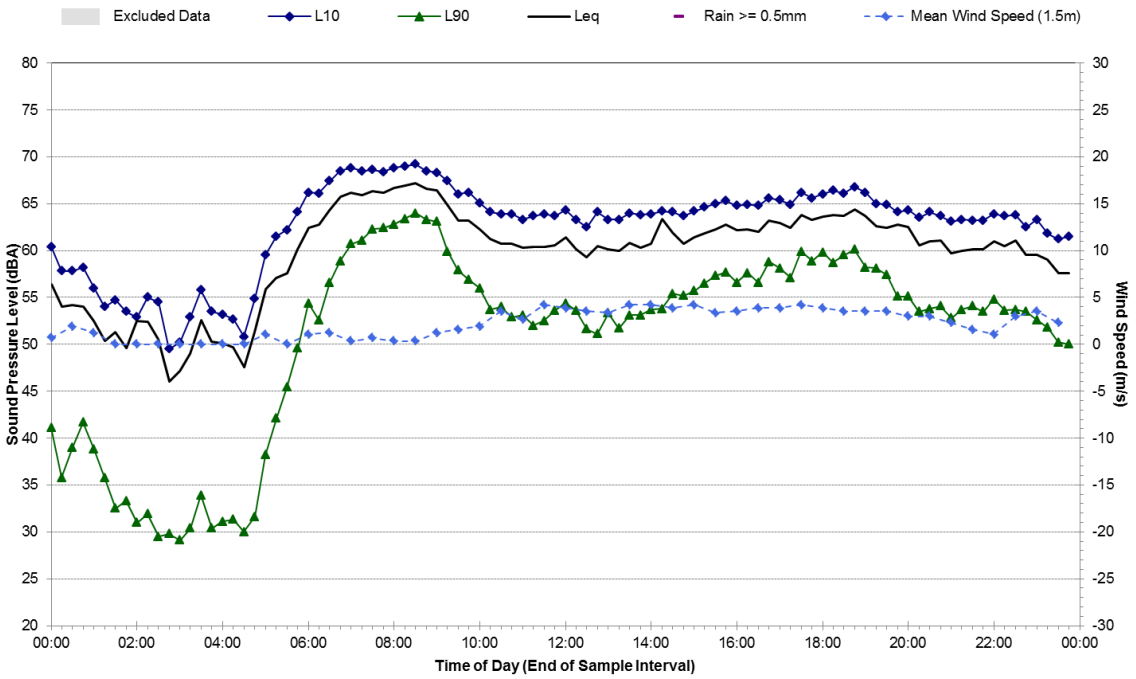
Statistical Ambient Noise Levels

Public Land outside 14 Dobinson Place - Thursday, December 12, 2013



Statistical Ambient Noise Levels

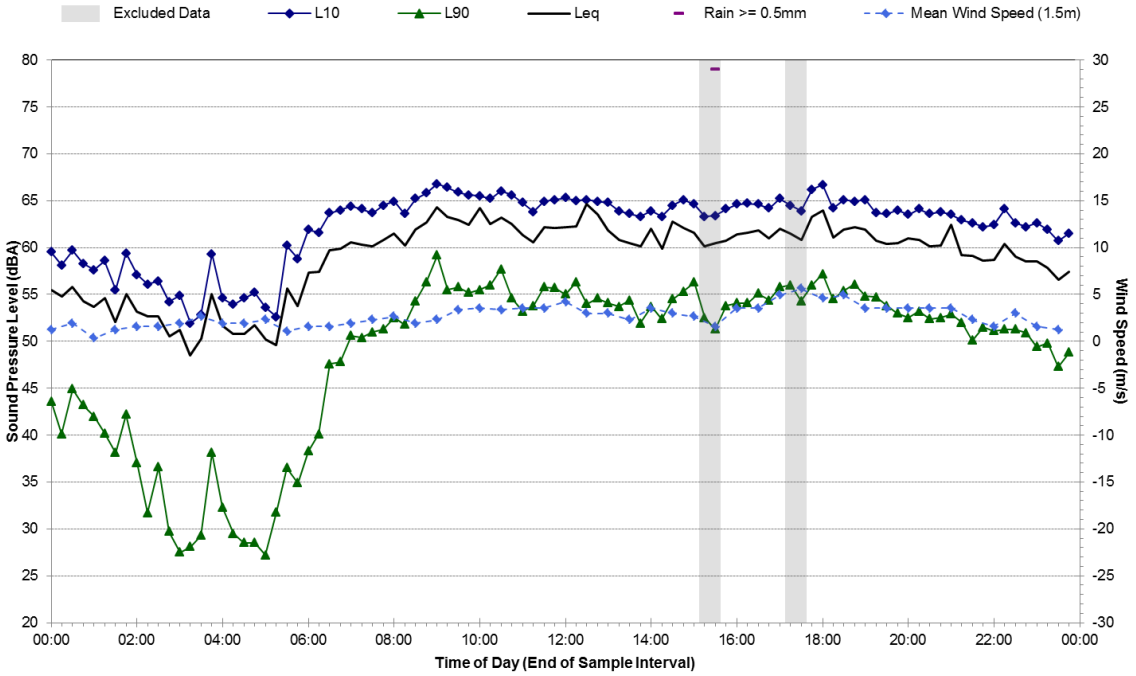
Public Land outside 14 Dobinson Place - Friday, December 13, 2013



Noise Monitoring Charts – Location 6 - Public Land outside 14 Dobinson Place

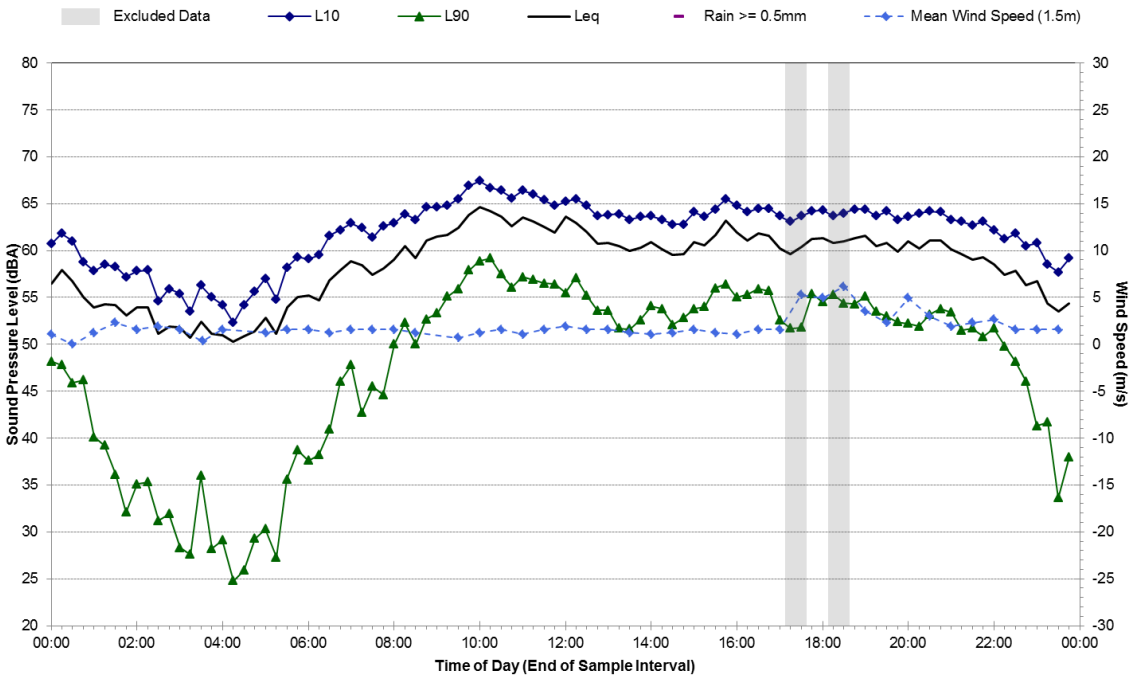
Statistical Ambient Noise Levels

Public Land outside 14 Dobinson Place - Saturday, December 14, 2013



Statistical Ambient Noise Levels

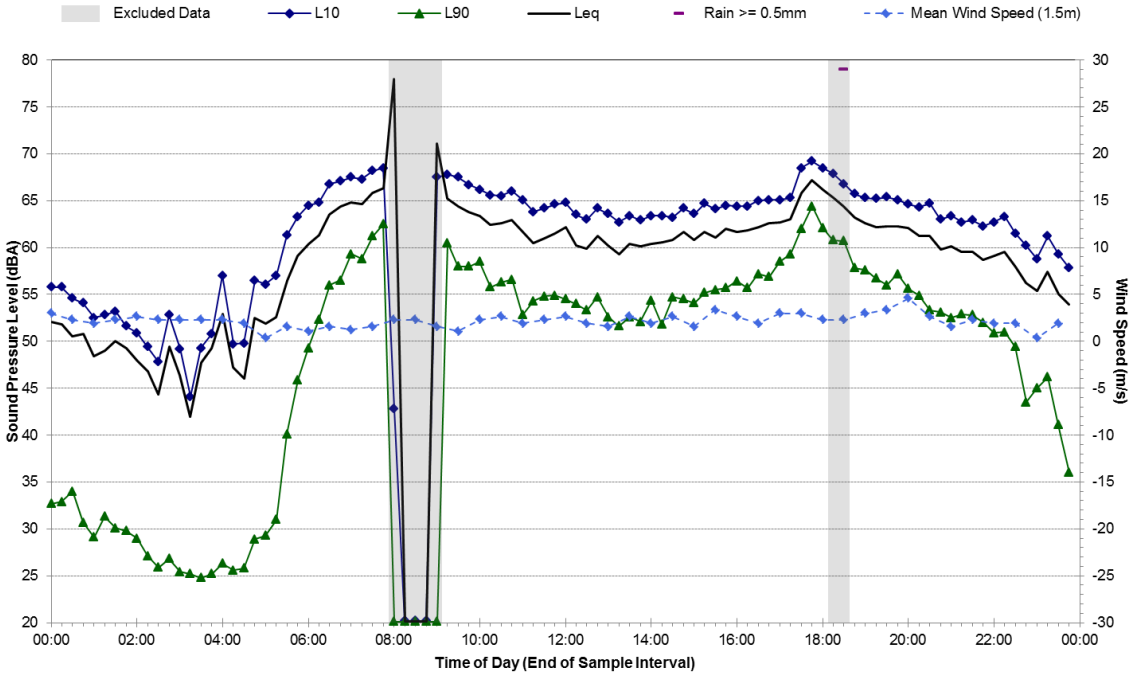
Public Land outside 14 Dobinson Place - Sunday, December 15, 2013



Noise Monitoring Charts – Location 6 - Public Land outside 14 Dobinson Place

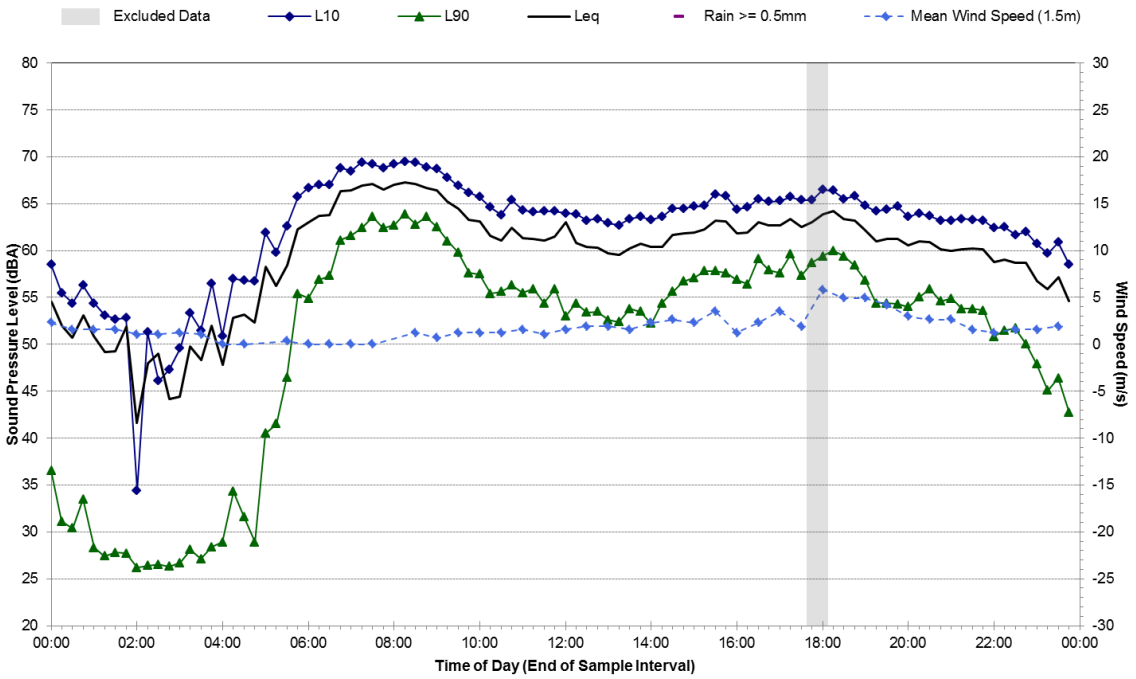
Statistical Ambient Noise Levels

Public Land outside 14 Dobinson Place - Monday, December 16, 2013



Statistical Ambient Noise Levels

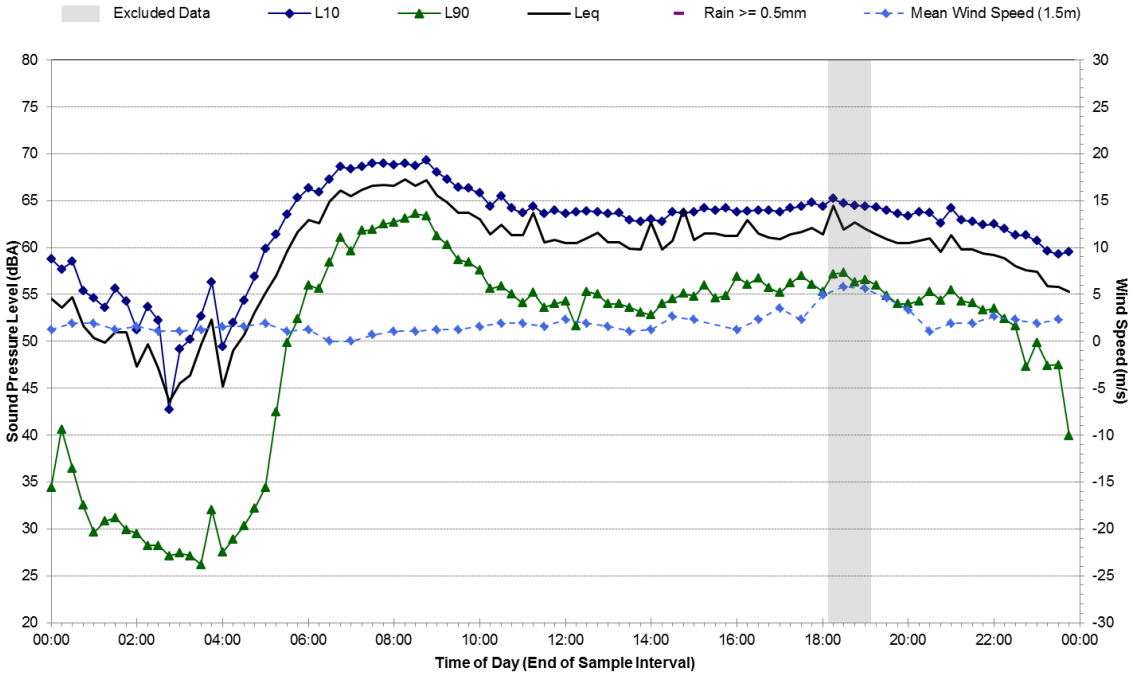
Public Land outside 14 Dobinson Place - Tuesday, December 17, 2013



