

Oxley Highway to Kundabung Pacific Highway upgrade

Post construction operational noise report

Roads and Maritime Services | October 2019

PREPARED BY

SLR Consulting Australia Pty Ltd
ABN 29 001 584 612
Grd Floor, 2 Lincoln Street
Lane Cove NSW 2066 Australia
(PO Box 176 Lane Cove NSW 1595 Australia)
T: +61 2 9427 8100
E: sydney@slrconsulting.com www.slrconsulting.com

BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Roads and Maritime Services (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
610.12331-R02-v1.2	16 May 2019	John Sleeman	Robert Hall Mark Russell	John Sleeman
610.12331-R02-v1.1	30 April 2019	John Sleeman	Robert Hall Mark Russell	John Sleeman
610.12331-R02-v1.0	29 March 2019	John Sleeman	Robert Hall Mark Russell	John Sleeman

GLOSSARY OF TERMS AND ABBREVIATIONS

AHD	Australian height datum
Ch	Chainage
CORTN	Calculation of Road Traffic Noise
dB	Un-weighted noise level, or the change between two un-weighted or weighted noise levels
dBA	'A weighted' noise level, which corresponds to the response of the human ear
EA	Environmental Assessment
ECRTN	Environmental Criteria for Road Traffic Noise
ENMM	Environmental Noise Management Manual
EPA	Environment Protection Authority
FDD	Final Design Documentation
GDA	Geocentric Datum of Australia
IFC	Issued for Construction
INP	Industrial Noise Policy
LA1, LA10, LA90	A weighted noise levels exceeded for 1%, 10% and 90% of the measurement period
LAeq	The A-weighted equivalent noise level (basically the average noise level)
NB	Northbound
NMVG	Noise Model Validation Guideline
NPfi	Noise Policy for Industry
OH2Ku	Oxley Highway to Kundabung
Roads and Maritime	Roads and Maritime Services
SB	Southbound
SDD	Substantial Detailed Design
SWTC	Scope of Works and Technical Criteria
WAE	Work as Executed

EXECUTIVE SUMMARY

The Oxley Highway to Kundabung project (OH2Ku) is Stage 3 of the Oxley Highway to Kempsey upgrade project and comprises 23 kilometres of new dual carriageway. Key features of the OH2Ku project include construction of four grade separated interchanges at Sancroix Road, Hastings River Drive, Haydons Wharf Road and Yarrabee Road as well as major bridges crossing the Hastings River, Wilsons River and the North Coast Railway. The project connects to the existing Pacific Highway just north of the Oxley Highway interchange in the south, and to the Kundabung to Kempsey upgrade near Barrys Creek in the north. Construction of the project started in November 2014, and it was opened to traffic March 2018, with highway traffic speed increased to 110km/h in May 2018.

During the detailed design phase of the project, predictive noise modelling was carried out to determine the likely road traffic noise levels expected from the project. The results of the noise modelling for OH2Ku upgrade were detailed in the Operational Noise Management Report (ONMP), dated February 2016.

Roads and Maritime Services has engaged SLR Australia Pty Ltd (SLR) to carry out a Post Construction Operational Noise Assessment of the OH2Ku, which is covered in this report.

Noise Criteria

Operational noise requirements for OH2Ku were developed in accordance with the Minister's Conditions of Approval, the Environment Protection Authority's (EPA's) Environmental Criteria for Road Traffic Noise (ECRTN) and Roads and Maritime's Environmental Noise Management Manual (ENMM).

Noise Monitoring

Unattended and attended noise monitoring was carried out at 12 locations. The results of the noise monitoring have been processed in accordance with the procedures contained in the ECRTN and ENMM and are presented within the body of this report.

Noise Modelling and Mitigation Review

Road traffic noise levels for OH2Ku were calculated using procedures based on the Calculation of Road Traffic Noise (CoRTN) prediction algorithms using the 'As Built' noise model and design traffic volumes provided by Roads and Maritime. Scenarios modelled for the noise assessments include the 'Year of Opening' (2018) and 'Design Year' (2028) for both day and night-time periods. Post-construction noise road traffic noise levels modelled were compared against the previously determined noise levels contained in the ONMR.

The comparison between ONMR noise levels and 'Year of Opening' (2018) and 'Design Year' (2028) in this assessment identified some inconsistencies in predicted noise levels. These inconsistencies are due to:

- changes in traffic data
- refinements to the design inputs which included minor changes to earth mounding along the alignment
- corrections of facade reference points from those identified in the previous impact assessment.

The ECRTN assessment contained in the ONMR was updated using the appropriate information and compared with the ECRTN assessment for the 'As Built' design, to determine the appropriateness of mitigation measures.