Noise Monitoring Charts – Location 6 - Public Land outside 14 Dobinson Place

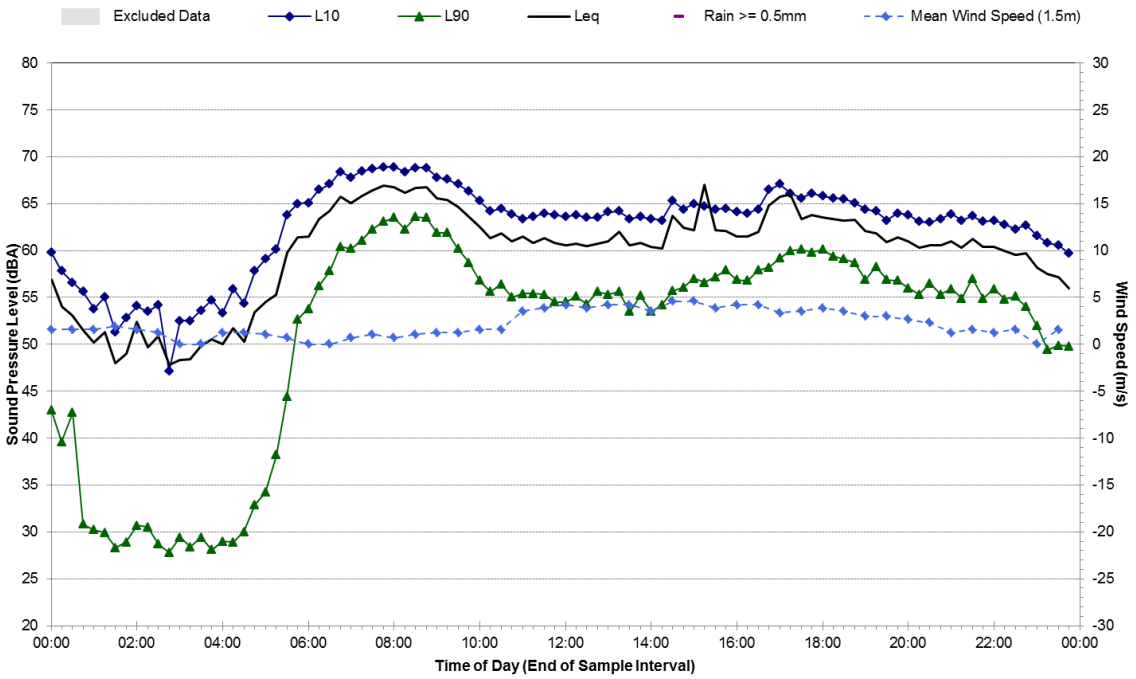
Statistical Ambient Noise Levels

Public Land outside 14 Dobinson Place - Wednesday, December 18, 2013



Statistical Ambient Noise Levels

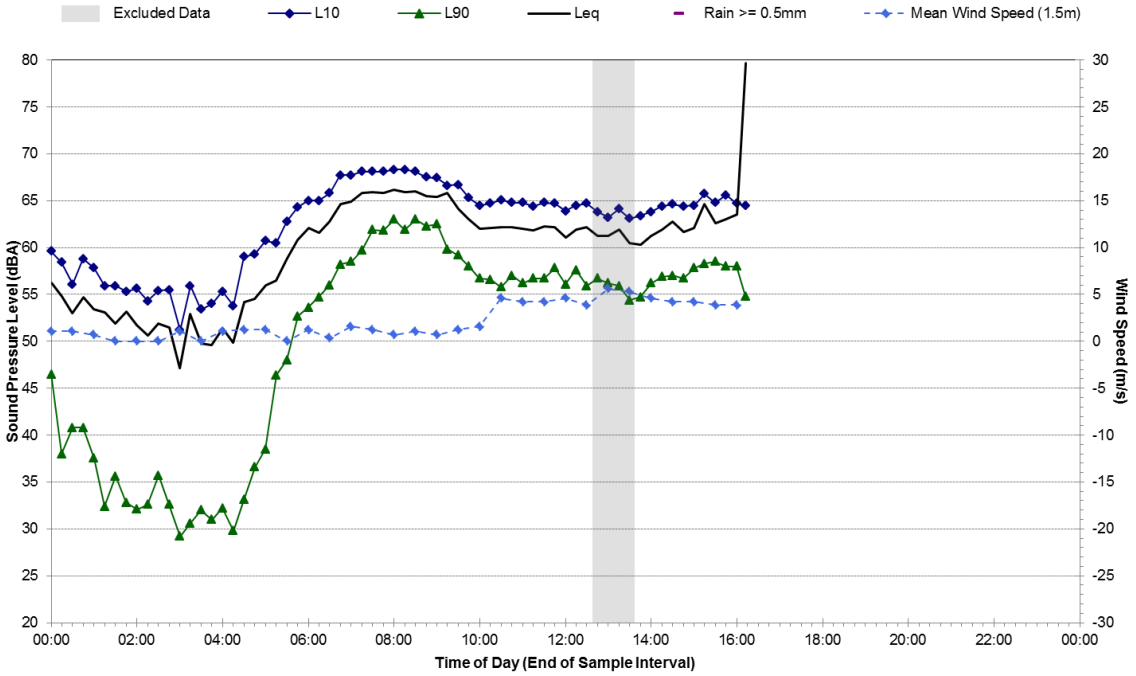
Public Land outside 14 Dobinson Place - Thursday, December 19, 2013



Noise Monitoring Charts – Location 6 - Public Land outside 14 Dobinson Place

Statistical Ambient Noise Levels

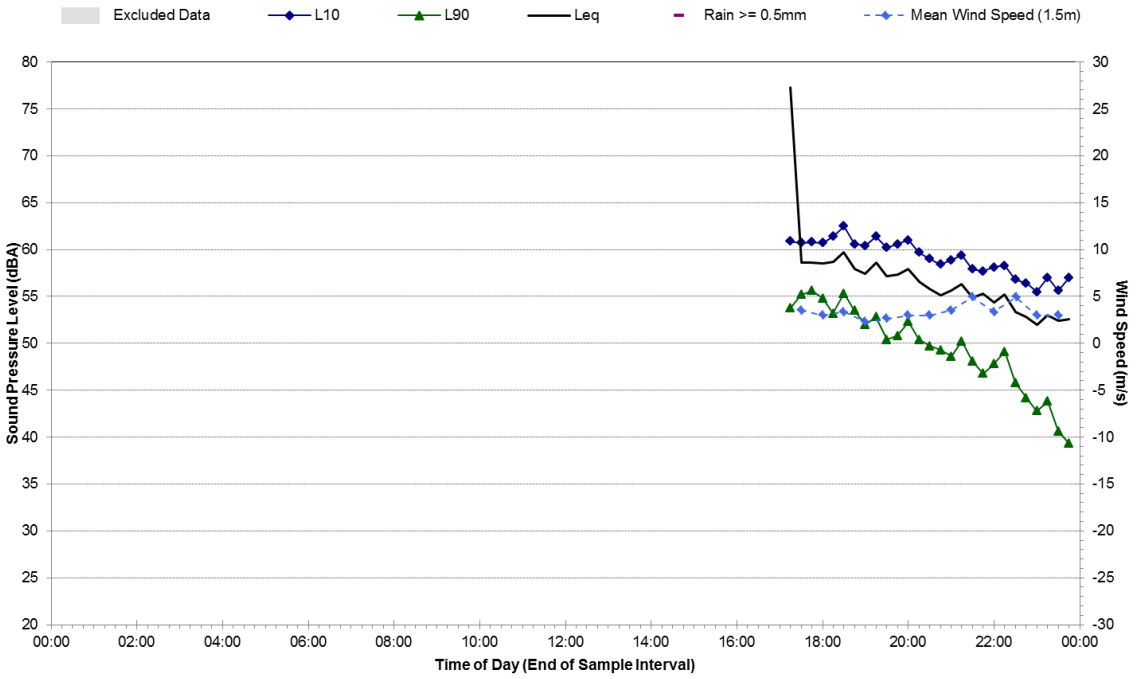
Public Land outside 14 Dobinson Place - Friday, December 20, 2013



Noise Monitoring Charts – Location 7 - Public Land outside 25 Ferguson Place

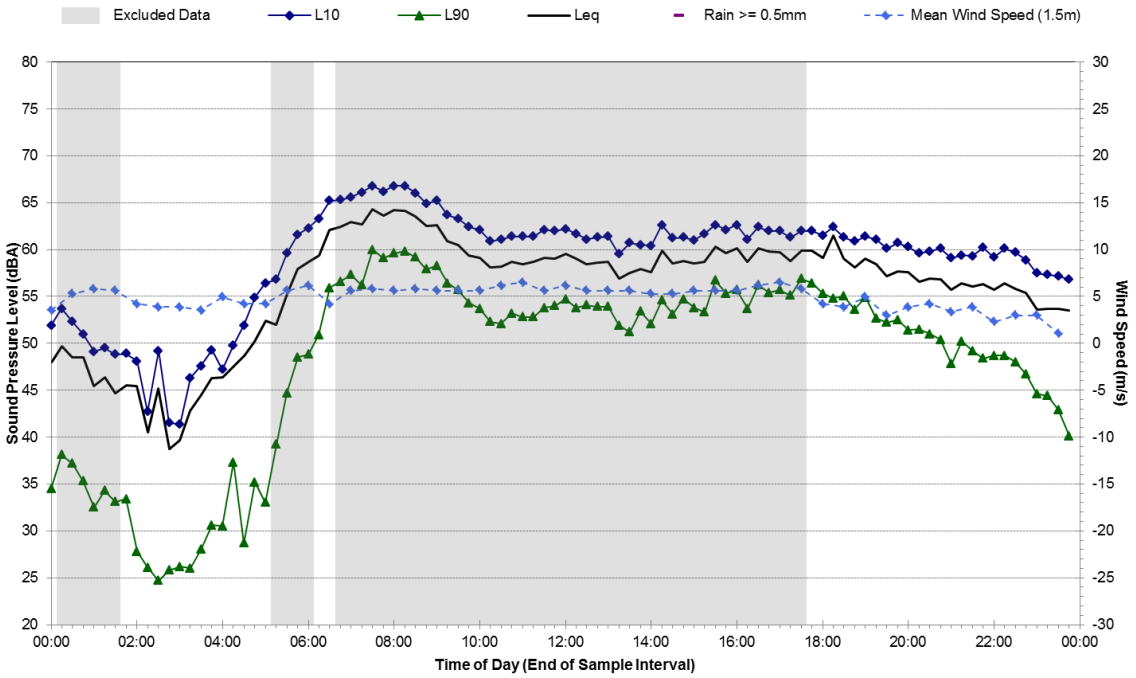
Statistical Ambient Noise Levels

Public Land outside 25 Ferguson Place - Monday, December 09, 2013



Statistical Ambient Noise Levels

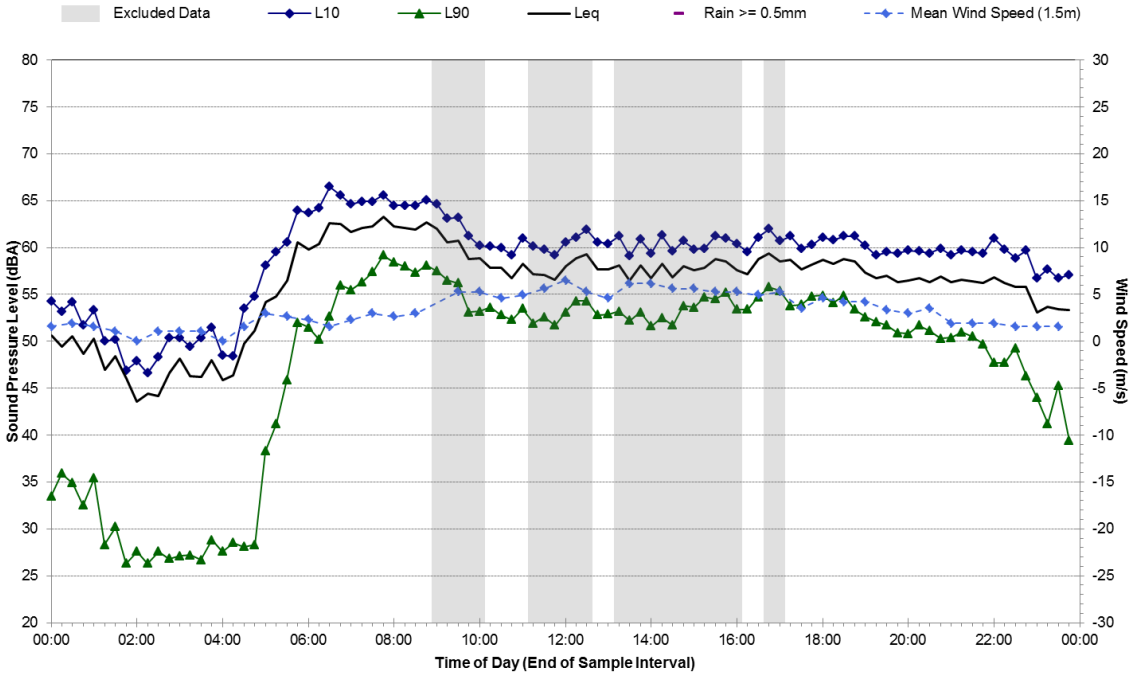
Public Land outside 25 Ferguson Place - Tuesday, December 10, 2013



Noise Monitoring Charts – Location 7 - Public Land outside 25 Ferguson Place

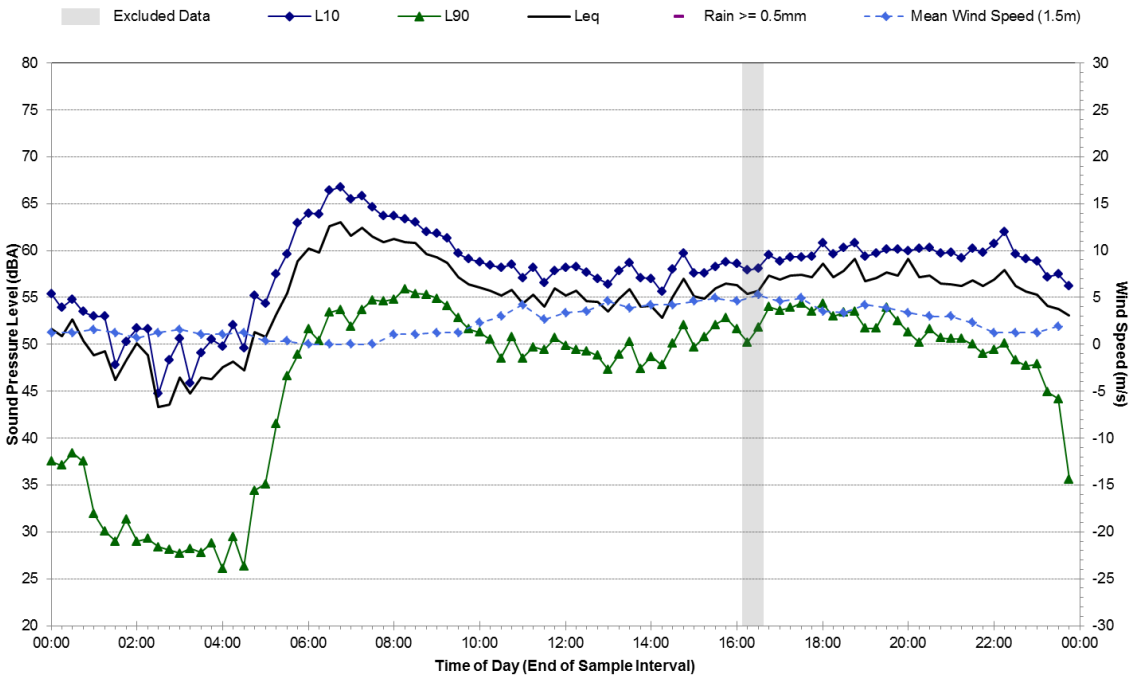
Statistical Ambient Noise Levels

Public Land outside 25 Ferguson Place - Wednesday, December 11, 2013



Statistical Ambient Noise Levels

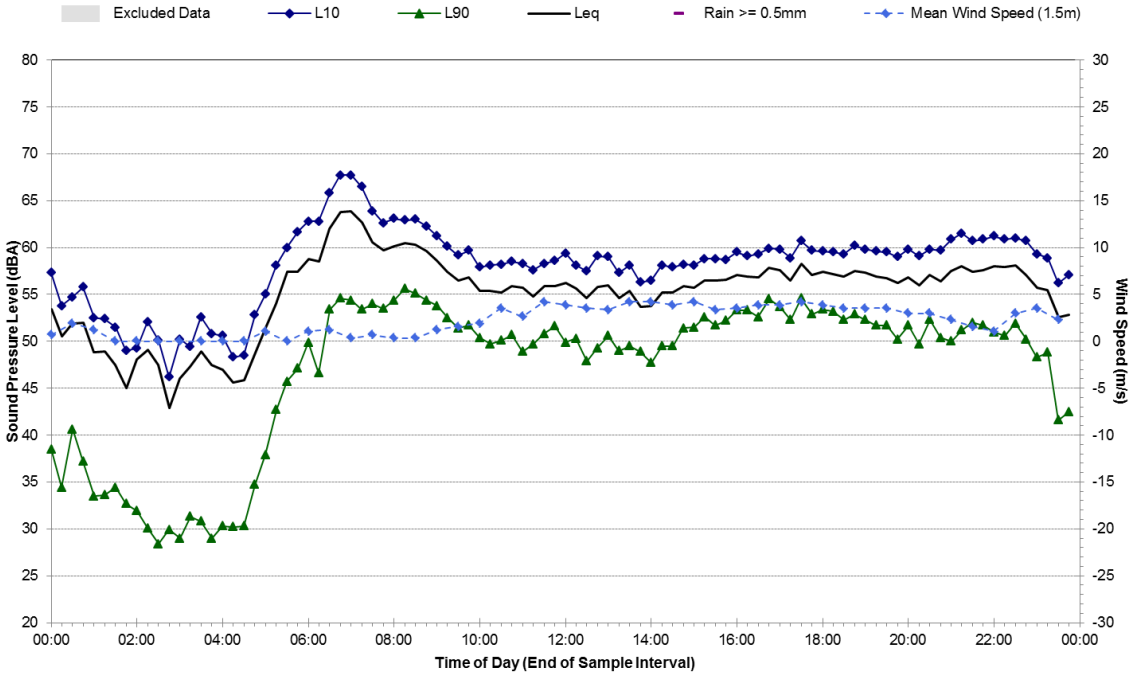
Public Land outside 25 Ferguson Place - Thursday, December 12, 2013



Noise Monitoring Charts – Location 7 - Public Land outside 25 Ferguson Place

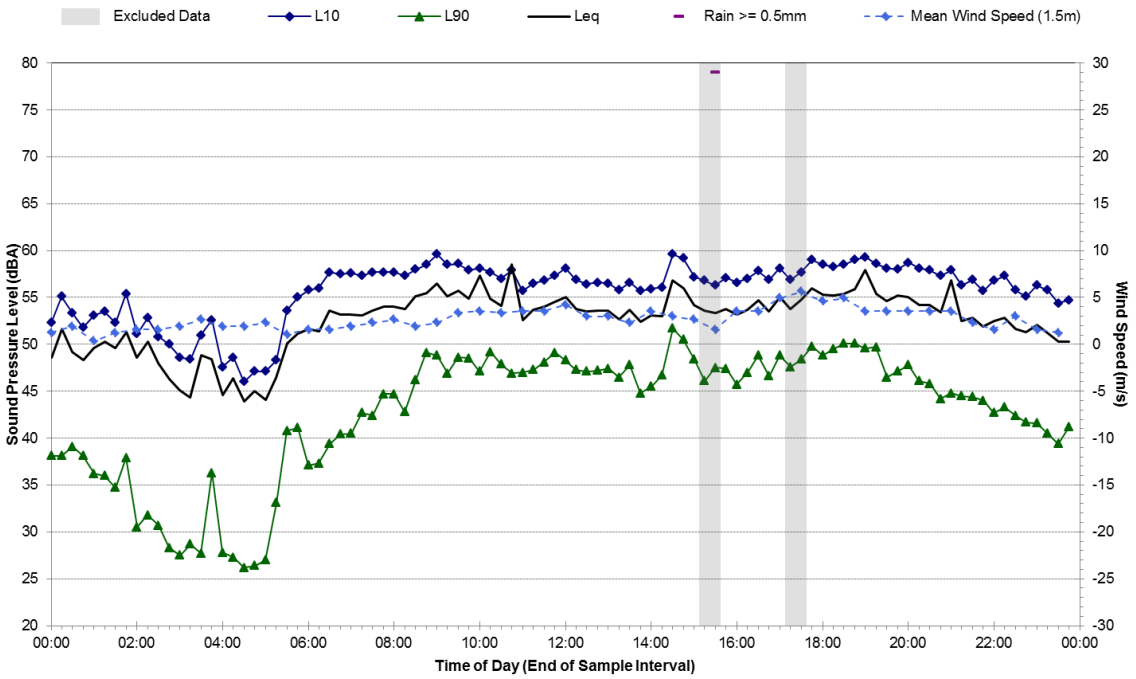
Statistical Ambient Noise Levels

Public Land outside 25 Ferguson Place - Friday, December 13, 2013



Statistical Ambient Noise Levels

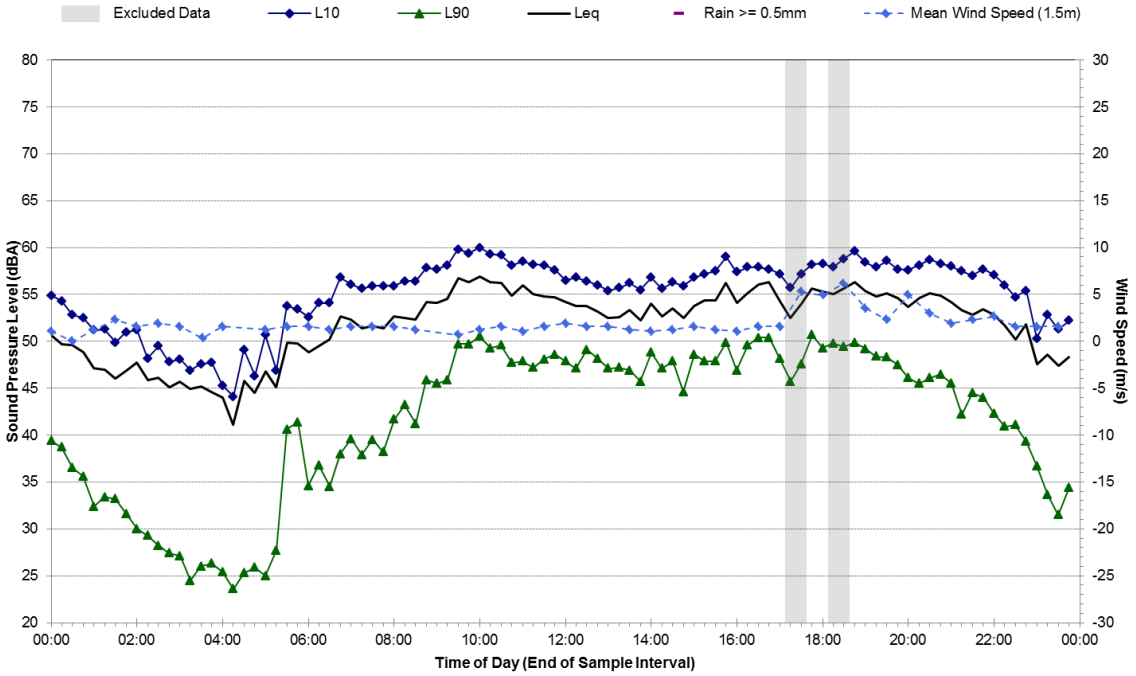
Public Land outside 25 Ferguson Place - Saturday, December 14, 2013



Noise Monitoring Charts – Location 7 - Public Land outside 25 Ferguson Place

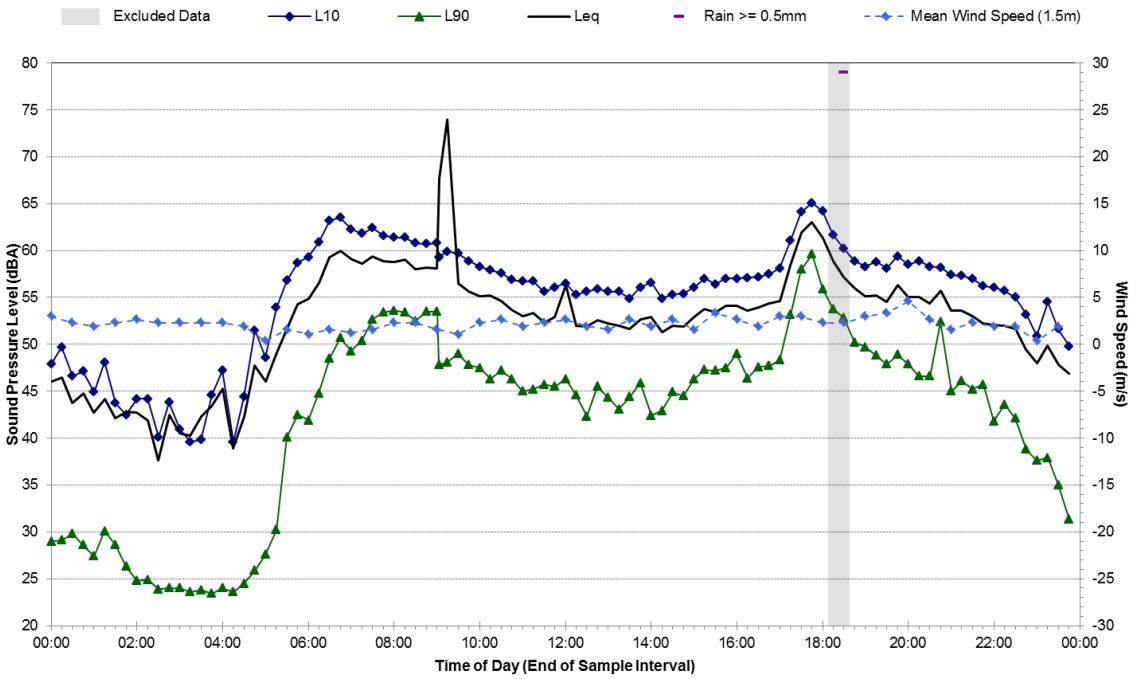
Statistical Ambient Noise Levels

Public Land outside 25 Ferguson Place - Sunday, December 15, 2013



Statistical Ambient Noise Levels

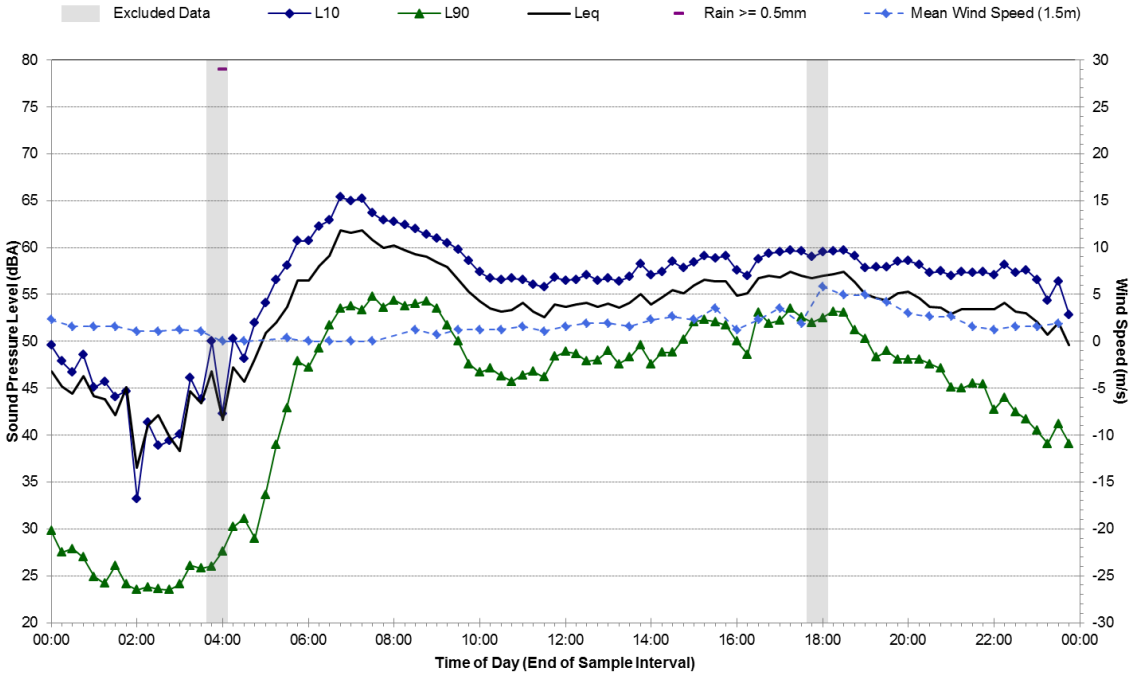
Public Land outside 25 Ferguson Place - Monday, December 16, 2013