EXECUTIVE SUMMARY

Roads and Maritime has provided noise mitigation to 70 properties. All properties treated have the appropriate level of mitigation as determined by the maximum exceedance level, as explained in **Section 3.2**, with the exception of sensitive receiver number ID 2065. The treatment level of mitigation applied to ID 2065 would be reviewed by Roads and Maritime.

Conclusion

Roads and Maritime has provided noise mitigation to 70 properties, and at sensitive receiver number ID 2065 the level of mitigation would be reviewed.

CONTENTS

1	INTRODUCTION.....	9
1.1	Project description.....	9
1.2	Purpose	9
1.3	Referenced documents and guidelines	9
1.4	Process for assessment.....	10
2	OPERATIONAL NOISE CRITERIA	12
2.1	Minister’s Conditions of Approval	12
2.2	Road traffic noise criteria	13
2.3	Environmental Noise Management Manual (ENMM)	14
2.4	Classification of the OH2Ku project	14
2.5	Assessment scenarios	15
3	TRAFFIC NOISE MITIGATION	15
3.1	Stone Mastic Asphalt road pavement surfaces	16
3.2	At-house acoustic treatment.....	16
4	POST - CONSTRUCTION NOISE MONITORING	17
4.1	Noise monitoring overview.....	17
4.2	Noise monitoring instrumentation	17
4.3	Weather conditions	17
4.4	Noise monitoring locations.....	17
4.5	Noise monitoring results.....	18
4.5.1	Summary of noise monitoring results	19
5	TRAFFIC DATA	22
5.1	Measured traffic	22
5.2	Traffic data comparison	22
5.3	Revised 2028 future design traffic forecasts	25
6	NOISE MODELLING	27
6.1	SoundPLAN and CORTN modelling parameters.....	27
6.2	Design inputs	27
6.3	Validation of noise model.....	29
6.3.1	404 Cooperabung Drive	30

CONTENTS

6.3.2	64 Haydons Wharf Road Cooperabung and 61 Hoskins Drive Blackmans Point	30
6.3.3	13 Cooperabung Drive and Stoney Park, Telegraph Point	30
6.3.4	28 Bushland Drive, Sancrox	30
7	POST CONSTRUCTION NOISE ASSESSMENT	32
7.1	Mitigation review.....	32
7.1.1	Discussion	34
7.2	Engine braking assessment.....	35
8	OPERATIONAL NOISE COMPLAINTS AND ENQUIRIES	36
9	CONCLUSION	37

DOCUMENT REFERENCES

TABLES

Table 1	Conditions of Approval for Operational noise – Condition E1	12
Table 2	ECRTN Daytime and night-time criteria for residential receivers	13
Table 3	At-House acoustic treatment guide	16
Table 4	Noise monitoring locations	18
Table 5	Summary of unattended noise monitoring results	19
Table 6	Summary of attended noise monitoring results.....	20
Table 7	2018 Traffic counting results	22
Table 8	Comparison of forecast post-construction Year 1 traffic to detailed design Year 1 traffic.....	23
Table 9	Opening Year 2018 and future design Year 2028 traffic forecast	25
Table 10	Design inputs and assumptions.....	27
Table 11	Comparison of 2018 predicted and measured noise levels for long term unattended monitoring	29
Table 12	Property treatment summary	32
Table 13	Residential complaints	36

FIGURES

Figure 1	OH2Ku Project area including sensitive receiver and noise logging locations.	11
Figure 2	Engine brake NTC value and event distribution	35

APPENDICES

Appendix A	Acoustic Terminology
Appendix B	Site Plan
Appendix C	Ambient Noise Logging Results
Appendix D	2018 and 2028 Noise Contours

CONTENTS

Appendix E	Updated ONMR ECRTN Assessment Year 2016 and Design Year 2026
Appendix F	As Built ECRTN Assessment Year of Opening 2018 and Design Year 2028
Appendix G	ONMR Year 2016 and Year of Opening 2018 Comparison and ONMR Design Year 2026 and Design Year 2028 Comparison

1 Introduction

1.1 Project description

The Oxley Highway to Kempsey section of the Pacific Highway upgrade received project approval in February 2012. The 37 kilometre upgrade was built in three stages – Sancrox Interchange , Oxley Highway to Kundabung and Kundabung to Kempsey.

The Oxley Highway to Kundabung project (OH2Ku) is Stage 3 of the Oxley Highway to Kempsey upgrade project and comprises 23 kilometres of new dual carriageway. Key features of the OH2Ku project include construction of four grade separated interchanges at Sancrox Road, Hastings River Drive, Haydons Wharf Road and Yarrabee Road as well as major bridges crossing the Hastings River, Wilsons River and the North Coast Railway. The project connects to the existing Pacific Highway just north of the Oxley Highway interchange in the south and to the Kundabung to Kempsey upgrade near Barrys Creek in the north.

Figure 1 illustrates the project area.