Noise Monitoring Charts – Location 7 - Public Land outside 25 Ferguson Place

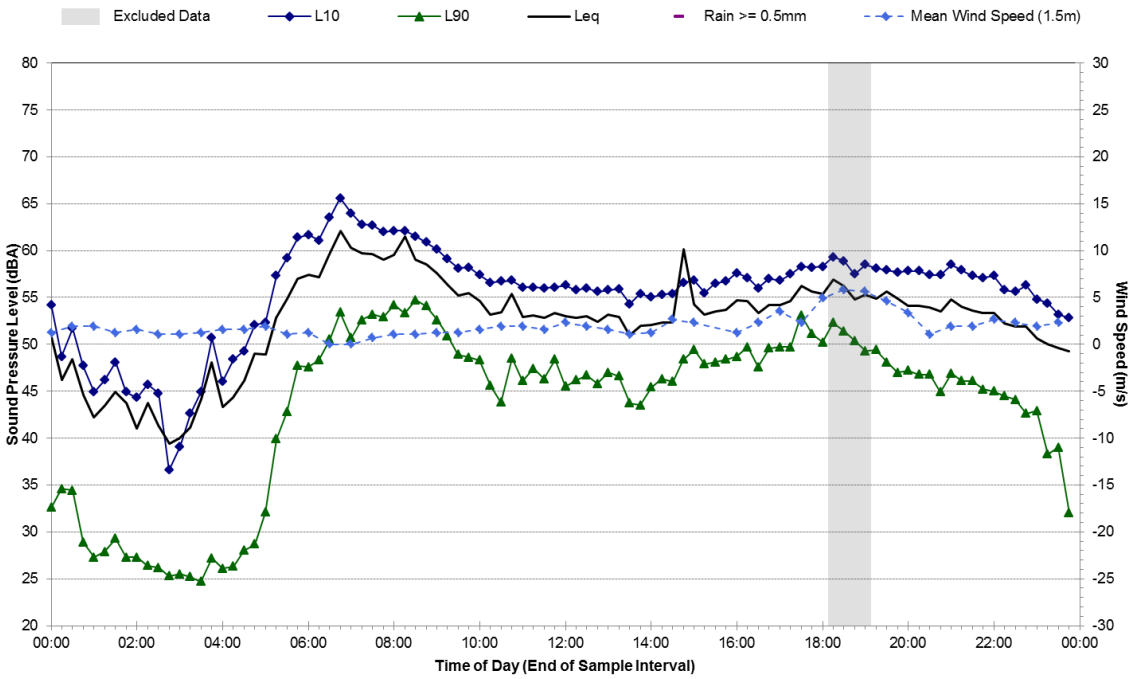
Statistical Ambient Noise Levels

Public Land outside 25 Ferguson Place - Tuesday, December 17, 2013



Statistical Ambient Noise Levels

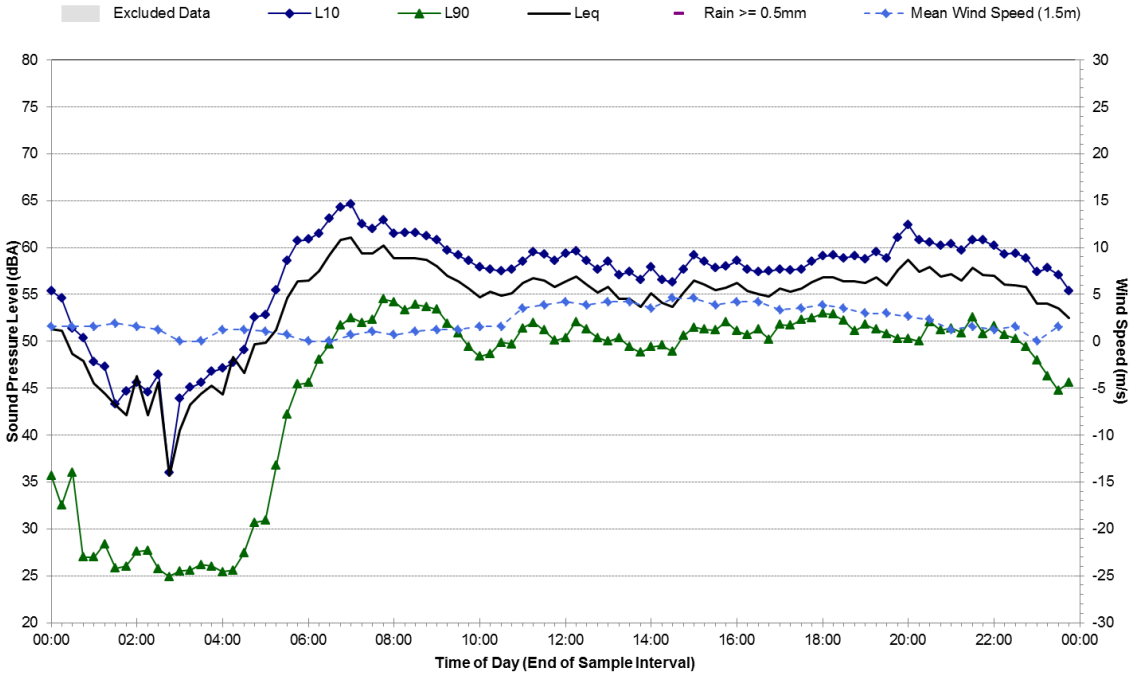
Public Land outside 25 Ferguson Place - Wednesday, December 18, 2013



Noise Monitoring Charts – Location 7 - Public Land outside 25 Ferguson Place

Statistical Ambient Noise Levels

Public Land outside 25 Ferguson Place - Thursday, December 19, 2013



Statistical Ambient Noise Levels

Public Land outside 25 Ferguson Place - Friday, December 20, 2013

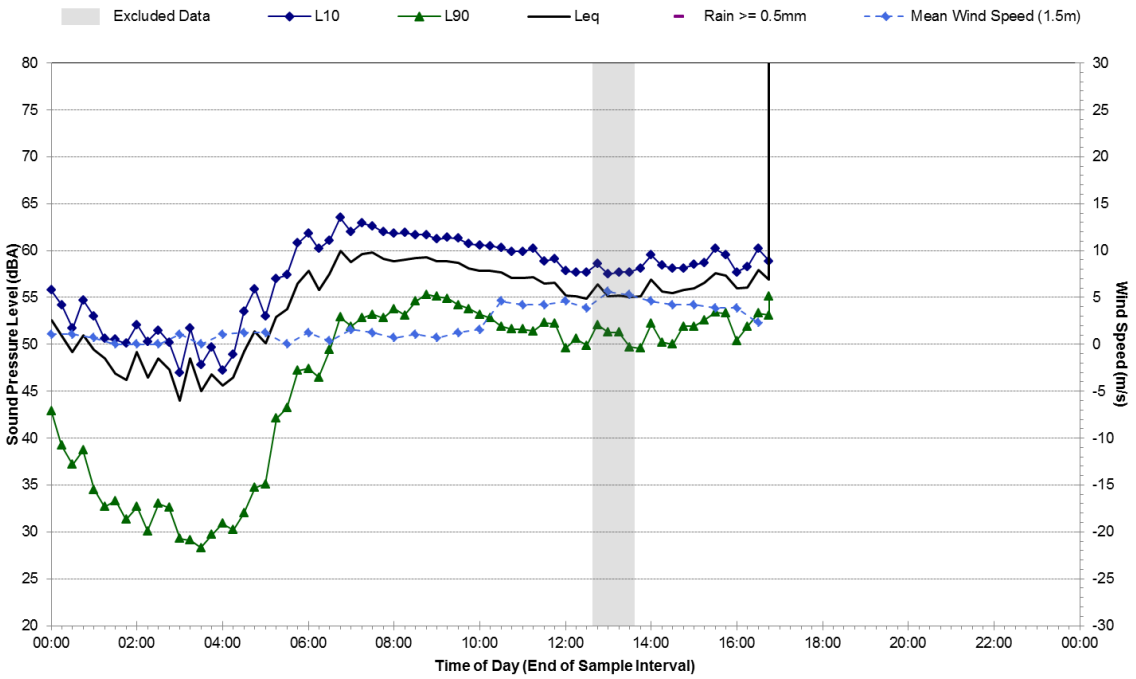


Table I1 - Single Point Receiver Results – Ginninderra Drive

Receiver Location		Predicted $L_{A10(18hour)}$ No Mitigation, By Year			Noise Planning Guideline Goal, dB, $L_{A10,18hr}$	Predicted excess over Planning Guideline, dBA			Year By Which Mitigation Should Be Implemented (where required)	Predicted $L_{A10(18hour)}$ – With Mitigation (2041)
Block	**Section**	**2021**	**2031**	**2041**		**2021**	**2031**	**2041**		
Dunlop (North of Alignment)										
11	99	53	52	56	58	Pass	Pass	Pass	-	53
10	99	53	52	56	58	Pass	Pass	Pass	-	53
9	99	53	52	56	58	Pass	Pass	Pass	-	53
8	99	53	52	56	58	Pass	Pass	Pass	-	53
7	99	53	52	56	58	Pass	Pass	Pass	-	53
6	99	53	52	56	58	Pass	Pass	Pass	-	53
5	99	53	52	56	58	Pass	Pass	Pass	-	53
4	99	53	52	56	58	Pass	Pass	Pass	-	53
3	99	53	52	56	58	Pass	Pass	Pass	-	53
2	99	53	52	56	58	Pass	Pass	Pass	-	54
11	102	53	52	56	58	Pass	Pass	Pass	-	53
10	102	51	50	54	58	Pass	Pass	Pass	-	52
10	103	57	56	60	58	Pass	Pass	2	2041	56
7	13	54	53	57	58	Pass	Pass	Pass	-	54
8	13	55	54	58	58	Pass	Pass	Pass	-	55
9	13	54	53	57	58	Pass	Pass	Pass	-	54
11	13	55	54	58	58	Pass	Pass	Pass	-	54
12	13	55	54	58	58	Pass	Pass	Pass	-	54
14	13	55	54	58	58	Pass	Pass	Pass	-	55
1	5	57	56	58	58	Pass	Pass	Pass	-	55
3	5	57	56	58	58	Pass	Pass	Pass	-	54
6	5	56	55	57	58	Pass	Pass	Pass	-	53

Single Point Receiver Results – Ginninderra Drive

Receiver Location		Predicted $L_{A10(18hour)}$ No Mitigation, By Year			Noise Planning Guideline Goal, dB, $L_{A10,18hr}$	Predicted excess over Planning Guideline, dBA			Year By Which Mitigation Should Be Implemented (where required)	Predicted $L_{A10(18hour)}$ – With Mitigation (2041)
Block	**Section**	**2021**	**2031**	**2041**		**2021**	**2031**	**2041**		
5	6	58	57	59	58	Pass	Pass	1	2041	54
5	6	58	57	59	58	Pass	Pass	1	2041	54
32	2	58	57	59	58	Pass	Pass	1	2041	54
31	2	57	56	58	58	Pass	Pass	Pass	-	54
30	2	58	57	59	58	Pass	Pass	1	2041	55
29	2	58	57	59	58	Pass	Pass	1	2041	55
28	2	58	57	59	58	Pass	Pass	1	2041	55
27	2	58	57	59	58	Pass	Pass	1	2041	55
26	2	58	57	59	58	Pass	Pass	1	2041	55
25	2	57	56	58	58	Pass	Pass	Pass	-	55
24	2	58	57	59	58	Pass	Pass	1	2041	55
23	2	58	57	59	58	Pass	Pass	1	2041	56
22	2	58	57	59	58	Pass	Pass	1	2041	56
21	2	57	56	58	58	Pass	Pass	Pass	-	56
20	2	59	58	60	58	1	Pass	2	2021	56
Charnwood (North of Alignment)										
5 (Church)	97	64	63	64	63	1	Pass	1	2021	-
14 (School)	97	60	59	60	63	Pass	Pass	Pass	-	-
2 (Church)	97	60	59	60	63	Pass	Pass	Pass	-	-
13 (Church)	97	61	60	61	63	Pass	Pass	Pass	-	-
Flynn (North of Alignment)										
18	68	58	57	58	65	Pass	Pass	Pass	-	-
17	68	60	59	60	65	Pass	Pass	Pass	-	-

Single Point Receiver Results – Ginninderra Drive

Receiver Location		Predicted $L_{A10(18hour)}$ No Mitigation, By Year			Noise Planning Guideline Goal, dB, $L_{A10,18hr}$	Predicted excess over Planning Guideline, dBA			Year By Which Mitigation Should Be Implemented (where required)	Predicted $L_{A10(18hour)}$ – With Mitigation (2041)
Block	**Section**	**2021**	**2031**	**2041**		**2021**	**2031**	**2041**		
15	68	62	61	62	65	Pass	Pass	Pass	-	-
14	68	65	64	65	65	Pass	Pass	Pass	-	-
11	68	65	64	65	65	Pass	Pass	Pass	-	-
10	68	65	64	65	65	Pass	Pass	Pass	-	-
7	68	65	65	65	65	Pass	Pass	Pass	-	-
6	68	65	64	65	65	Pass	Pass	Pass	-	-
3	68	65	64	65	65	Pass	Pass	Pass	-	-
2	68	65	64	65	65	Pass	Pass	Pass	-	-
8	61	62	61	62	65	Pass	Pass	Pass	-	-
7	61	62	61	62	65	Pass	Pass	Pass	-	-
6	61	62	61	62	65	Pass	Pass	Pass	-	-
5	61	62	61	62	65	Pass	Pass	Pass	-	-
4	61	62	61	62	65	Pass	Pass	Pass	-	-
3	61	61	60	61	65	Pass	Pass	Pass	-	-
2	61	60	59	60	65	Pass	Pass	Pass	-	-
1	61	59	58	59	65	Pass	Pass	Pass	-	-
1	37	63	62	63	65	Pass	Pass	Pass	-	-
7	37	63	62	63	65	Pass	Pass	Pass	-	-
8	37	62	61	62	65	Pass	Pass	Pass	-	-
20	35	58	57	58	65	Pass	Pass	Pass	-	-
19	35	59	58	59	65	Pass	Pass	Pass	-	-
18	35	60	59	60	65	Pass	Pass	Pass	-	-
17	35	61	60	61	65	Pass	Pass	Pass	-	-
16	35	61	60	61	65	Pass	Pass	Pass	-	-
15	35	61	60	61	65	Pass	Pass	Pass	-	-

Single Point Receiver Results – Ginninderra Drive

Receiver Location		Predicted $L_{A10(18hour)}$ No Mitigation, By Year			Noise Planning Guideline Goal, dB, $L_{A10,18hr}$	Predicted excess over Planning Guideline, dBA			Year By Which Mitigation Should Be Implemented (where required)	Predicted $L_{A10(18hour)}$ – With Mitigation (2041)
Block	**Section**	**2021**	**2031**	**2041**		**2021**	**2031**	**2041**		
14	35	56	55	56	65	Pass	Pass	Pass	-	-
2	63	62	61	62	65	Pass	Pass	Pass	-	-
3	63	61	60	61	65	Pass	Pass	Pass	-	-
4	63	61	60	61	65	Pass	Pass	Pass	-	-
5	63	61	60	61	65	Pass	Pass	Pass	-	-
6	63	62	61	62	65	Pass	Pass	Pass	-	-
7	63	61	60	61	65	Pass	Pass	Pass	-	-
8	63	61	60	61	65	Pass	Pass	Pass	-	-
9	63	62	61	62	65	Pass	Pass	Pass	-	-
10	63	63	62	63	65	Pass	Pass	Pass	-	-
11	63	64	63	64	65	Pass	Pass	Pass	-	-
12	63	64	63	64	65	Pass	Pass	Pass	-	-
13	63	61	60	61	65	Pass	Pass	Pass	-	-
14	63	60	59	60	65	Pass	Pass	Pass	-	-
15	63	60	59	60	65	Pass	Pass	Pass	-	-
1	31	56	55	56	65	Pass	Pass	Pass	-	-
2	31	58	57	58	65	Pass	Pass	Pass	-	-
3	31	58	57	58	65	Pass	Pass	Pass	-	-
4	31	58	57	58	65	Pass	Pass	Pass	-	-
5	31	57	57	57	65	Pass	Pass	Pass	-	-
6	31	57	56	57	65	Pass	Pass	Pass	-	-
7	31	56	55	56	65	Pass	Pass	Pass	-	-
8	31	56	55	56	65	Pass	Pass	Pass	-	-
15	30	58	57	58	65	Pass	Pass	Pass	-	-
13	30	58	57	58	65	Pass	Pass	Pass	-	-

Single Point Receiver Results – Ginninderra Drive

Receiver Location		Predicted $L_{A10(18hour)}$ No Mitigation, By Year			Noise Planning Guideline Goal, dB, $L_{A10,18hr}$	Predicted excess over Planning Guideline, dBA			Year By Which Mitigation Should Be Implemented (where required)	Predicted $L_{A10(18hour)}$ – With Mitigation (2041)
Block	**Section**	**2021**	**2031**	**2041**		**2021**	**2031**	**2041**		
12	30	56	55	56	65	Pass	Pass	Pass	-	-
Dunlop (South of Alignment)										
U5-11	27	56	55	59	58	Pass	Pass	1	2041	-
U6-11	27	58	57	61	58	Pass	Pass	3	2041	-
U7-11	27	58	58	62	58	Pass	Pass	4	2041	54
U8-11	27	60	59	63	58	2	1	5	2041	54
U1-5	27	60	59	63	58	2	1	5	2041	54
U2-5	27	60	59	63	58	2	1	5	2041	55
U3-5	27	60	59	63	58	2	1	5	2041	55
U4-5	27	60	59	63	58	2	1	5	2041	55
U5-5	27	60	59	63	58	2	1	5	2041	54
U3,4-5	27	60	59	63	58	2	1	5	2041	55
8	26	58	58	62	58	Pass	Pass	4	2041	54
1	26	56	55	59	58	Pass	Pass	1	2041	54
2	26	54	53	57	58	Pass	Pass	Pass	-	53
6	32	55	54	58	58	Pass	Pass	Pass	-	54
8	32	55	54	58	58	Pass	Pass	Pass	-	54
27	32	57	56	60	58	Pass	Pass	2	2041	55
24	32	56	55	59	58	Pass	Pass	1	2041	55
22	32	56	55	59	58	Pass	Pass	1	2041	55
23	32	56	55	59	58	Pass	Pass	1	2041	55
21	32	60	59	63	58	2	1	5	2021	55
17	35	53	52	56	58	Pass	Pass	Pass	-	51
18	35	54	53	57	58	Pass	Pass	Pass	-	51
19	35	54	53	57	58	Pass	Pass	Pass	-	52

Single Point Receiver Results – Ginninderra Drive

Receiver Location		Predicted $L_{A10(18hour)}$ No Mitigation, By Year			Noise Planning Guideline Goal, dB, $L_{A10,18hr}$	Predicted excess over Planning Guideline, dBA			Year By Which Mitigation Should Be Implemented (where required)	Predicted $L_{A10(18hour)}$ – With Mitigation (2041)
Block	**Section**	**2021**	**2031**	**2041**		**2021**	**2031**	**2041**		
20	35	56	55	59	58	Pass	Pass	1	2041	53
46	36	58	58	62	58	Pass	Pass	4	2041	57
45	36	57	56	60	58	Pass	Pass	2	2041	57
Macgregor (South of Alignment)										
1	17	52	51	53	58	Pass	Pass	Pass	-	-
2	17	52	51	53	58	Pass	Pass	Pass	-	-
3	17	52	51	53	58	Pass	Pass	Pass	-	-
4	17	52	51	53	58	Pass	Pass	Pass	-	-
5	17	52	51	53	58	Pass	Pass	Pass	-	-
13	18	52	51	53	58	Pass	Pass	Pass	-	-
1	18	52	51	53	58	Pass	Pass	Pass	-	-
4	19	52	51	53	58	Pass	Pass	Pass	-	-
5	19	53	52	54	58	Pass	Pass	Pass	-	-
6	19	53	52	54	58	Pass	Pass	Pass	-	-
11	23	54	53	55	58	Pass	Pass	Pass	-	-
1	23	53	52	54	58	Pass	Pass	Pass	-	-
4	24	52	51	53	58	Pass	Pass	Pass	-	-
5	24	53	52	54	58	Pass	Pass	Pass	-	-
6	24	53	52	54	58	Pass	Pass	Pass	-	-
1	25	54	53	55	58	Pass	Pass	Pass	-	-
2	25	54	53	55	58	Pass	Pass	Pass	-	-
3	25	54	53	55	58	Pass	Pass	Pass	-	-
4	25	53	52	54	58	Pass	Pass	Pass	-	-
5	25	53	52	54	58	Pass	Pass	Pass	-	-
1	32	53	52	54	58	Pass	Pass	Pass	-	-

Single Point Receiver Results – Ginninderra Drive

Receiver Location		Predicted LA10(18hour) No Mitigation, By Year			Noise Planning Guideline Goal, dB, $L_{A10,18hr}$	Predicted excess over Planning Guideline, dBA			Year By Which Mitigation Should Be Implemented (where required)	Predicted LA10(18hour) – With Mitigation (2041)
Block	**Section**	**2021**	**2031**	**2041**		**2021**	**2031**	**2041**		
2	32	52	51	53	58	Pass	Pass	Pass	-	-
3	32	52	51	53	58	Pass	Pass	Pass	-	-
4	32	52	51	53	58	Pass	Pass	Pass	-	-
5	32	51	50	52	58	Pass	Pass	Pass	-	-
6	32	51	50	52	58	Pass	Pass	Pass	-	-
7	32	50	49	51	58	Pass	Pass	Pass	-	-
14	32	51	50	52	58	Pass	Pass	Pass	-	-
Latham (South of Alignment)										
3	114	55	54	56	58	Pass	Pass	Pass	-	-
2	114	59	59	60	58	1	1	2	2021	54
1	114	62	61	62	58	4	3	4	2021	56
11	113	64	63	64	58	6	5	6	2021	57
1	113	65	64	65	58	7	6	7	2021	57
12	112	61	60	61	58	3	2	3	2021	56
1	112	64	64	65	58	6	6	7	2021	56
9	111	60	59	61	58	2	1	3	2021	56
1	111	60	60	61	58	2	2	3	2021	56
1	109	60	60	61	58	2	2	3	2021	57
2	109	61	61	62	58	3	3	4	2021	57
3	109	63	62	63	58	5	4	5	2021	57
4	109	63	62	63	58	5	4	5	2021	56
5	109	62	61	62	58	4	3	4	2021	56
1	108	63	62	63	58	5	4	5	2021	55
2	108	65	64	65	58	7	6	7	2021	56
3	108	65	65	66	58	7	7	8	2021	57

Single Point Receiver Results – Ginninderra Drive

Receiver Location		Predicted $L_{A10(18hour)}$ No Mitigation, By Year			Noise Planning Guideline Goal, dB, $L_{A10,18hr}$	Predicted excess over Planning Guideline, dBA			Year By Which Mitigation Should Be Implemented (where required)	Predicted $L_{A10(18hour)}$ – With Mitigation (2041)
Block	**Section**	**2021**	**2031**	**2041**		**2021**	**2031**	**2041**		
4	108	62	61	63	58	4	3	5	2021	57
5	108	64	63	65	58	6	5	7	2021	56
6	108	65	64	65	58	7	6	7	2021	56
7	108	64	64	65	58	6	6	7	2021	57
8	108	65	64	66	58	7	6	8	2021	57
5	107	62	61	63	58	4	3	5	2021	58
6	107	61	60	61	58	3	2	3	2021	57
14	100	57	56	57	65	Pass	Pass	Pass	-	-
13	100	60	59	60	65	Pass	Pass	Pass	-	-
14	101	62	61	62	65	Pass	Pass	Pass	-	-
10	101	61	60	61	65	Pass	Pass	Pass	-	-
9	101	61	60	61	65	Pass	Pass	Pass	-	-
6	101	61	60	61	65	Pass	Pass	Pass	-	-
5	101	60	59	60	65	Pass	Pass	Pass	-	-
3	101	62	61	62	65	Pass	Pass	Pass	-	-
2	101	61	60	61	65	Pass	Pass	Pass	-	-
1	101	61	60	61	65	Pass	Pass	Pass	-	-
9	116	62	61	62	65	Pass	Pass	Pass	-	-
24	117	61	60	61	65	Pass	Pass	Pass	-	-
1	117	60	59	60	65	Pass	Pass	Pass	-	-
15	118	59	58	59	65	Pass	Pass	Pass	-	-
1	118	60	59	60	65	Pass	Pass	Pass	-	-
1	118	60	59	60	65	Pass	Pass	Pass	-	-
U1-35	35	60	59	60	65	Pass	Pass	Pass	-	-
U2-35	35	56	55	56	65	Pass	Pass	Pass	-	-

Single Point Receiver Results – Ginninderra Drive

Receiver Location		Predicted $L_{A10(18hour)}$ No Mitigation, By Year			Noise Planning Guideline Goal, dB, $L_{A10,18hr}$	Predicted excess over Planning Guideline, dBA			Year By Which Mitigation Should Be Implemented (where required)	Predicted $L_{A10(18hour)}$ – With Mitigation (2041)
Block	**Section**	**2021**	**2031**	**2041**		**2021**	**2031**	**2041**		
U3-35	35	57	57	57	65	Pass	Pass	Pass	-	-
U4-35	35	55	54	55	65	Pass	Pass	Pass	-	-
U5-35	35	57	57	57	65	Pass	Pass	Pass	-	-
U6-35	35	57	56	57	65	Pass	Pass	Pass	-	-
U7-35	35	56	55	56	65	Pass	Pass	Pass	-	-
26	119	52	51	52	65	Pass	Pass	Pass	-	-

Table J1 - Single Point Receiver Results – Southern Cross Drive

Receiver Location		Predicted $L_{A10(18hour)}$ No Mitigation, By Year			Noise Planning Guideline Goal, dB, $L_{A10,18hr}$	Predicted excess over Planning Guideline, dBA			Year By Which Mitigation Should Be Implemented (where required)	Predicted $L_{A10(18hour)}$ – With Mitigation (2041)
Block	**Section**	**2021**	**2031**	**2041**		**2021**	**2031**	**2041**		
Macgregor (North of Alignment)										
1	120	52	56	57	63	Pass	Pass	Pass	-	-
40	120	52	55	57	63	Pass	Pass	Pass	-	-
39	120	52	55	57	63	Pass	Pass	Pass	-	-
38	120	52	55	57	63	Pass	Pass	Pass	-	-
13	117	52	55	57	63	Pass	Pass	Pass	-	-
12	117	52	55	57	63	Pass	Pass	Pass	-	-
11	117	52	55	57	63	Pass	Pass	Pass	-	-
10	117	51	55	56	63	Pass	Pass	Pass	-	-
9	117	51	55	56	63	Pass	Pass	Pass	-	-
8	117	51	55	56	63	Pass	Pass	Pass	-	-
7	117	51	55	56	63	Pass	Pass	Pass	-	-
6	117	51	54	56	63	Pass	Pass	Pass	-	-
12	74	62	63	63	63	Pass	Pass	Pass	-	-
11	74	61	62	63	63	Pass	Pass	Pass	-	-
10	74	61	62	63	63	Pass	Pass	Pass	-	-
9	74	61	62	62	63	Pass	Pass	Pass	-	-
8	74	60	61	62	63	Pass	Pass	Pass	-	-
7	74	61	62	62	63	Pass	Pass	Pass	-	-
6	74	62	63	63	63	Pass	Pass	Pass	-	-
5	74	62	63	63	63	Pass	Pass	Pass	-	-
4	74	62	63	63	63	Pass	Pass	Pass	-	-
3	74	61	62	63	63	Pass	Pass	Pass	-	-
2	74	62	63	63	63	Pass	Pass	Pass	-	-

Single Point Receiver Results – Southern Cross Drive

Receiver Location		Predicted $L_{A10(18hour)}$ No Mitigation, By Year			Noise Planning Guideline Goal, dB, $L_{A10,18hr}$	Predicted excess over Planning Guideline, dBA			Year By Which Mitigation Should Be Implemented (where required)	Predicted $L_{A10(18hour)}$ – With Mitigation (2041)
Block	**Section**	**2021**	**2031**	**2041**		**2021**	**2031**	**2041**		
1	74	60	61	62	63	Pass	Pass	Pass	-	-
14	67	62	63	63	63	Pass	Pass	Pass	-	-
13	67	62	63	63	63	Pass	Pass	Pass	-	-
12	67	61	62	63	63	Pass	Pass	Pass	-	-
11	67	62	63	63	63	Pass	Pass	Pass	-	-
10	67	62	63	63	63	Pass	Pass	Pass	-	-
9	67	62	63	63	63	Pass	Pass	Pass	-	-
48	66	61	62	63	63	Pass	Pass	Pass	-	-
46	66	63	64	64	63	Pass	1	1	2031	-
45	66	62	63	63	63	Pass	Pass	Pass	-	-
44	66	61	62	62	63	Pass	Pass	Pass	-	-
43	66	63	64	64	63	Pass	1	1	2031	-
42	66	63	64	64	63	Pass	1	1	2031	-
41	66	62	63	64	63	Pass	Pass	1	2041	-
40	66	61	62	63	63	Pass	Pass	Pass	-	-
39	66	63	64	64	63	Pass	1	1	2031	-
29	65	62	63	64	63	Pass	Pass	1	2041	-
28	65	62	63	63	63	Pass	Pass	Pass	-	-
27	65	61	62	62	63	Pass	Pass	Pass	-	-
26	65	61	62	62	63	Pass	Pass	Pass	-	-
25	65	62	63	63	63	Pass	Pass	Pass	-	-
24	65	61	62	63	63	Pass	Pass	Pass	-	-
23	65	61	62	62	63	Pass	Pass	Pass	-	-
22	65	62	63	63	63	Pass	Pass	Pass	-	-
U2-21	65	54	55	56	63	Pass	Pass	Pass	-	-

Single Point Receiver Results – Southern Cross Drive

Receiver Location		Predicted $L_{A10(18hour)}$ No Mitigation, By Year			Noise Planning Guideline Goal, dB, $L_{A10,18hr}$	Predicted excess over Planning Guideline, dBA			Year By Which Mitigation Should Be Implemented (where required)	Predicted $L_{A10(18hour)}$ – With Mitigation (2041)
Block	**Section**	**2021**	**2031**	**2041**		**2021**	**2031**	**2041**		
U1-21	65	62	63	64	63	Pass	Pass	1	2041	-
20	65	62	63	63	63	Pass	Pass	Pass	-	-
19	65	61	62	63	63	Pass	Pass	Pass	-	-
18	65	62	63	63	63	Pass	Pass	Pass	-	-
17	65	62	63	63	63	Pass	Pass	Pass	-	-
31	38	64	65	66	65	Pass	Pass	1	2041	-
29	38	64	65	66	65	Pass	Pass	1	2041	-
28	38	64	64	65	65	Pass	Pass	Pass	-	-
27	38	63	64	64	65	Pass	Pass	Pass	-	-
26	38	64	64	65	65	Pass	Pass	Pass	-	-
25	38	65	65	66	65	Pass	Pass	1	2041	-
24	38	63	63	64	65	Pass	Pass	Pass	-	-
23	38	62	63	64	65	Pass	Pass	Pass	-	-
22	38	64	64	65	65	Pass	Pass	Pass	-	-
21	38	63	63	64	65	Pass	Pass	Pass	-	-
20	38	63	64	64	65	Pass	Pass	Pass	-	-
19	38	63	64	65	65	Pass	Pass	Pass	-	-
18	38	63	63	64	65	Pass	Pass	Pass	-	-
17	38	63	63	64	65	Pass	Pass	Pass	-	-
16	38	62	62	63	65	Pass	Pass	Pass	-	-
12	43	63	63	64	65	Pass	Pass	Pass	-	-
11	43	62	62	63	65	Pass	Pass	Pass	-	-
Latham (North of Alignment)										
16	44	61	61	62	65	Pass	Pass	Pass	-	-
15	44	60	61	62	65	Pass	Pass	Pass	-	-

Single Point Receiver Results – Southern Cross Drive

Receiver Location		Predicted $L_{A10(18hour)}$ No Mitigation, By Year			Noise Planning Guideline Goal, dB, $L_{A10,18hr}$	Predicted excess over Planning Guideline, dBA			Year By Which Mitigation Should Be Implemented (where required)	Predicted $L_{A10(18hour)}$ – With Mitigation (2041)
Block	**Section**	**2021**	**2031**	**2041**		**2021**	**2031**	**2041**		
14	44	61	62	63	65	Pass	Pass	Pass	-	-
13	44	63	63	64	65	Pass	Pass	Pass	-	-
12	44	63	63	64	65	Pass	Pass	Pass	-	-
11	44	63	64	65	65	Pass	Pass	Pass	-	-
10	44	63	64	65	65	Pass	Pass	Pass	-	-
9	44	61	61	62	65	Pass	Pass	Pass	-	-
8	44	63	63	64	65	Pass	Pass	Pass	-	-
7	44	64	64	65	65	Pass	Pass	Pass	-	-
6	44	64	64	65	65	Pass	Pass	Pass	-	-
5	44	64	64	65	65	Pass	Pass	Pass	-	-
4	44	64	64	65	65	Pass	Pass	Pass	-	-
3	44	64	64	65	65	Pass	Pass	Pass	-	-
2	44	63	63	64	65	Pass	Pass	Pass	-	-
1	44	63	63	64	65	Pass	Pass	Pass	-	-
35	44	63	63	64	65	Pass	Pass	Pass	-	-
2	57	62	63	64	65	Pass	Pass	Pass	-	-
19	58	53	53	54	65	Pass	Pass	Pass	-	-
18	58	54	54	55	65	Pass	Pass	Pass	-	-
17	58	54	54	55	65	Pass	Pass	Pass	-	-
16	58	55	56	57	65	Pass	Pass	Pass	-	-
15	58	56	56	57	65	Pass	Pass	Pass	-	-
14	58	57	58	59	65	Pass	Pass	Pass	-	-
13	58	58	58	59	65	Pass	Pass	Pass	-	-
12	58	59	60	60	65	Pass	Pass	Pass	-	-
1	59	62	62	63	65	Pass	Pass	Pass	-	-

Single Point Receiver Results – Southern Cross Drive

Receiver Location		Predicted $L_{A10(18hour)}$ No Mitigation, By Year			Noise Planning Guideline Goal, dB, $L_{A10,18hr}$	Predicted excess over Planning Guideline, dBA			Year By Which Mitigation Should Be Implemented (where required)	Predicted $L_{A10(18hour)}$ – With Mitigation (2041)
Block	**Section**	**2021**	**2031**	**2041**		**2021**	**2031**	**2041**		
18	59	63	63	64	65	Pass	Pass	Pass	-	-
1	70	61	61	61	65	Pass	Pass	Pass	-	-
8	70	61	61	62	65	Pass	Pass	Pass	-	-
10	70	59	59	59	65	Pass	Pass	Pass	-	-
11	70	60	60	61	65	Pass	Pass	Pass	-	-
12	70	60	60	61	65	Pass	Pass	Pass	-	-
Holt (South of Alignment)										
U3-1	102	50	54	55	58	Pass	Pass	Pass	-	-
U2-1	102	50	54	55	58	Pass	Pass	Pass	-	-
U1-1	102	50	53	55	58	Pass	Pass	Pass	-	-
1	103	49	53	54	58	Pass	Pass	Pass	-	-
2	103	49	52	54	58	Pass	Pass	Pass	-	-
3	103	49	52	54	58	Pass	Pass	Pass	-	-
4	103	49	52	54	58	Pass	Pass	Pass	-	-
5	103	48	52	53	58	Pass	Pass	Pass	-	-
6	103	48	52	53	58	Pass	Pass	Pass	-	-
7	103	48	51	53	58	Pass	Pass	Pass	-	-
8	103	48	51	53	58	Pass	Pass	Pass	-	-
9	103	47	51	52	58	Pass	Pass	Pass	-	-
10	103	47	50	52	58	Pass	Pass	Pass	-	-
11	3	64	65	65	63	1	2	2	2021	-
12	3	64	65	65	63	1	2	2	2021	-
13	3	65	66	66	63	2	3	3	2021	-
14	3	65	66	66	63	2	3	3	2021	-
15	3	65	66	67	63	2	3	4	2021	-

Single Point Receiver Results – Southern Cross Drive

Receiver Location		Predicted $L_{A10(18hour)}$ No Mitigation, By Year			Noise Planning Guideline Goal, dB, $L_{A10,18hr}$	Predicted excess over Planning Guideline, dBA			Year By Which Mitigation Should Be Implemented (where required)	Predicted $L_{A10(18hour)}$ – With Mitigation (2041)
Block	**Section**	**2021**	**2031**	**2041**		**2021**	**2031**	**2041**		
16	3	65	66	66	63	2	3	3	2021	-
17	3	65	66	66	63	2	3	3	2021	-
18	3	64	65	66	63	1	2	3	2021	-
19	3	65	66	66	63	2	3	3	2021	-
20	3	64	65	66	63	1	2	3	2021	-
21	3	64	65	66	63	1	2	3	2021	-
22	3	64	65	65	63	1	2	2	2021	-
1	5	64	65	66	63	1	2	3	2021	-
2	5	65	66	66	63	2	3	3	2021	-
3	5	65	66	66	63	2	3	3	2021	-
4	5	64	65	65	63	1	2	2	2021	-
5	5	66	67	67	63	3	4	4	2021	-
6	5	66	67	67	63	3	4	4	2021	-
7	5	66	67	67	63	3	4	4	2021	-
8	5	65	66	67	63	2	3	4	2021	-
9	5	64	65	65	63	1	2	2	2021	-
10	5	65	66	66	63	2	3	3	2021	-
11	5	65	66	67	63	2	3	4	2021	-
12	5	64	65	65	63	1	2	2	2021	-
13	5	64	65	65	63	1	2	2	2021	-
1	14	65	66	67	63	2	3	4	2021	-
3	14	63	64	64	63	Pass	1	1	2031	-
4	14	65	66	66	63	2	3	3	2021	-
5	14	65	66	66	63	2	3	3	2021	-
6	14	65	66	66	63	2	3	3	2021	-

Single Point Receiver Results – Southern Cross Drive

Receiver Location		Predicted $L_{A10(18hour)}$ No Mitigation, By Year			Noise Planning Guideline Goal, dB, $L_{A10,18hr}$	Predicted excess over Planning Guideline, dBA			Year By Which Mitigation Should Be Implemented (where required)	Predicted $L_{A10(18hour)}$ – With Mitigation (2041)
Block	**Section**	**2021**	**2031**	**2041**		**2021**	**2031**	**2041**		
7	14	64	65	65	63	1	2	2	2021	-
8	14	64	65	66	63	1	2	3	2021	-
21 (Commercial)	51	66	67	67	75	Pass	Pass	Pass	-	-
25 (Commercial)	51	64	65	65	75	Pass	Pass	Pass	-	-
60	51	59	60	61	63	Pass	Pass	Pass	-	-
60	51	61	62	62	63	Pass	Pass	Pass	-	-
60	51	62	63	63	63	Pass	Pass	Pass	-	-
60	51	60	61	62	63	Pass	Pass	Pass	-	-
60	51	54	55	55	63	Pass	Pass	Pass	-	-
60	51	54	55	55	63	Pass	Pass	Pass	-	-
1	85	61	61	62	65	Pass	Pass	Pass	-	-
6	85	62	62	63	65	Pass	Pass	Pass	-	-
1	84	59	60	61	65	Pass	Pass	Pass	-	-
17	84	58	58	59	65	Pass	Pass	Pass	-	-
16	84	58	58	59	65	Pass	Pass	Pass	-	-
13	84	59	60	61	65	Pass	Pass	Pass	-	-
11	84	60	60	61	65	Pass	Pass	Pass	-	-
10	84	59	59	60	65	Pass	Pass	Pass	-	-
6	84	58	58	59	65	Pass	Pass	Pass	-	-
10	82	59	59	60	65	Pass	Pass	Pass	-	-
11	82	59	59	60	65	Pass	Pass	Pass	-	-
11	81	60	60	61	65	Pass	Pass	Pass	-	-
1	81	61	62	62	65	Pass	Pass	Pass	-	-
8	75	61	62	63	65	Pass	Pass	Pass	-	-

Single Point Receiver Results – Southern Cross Drive

Receiver Location		Predicted $L_{A10(18hour)}$ No Mitigation, By Year			Noise Planning Guideline Goal, dB, $L_{A10,18hr}$	Predicted excess over Planning Guideline, dBA			Year By Which Mitigation Should Be Implemented (where required)	Predicted $L_{A10(18hour)}$ – With Mitigation (2041)
Block	**Section**	**2021**	**2031**	**2041**		**2021**	**2031**	**2041**		
1	76	60	61	62	65	Pass	Pass	Pass	-	-
2	76	61	61	62	65	Pass	Pass	Pass	-	-
3	76	60	61	62	65	Pass	Pass	Pass	-	-
4	76	60	61	62	65	Pass	Pass	Pass	-	-
5	76	60	60	61	65	Pass	Pass	Pass	-	-
6	76	60	60	61	65	Pass	Pass	Pass	-	-
7	76	60	60	61	65	Pass	Pass	Pass	-	-
8	76	59	60	61	65	Pass	Pass	Pass	-	-
9	76	59	59	60	65	Pass	Pass	Pass	-	-
10	76	59	59	60	65	Pass	Pass	Pass	-	-
11	76	59	59	60	65	Pass	Pass	Pass	-	-
12	76	59	59	60	65	Pass	Pass	Pass	-	-
13	76	59	60	61	65	Pass	Pass	Pass	-	-
14	76	59	59	60	65	Pass	Pass	Pass	-	-
15	76	59	60	61	65	Pass	Pass	Pass	-	-
16	76	60	60	61	65	Pass	Pass	Pass	-	-
17	76	59	60	61	65	Pass	Pass	Pass	-	-
18	76	59	59	60	65	Pass	Pass	Pass	-	-
19	76	59	59	60	65	Pass	Pass	Pass	-	-
5	80	58	59	59	65	Pass	Pass	Pass	-	-
6	80	58	59	60	65	Pass	Pass	Pass	-	-
7	80	58	59	60	65	Pass	Pass	Pass	-	-
8	80	58	59	60	65	Pass	Pass	Pass	-	-
9	80	56	56	57	65	Pass	Pass	Pass	-	-

Single Point Receiver Results – Southern Cross Drive

Receiver Location		Predicted $L_{A10(18hour)}$ No Mitigation, By Year			Noise Planning Guideline Goal, dB, $L_{A10,18hr}$	Predicted excess over Planning Guideline, dBA			Year By Which Mitigation Should Be Implemented (where required)	Predicted $L_{A10(18hour)}$ – With Mitigation (2041)
Block	**Section**	**2021**	**2031**	**2041**		**2021**	**2031**	**2041**		
Higgins (South of Alignment)										
1	16	57	57	58	65	Pass	Pass	Pass	-	-
38	16	57	57	57	65	Pass	Pass	Pass	-	-
39	16	59	59	60	65	Pass	Pass	Pass	-	-
40	16	60	60	61	65	Pass	Pass	Pass	-	-
1	20	61	61	61	65	Pass	Pass	Pass	-	-
2	20	58	58	58	65	Pass	Pass	Pass	-	-
3	20	57	57	58	65	Pass	Pass	Pass	-	-
4	20	56	56	56	65	Pass	Pass	Pass	-	-
5	20	56	56	57	65	Pass	Pass	Pass	-	-
13	20	58	58	58	65	Pass	Pass	Pass	-	-
14	20	57	57	58	65	Pass	Pass	Pass	-	-
15	20	55	55	56	65	Pass	Pass	Pass	-	-
21	20	54	54	55	65	Pass	Pass	Pass	-	-
22	20	57	57	57	65	Pass	Pass	Pass	-	-
23	20	54	54	55	65	Pass	Pass	Pass	-	-
31	20	54	54	54	65	Pass	Pass	Pass	-	-
32	20	54	54	54	65	Pass	Pass	Pass	-	-
33	20	50	50	51	65	Pass	Pass	Pass	-	-

Table K1 - Single Point Receiver Results – Drake Brockman Drive

Receiver Location		Predicted $L_{A10(18hour)}$ No Mitigation, By Year			Noise Planning Guideline Goal, dB, $L_{A10,18hr}$	Predicted excess over Planning Guideline, dBA			Year By Which Mitigation Should Be Implemented (where required)	Predicted $L_{A10(18hour)}$ – With Mitigation (2041)
Block	**Section**	**2021**	**2031**	**2041**		**2021**	**2031**	**2041**		
Higgins (North of Alignment)										
12	41	56	57	59	58	Pass	Pass	1	2041	54
13	41	56	57	59	58	Pass	Pass	1	2041	54
14	41	56	56	59	58	Pass	Pass	1	2041	54
15	41	56	56	59	58	Pass	Pass	1	2041	54
16	41	56	57	59	58	Pass	Pass	1	2041	55
17	41	57	58	60	58	Pass	Pass	2	2041	55
18	41	57	58	60	58	Pass	Pass	2	2041	55
19	41	55	56	58	58	Pass	Pass	Pass	-	53
41	41	56	56	58	58	Pass	Pass	Pass	-	53
42	41	56	57	59	58	Pass	Pass	1	2041	54
43	41	59	59	61	58	1	1	3	2021	56
44	41	58	58	60	58	Pass	Pass	2	2041	55
45	41	59	59	62	58	1	1	4	2021	56
46	41	59	59	62	58	1	1	4	2021	56
24	44	56	56	58	58	Pass	Pass	Pass	-	54
12	44	55	56	58	58	Pass	Pass	Pass	-	54
12	44	55	56	58	58	Pass	Pass	Pass	-	54
11	44	56	57	59	58	Pass	Pass	1	2041	54
10	44	57	58	60	58	Pass	Pass	2	2041	55
9	44	57	58	60	58	Pass	Pass	2	2041	55
8	44	57	58	60	58	Pass	Pass	2	2041	55
7	44	57	57	59	58	Pass	Pass	1	2041	54
6	44	57	57	59	58	Pass	Pass	1	2041	55

Single Point Receiver Results – Drake Brockman Drive

Receiver Location		Predicted $L_{A10(18hour)}$ No Mitigation, By Year			Noise Planning Guideline Goal, dB, $L_{A10,18hr}$	Predicted excess over Planning Guideline, dBA			Year By Which Mitigation Should Be Implemented (where required)	Predicted $L_{A10(18hour)}$ – With Mitigation (2041)
Block	**Section**	**2021**	**2031**	**2041**		**2021**	**2031**	**2041**		
5	44	57	57	59	58	Pass	Pass	1	2041	55
4	44	56	57	59	58	Pass	Pass	1	2041	54
3	44	56	57	59	58	Pass	Pass	1	2041	54
2	44	56	57	59	58	Pass	Pass	1	2041	54
1	44	56	57	59	58	Pass	Pass	1	2041	54
11	50	57	57	59	58	Pass	Pass	1	2041	54
10	50	57	57	59	58	Pass	Pass	1	2041	54
9	50	56	57	59	58	Pass	Pass	1	2041	54
8	50	56	57	59	58	Pass	Pass	1	2041	54
7	50	56	57	59	58	Pass	Pass	1	2041	55
6	50	57	57	59	58	Pass	Pass	1	2041	55
5	50	56	57	59	58	Pass	Pass	1	2041	55
4	50	57	57	59	58	Pass	Pass	1	2041	56
3	50	56	57	59	58	Pass	Pass	1	2041	55
2	50	57	57	59	58	Pass	Pass	1	2041	55
1	50	57	57	59	58	Pass	Pass	1	2041	55
18	7	59	60	62	58	1	1	4	2021	56
7	7	59	59	61	58	1	1	3	2021	55
6	7	58	58	60	58	Pass	Pass	2	2041	55
5	7	57	58	60	58	Pass	Pass	2	2041	54
4	7	58	58	60	58	Pass	Pass	2	2041	55
3	7	57	58	60	58	Pass	Pass	2	2041	54
2	7	58	59	61	58	Pass	0	3	2041	55
1	7	57	58	60	58	Pass	Pass	2	2041	54
24	6	53	54	56	58	Pass	Pass	Pass	-	52

Single Point Receiver Results – Drake Brockman Drive

Receiver Location		Predicted $L_{A10(18hour)}$ No Mitigation, By Year			Noise Planning Guideline Goal, dB, $L_{A10,18hr}$	Predicted excess over Planning Guideline, dBA			Year By Which Mitigation Should Be Implemented (where required)	Predicted $L_{A10(18hour)}$ – With Mitigation (2041)
Block	**Section**	**2021**	**2031**	**2041**		**2021**	**2031**	**2041**		
23	6	53	54	56	58	Pass	Pass	Pass	-	52
22	6	54	54	56	58	Pass	Pass	Pass	-	53
21	6	55	55	57	58	Pass	Pass	Pass	-	53
20	6	55	55	57	58	Pass	Pass	Pass	-	53
19	6	55	55	58	58	Pass	Pass	Pass	-	54
18	6	54	54	56	58	Pass	Pass	Pass	-	53
17	6	54	54	57	58	Pass	Pass	Pass	-	54
16	6	54	55	57	58	Pass	Pass	Pass	-	54
15	6	54	55	57	58	Pass	Pass	Pass	-	53
14	6	53	54	56	58	Pass	Pass	Pass	-	52
1	6	57	58	60	58	Pass	Pass	2	2041	52
Holt (North of Alignment)										
U1-54	24	62	63	66	63	Pass	Pass	3	2041	63
U2-54	24	62	63	66	63	Pass	Pass	3	2041	63
U3-54	24	62	63	66	63	Pass	Pass	3	2041	63
U4-54	24	62	63	66	63	Pass	Pass	3	2041	63
U4-54	24	62	63	66	63	Pass	Pass	3	2041	63
U6-54	24	62	63	66	63	Pass	Pass	3	2041	63
U7-54	24	63	64	66	63	Pass	1	3	2031	63
U8-54	24	63	64	66	63	Pass	1	3	2031	63
1	24	62	63	66	63	Pass	Pass	3	2041	62
2	24	63	64	66	63	Pass	1	3	2031	63
3	24	62	63	66	63	Pass	Pass	3	2041	62
4	24	62	63	66	63	Pass	Pass	3	2041	62
5	24	62	63	66	63	Pass	Pass	3	2041	61

Single Point Receiver Results – Drake Brockman Drive

Receiver Location		Predicted $L_{A10(18hour)}$ No Mitigation, By Year			Noise Planning Guideline Goal, dB, $L_{A10,18hr}$	Predicted excess over Planning Guideline, dBA			Year By Which Mitigation Should Be Implemented (where required)	Predicted $L_{A10(18hour)}$ – With Mitigation (2041)
Block	**Section**	**2021**	**2031**	**2041**		**2021**	**2031**	**2041**		
6	24	63	64	66	63	Pass	1	3	2031	61
7	24	62	64	66	63	Pass	0	3	2041	61
8	24	62	63	66	63	Pass	Pass	3	2041	61
9	24	62	63	66	63	Pass	Pass	3	2041	61
10	24	62	63	66	63	Pass	Pass	3	2041	62
11	24	62	63	65	63	Pass	Pass	2	2041	61
12	24	59	60	63	63	Pass	Pass	Pass	-	59
13	24	58	59	61	63	Pass	Pass	Pass	-	58
14	24	61	62	64	63	Pass	Pass	1	2041	60
15	24	59	60	63	63	Pass	Pass	Pass	-	59
16	24	59	60	62	63	Pass	Pass	Pass	-	59
154-3	33	58	59	62	63	Pass	Pass	Pass	-	58
156-3	33	58	59	61	63	Pass	Pass	Pass	-	58
156-3	33	57	58	60	63	Pass	Pass	Pass	-	58
158-3	33	57	58	61	63	Pass	Pass	Pass	-	58
160-3	33	57	58	61	63	Pass	Pass	Pass	-	58
160A-3	33	57	58	61	63	Pass	Pass	Pass	-	58
162-3	33	58	59	61	63	Pass	Pass	Pass	-	58
162A-3	33	58	59	61	63	Pass	Pass	Pass	-	59
164-3	33	58	59	61	63	Pass	Pass	Pass	-	59
164A-3	33	58	59	61	63	Pass	Pass	Pass	-	59
4	33	61	62	65	63	Pass	Pass	2	2041	63
36	34	60	61	64	63	Pass	Pass	1	2041	61
37	34	62	63	65	63	Pass	Pass	2	2041	62
38	34	58	60	62	63	Pass	Pass	Pass	-	59

Single Point Receiver Results – Drake Brockman Drive

Receiver Location		Predicted $L_{A10(18hour)}$ No Mitigation, By Year			Noise Planning Guideline Goal, dB, $L_{A10,18hr}$	Predicted excess over Planning Guideline, dBA			Year By Which Mitigation Should Be Implemented (where required)	Predicted $L_{A10(18hour)}$ – With Mitigation (2041)
Block	**Section**	**2021**	**2031**	**2041**		**2021**	**2031**	**2041**		
39	34	61	62	65	63	Pass	Pass	2	2041	60
40	34	60	61	64	63	Pass	Pass	1	2041	59
41	34	59	61	63	63	Pass	Pass	Pass	-	59
42	34	61	62	64	63	Pass	Pass	1	2041	60
44	34	60	61	64	63	Pass	Pass	1	2041	60
45	34	61	62	65	63	Pass	Pass	2	2041	61
46	34	61	63	65	63	Pass	Pass	2	2041	62
47	34	59	60	63	63	Pass	Pass	Pass	-	60

Noise Contour Map – Ginninderra Drive (No Mitigation)

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Note: All results have an accuracy of ±2dBA

Ginninderra Drive
Road Traffic Noise Level Predictions
Using Predicted Year 2041 Traffic Flows
(Without Implementation of Noise Mitigation)

N
W
E
S
0 25 50 75 100 m

The Riverview Group

West Belconnen Subdivision

Report Ref: 670.10602-R2

FIGURE L1

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Ginninderra Drive
Road Traffic Noise Level Predictions
Using Predicted Year 2041 Traffic Flows
(Without Implementation of Noise Mitigation)

N W E S

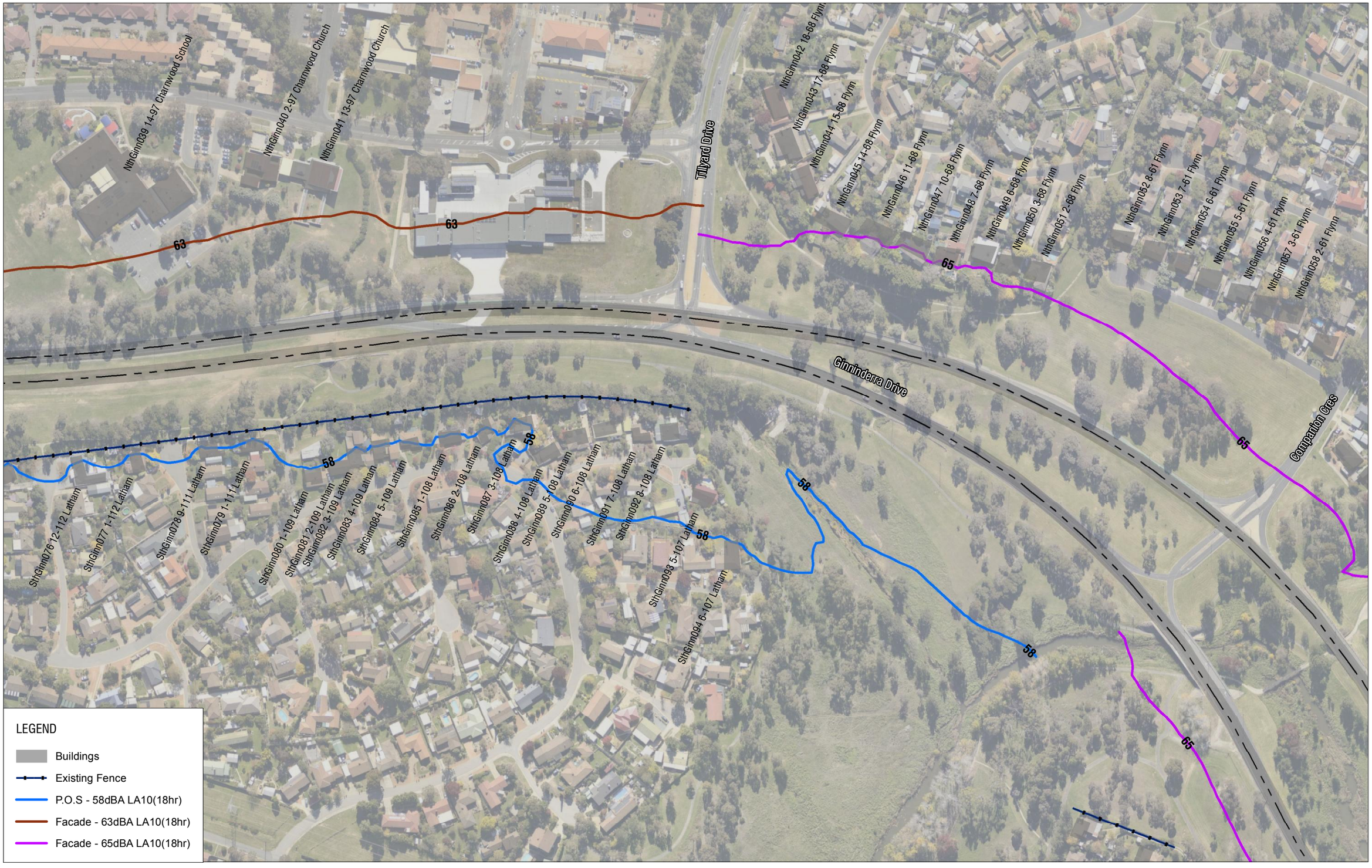
0 25 50 75 100 m

The Riverview Group

West Belconnen Subdivision

Report Ref: 670.10602-R2

FIGURE L2



LEGEND

- Buildings
- Existing Fence
- P.O.S - 58dBA LA10(18hr)
- Facade - 63dBA LA10(18hr)
- Facade - 65dBA LA10(18hr)

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Ginninderra Drive
Road Traffic Noise Level Predictions
Using Predicted Year 2041 Traffic Flows
(Without Implementation of Noise Mitigation)

N E S W

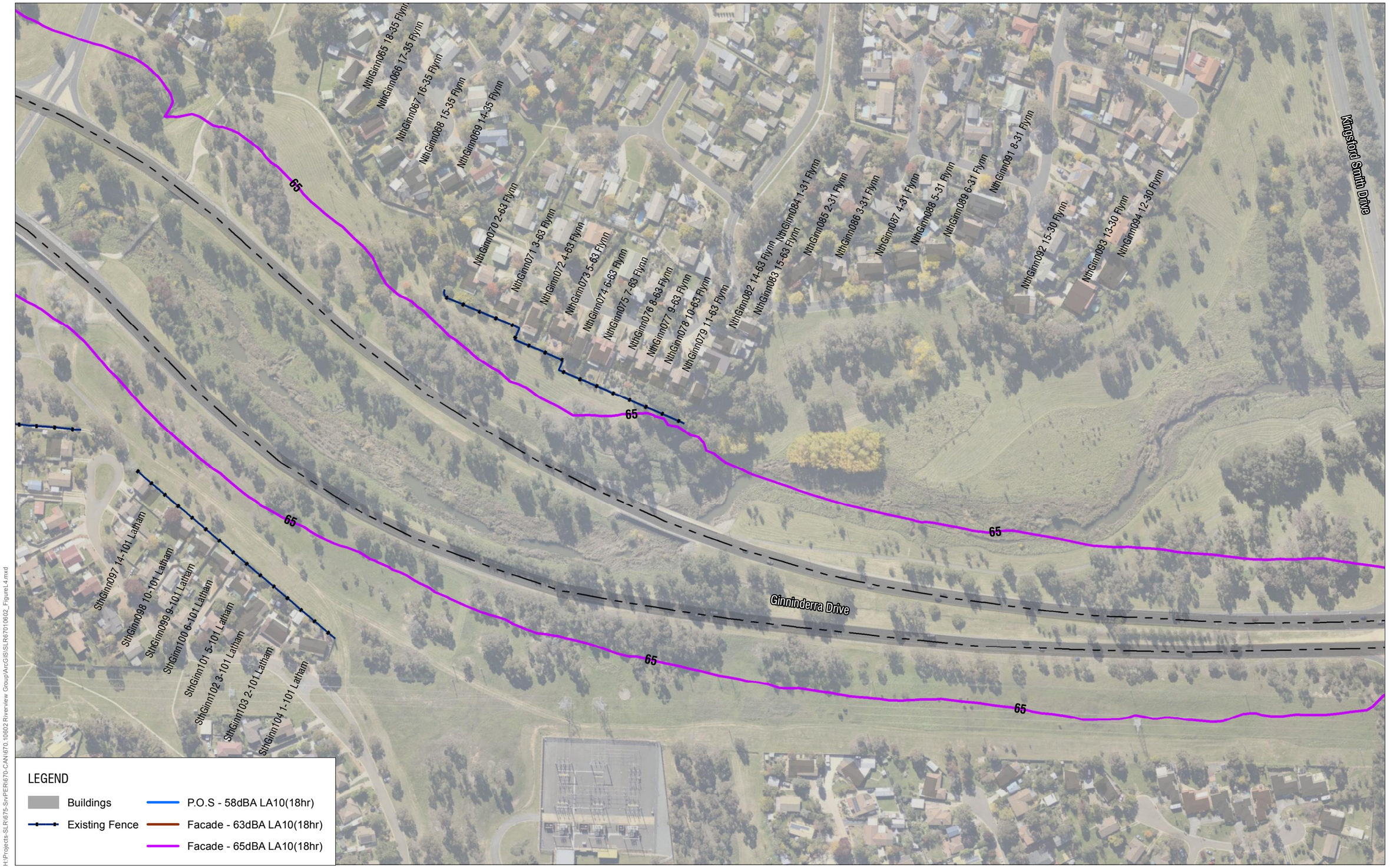
0 25 50 75 100 m

The Riverview Group

West Belconnen Subdivision

Report Ref: 670.10602-R2

FIGURE L3



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Note: All results have an accuracy of ±2dBA

Ginninderra Drive
Road Traffic Noise Level Predictions
Using Predicted Year 2041 Traffic Flows
(Without Implementation of Noise Mitigation)

N E S W

0 25 50 75 100 m

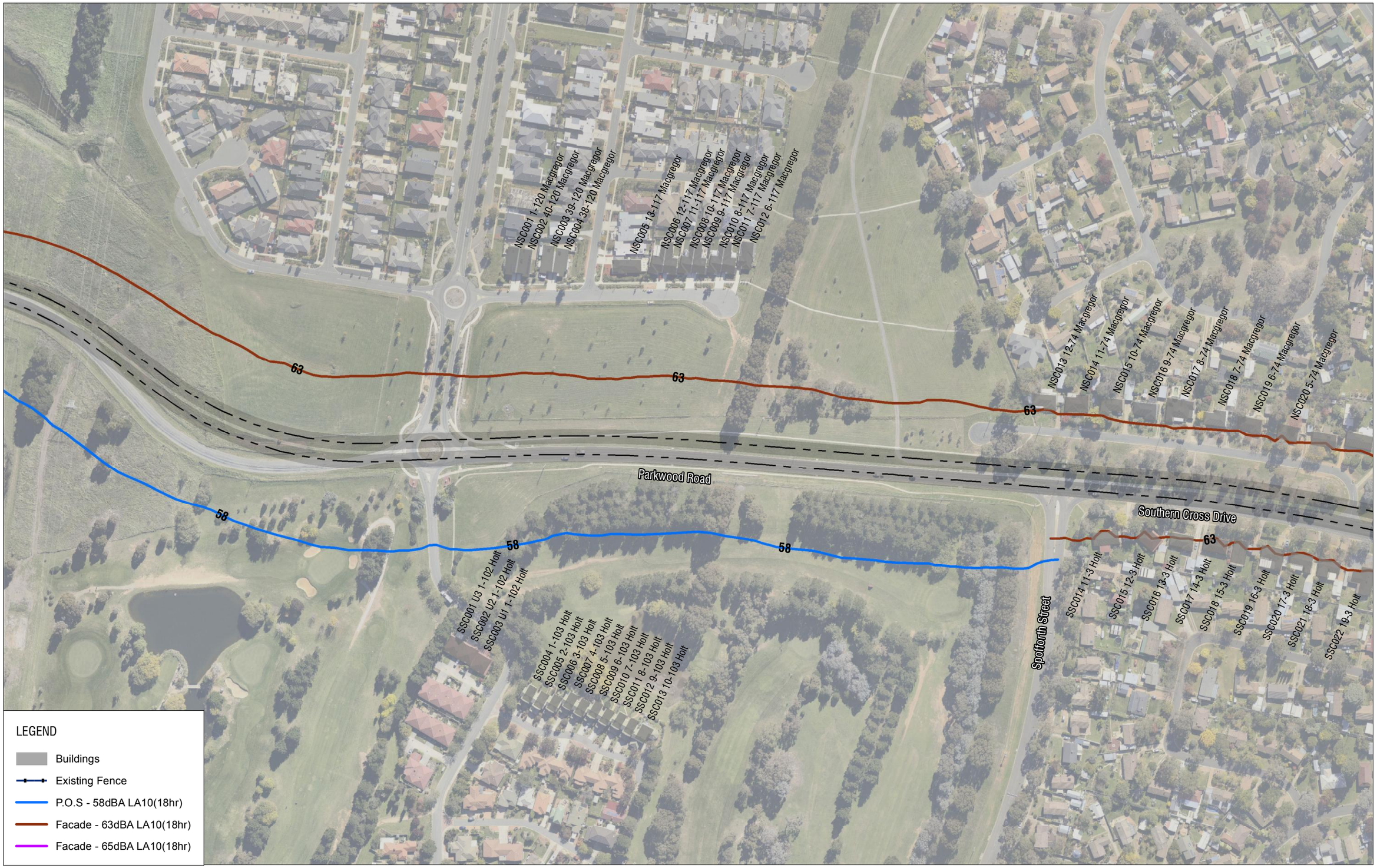
The Riverview Group

West Belconnen Subdivision

Report Ref: 670.10602-R2

FIGURE L4

Noise Contour Map – Southern Cross Drive (No Mitigation)



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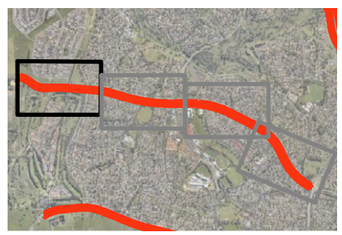

Note: All results have an accuracy of ±2dBA

Southern Cross Drive
Road Traffic Noise Level Predictions
Using Predicted Year 2041 Traffic Flows
(Without Implementation of Noise Mitigation)

N
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0 25 50 75 100 m

The Riverview Group

West Belconnen Subdivision

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FIGURE M1

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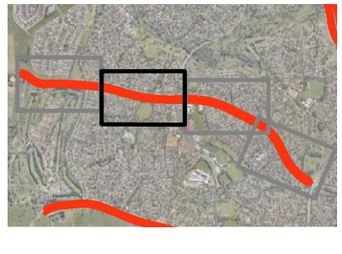

Note: All results have an accuracy of ±2dBA

Southern Cross Drive
Road Traffic Noise Level Predictions
Using Predicted Year 2041 Traffic Flows
(Without Implementation of Noise Mitigation)

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0 25 50 75 100 m

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West Belconnen Subdivision

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FIGURE M2

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Southern Cross Drive
Road Traffic Noise Level Predictions
Using Predicted Year 2041 Traffic Flows
(Without Implementation of Noise Mitigation)

N
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0 25 50 75 100 m

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FIGURE M3

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Southern Cross Drive
Road Traffic Noise Level Predictions
Using Predicted Year 2041 Traffic Flows
(Without Implementation of Noise Mitigation)

N E S W

0 25 50 75 100 m

The Riverview Group

West Belconnen Subdivision

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FIGURE M4

Noise Contour Map – Drake Brockman Drive (No Mitigation)

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Note: All results have an accuracy of ±2dBA

Drake Brockman Drive
Road Traffic Noise Level Predictions
Using Predicted Year 2041 Traffic Flows
(Without Implementation of Noise Mitigation)

N
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0 25 50 75 100 m

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FIGURE N1

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Note: All results have an accuracy of ±2dBA

Drake Brockman Drive
Road Traffic Noise Level Predictions
Using Predicted Year 2041 Traffic Flows
(Without Implementation of Noise Mitigation)

N
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0 25 50 75 100 m

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West Belconnen Subdivision

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FIGURE N2

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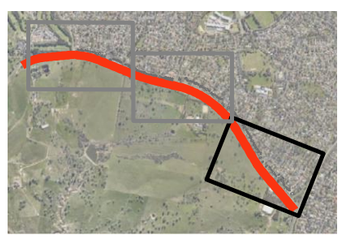

Note: All results have an accuracy of ±2dBA

Drake Brockman Drive
Road Traffic Noise Level Predictions
Using Predicted Year 2041 Traffic Flows
(Without Implementation of Noise Mitigation)

N E S W

0 25 50 75 100 m

The Riverview Group

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FIGURE N3

Noise Contour Map – Ginninderra Drive (With Mitigation)

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Note: All results have an accuracy of ±2dBA

Ginninderra Drive
Road Traffic Noise Level Predictions Using Predicted Year 2041 Traffic Flows (With Proposed Noise Mitigation Options Implemented)

N
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S
0 25 50 75 100 m

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FIGURE 01

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Note: All results have an accuracy of ±2dBA

Ginninderra Drive
Road Traffic Noise Level Predictions Using Predicted Year 2041 Traffic Flows (With Proposed Noise Mitigation Options Implemented)

N W E S

0 25 50 75 100 m

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FIGURE 02

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Ginninderra Drive
Road Traffic Noise Level Predictions Using Predicted Year 2041 Traffic Flows (With Proposed Noise Mitigation Options Implemented)

N E S W

0 25 50 75 100 m

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FIGURE O3

Noise Contour Map – Drake Brockman (With Mitigation)

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Drake Brockman Drive
Road Traffic Noise Level Predictions Using Predicted Year 2041 Traffic Flows (With Proposed Noise Mitigation Options Implemented)

N
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0 25 50 75 100 m

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West Belconnen Subdivision

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FIGURE P1

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Drake Brockman Drive
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Using Predicted Year 2041 Traffic Flows
(With Proposed Noise Mitigation Options Implemented)

N
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0 25 50 75 100 m

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West Belconnen Subdivision

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FIGURE P2

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Drake Brockman Drive
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Using Predicted Year 2041 Traffic Flows
(With Proposed Noise Mitigation Options Implemented)

N E S W

0 25 50 75 100 m

The Riverview Group

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FIGURE P3