Construction of the project started in November 2014, and opened to traffic March 2018, with highway traffic speed increased to 110km/h in May 2018.

1.2 Purpose

The purpose of this report is to review the traffic noise levels from the OH2Ku Pacific Highway upgrade and compare them against the predicted noise levels at the detailed design stage to assess the adequacy of the recommended and installed road traffic noise mitigation measures. This report also fulfils the requirements of Condition E1 of the Ministers Conditions of Approval (MCoA) for the project (refer to Section 2).

This report addresses the following objectives of the assessment:

- validate and calibrate the noise model for the 'As Built' scenario
- predict the corresponding noise levels for a design year of 10 years after opening
- review the model predictions against previous assessments
- identify any changes needed to the mitigation measures already implemented for the project (ie check house treatments meet requirements).

Specific acoustic terminology is used in this document. **Appendix A** contains an explanation of the various acoustic terms and descriptors.

1.3 Referenced documents and guidelines

The assessment has been carried out with reference to the following documents:

- E1 of the Minister's Condition of Approval (MCoA)
- Environmental Criteria for Road Traffic Noise (ECRTN) (EPA, 1999)
- Environmental Noise Management Manual (ENMM) (RTA, 2001)

- Roads and Maritime Procedure - Preparing a Post Construction Noise Assessment Report (PCNA) (RMS, 2014)
- Austroads: An Approach to the Validation of Road Traffic Noise Models (2002)
- Australian Standard AS 2702 - Acoustic Methods of Measurement of Road Traffic Noise
- Oxley Highway to Kempsey Environmental Assessment (EA), Volume 3 Working Paper 3; Noise and Vibration Working Paper
- Oxley Highway to Kundabung Operational Noise Management Report (ONMR), OH2Ku-NV01-RP-0001-D5, Feb 2016
- Noise Model Validation Guideline, Roads and Maritime, 2016
- OH2Ku Scope of Works and Technical Criteria (SWTC) Appendix 4 and 9.

1.4 Process for assessment

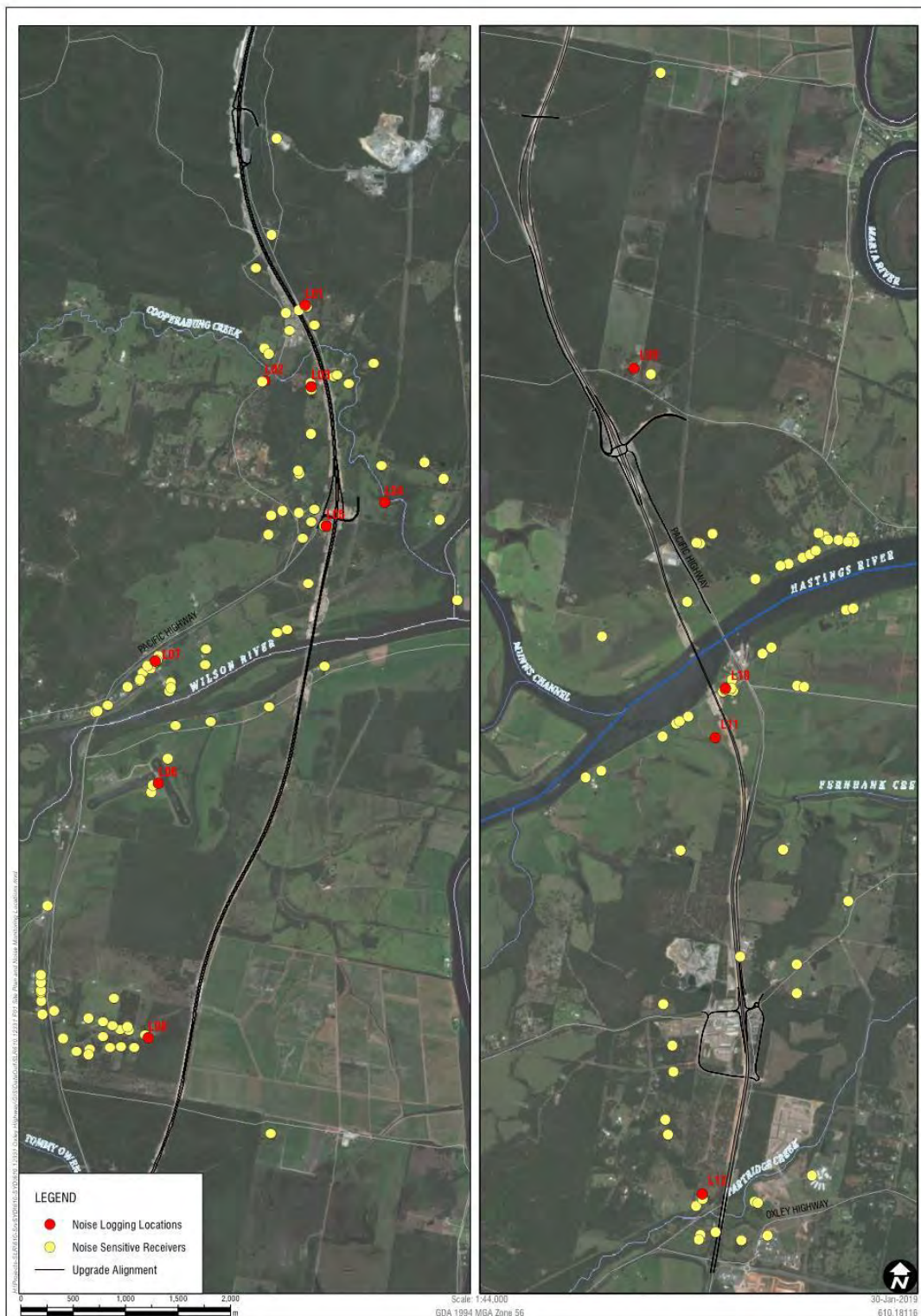
The post construction assessment process used in this report is summarised as follows:

- 1 Noise monitoring was carried out at representative locations along the project alignment. Traffic counting was taken at the same time to determine the representative level of road traffic noise adjacent to the project.
- 2 The noise monitoring data was processed, taking into account weather conditions and uncharacteristic noise events from sources other than road traffic.
- 3 The noise prediction model developed in the EA/detailed design stages was updated to produce the post-construction compliance noise model which reflects the 'As-Built' design of the project. This model includes the actual traffic flows (numbers and speeds), vehicle types (light and heavy) measured during the post-construction compliance noise monitoring and the road surfaces used on the project.
- 4 The 'As-Built' post-construction noise model predictions were compared and validated against the road traffic noise levels measured during the post-construction monitoring carried out for this assessment.
- 5 The post-construction traffic volumes were reviewed to determine whether they were significantly different from the opening traffic volumes used at the detailed design stage. Where the traffic volumes were not significantly different, then the detailed design traffic volumes for the design year were used to validate the post-construction noise model. Where the post-construction noise model predicts a noise level at a receiver that is more than 2dB higher than the detailed design predicted noise level, the mitigation was re-evaluated for that receiver.
- 6 Where the measured traffic data is significantly different from that used at detailed design and results in higher noise levels, then noise mitigation measures identified in detailed design were re-evaluated.

The Environmental Criteria for Road Traffic Noise (ECRTN) requires the assessment and measurement of road traffic noise before and after opening the upgrade and the prediction of traffic noise levels 10 years after opening. The ONMR was prepared using an opening date of 2016. The prediction model has been revised to reflect the measured traffic volumes and traffic speeds in 2018 for the upgraded highway. Changes in the traffic volume and the upgrade project design since the completion of the ONMR are discussed in **Section 5** of this report.

Road traffic noise prediction results for 2018 and 2028 are presented in **Appendix F** of this report.

Figure 1 OH2Ku Project area including sensitive receiver and noise logging locations.



2 Operational noise criteria

2.1 Minister's Conditions of Approval

The Planning and Infrastructure Minister's Conditions of Approval (MCoA) for the OH2Ku are mandatory requirements for the project.

The relevant conditions of approval to be addressed in the Operational Noise Report are presented in **Table 1** with a reference to where each condition is addressed in this report.

Table 1 Conditions of Approval for Operational noise – Condition E1

Condition E1	Where Addressed in this Report
E1. Within 12 months of the commencement of operation of the project, or as otherwise agreed by the Director General, the Proponent shall undertake operational noise monitoring to compare actual noise performance of the project against noise performance predicted in the review of noise mitigation measures required by condition C13 and prepare an Operational Noise Report to document this monitoring. The Report shall include, but not necessarily be limited to:	This report
a) noise monitoring to assess compliance with the operational noise levels predicted in the review of operational noise mitigation measures required under condition C12 and documents specified under condition A1 of this approval;	Section 4
b) a review of the operational noise levels in terms of criteria and noise goals established in the Environmental Criteria for Road Traffic Noise (Environment Protection Authority, 1999);	Section 2
c) methodology, location and frequency of noise monitoring undertaken, including monitoring sites at which project noise levels are ascertained, with specific reference to locations indicative of impacts on sensitive receivers;	Section 4
d) details of any complaints and enquiries received in relation to operational noise generated by the project between the date of commencement of operation and the date the report was prepared;	Section 8
e) any required recalibrations of the noise model taking into consideration factors such as actual traffic numbers and proportions;	Section 5 Section 6
f) an assessment of the performance and effectiveness of applied noise mitigation measures together with a review and if necessary, reassessment of all feasible and reasonable mitigation measures; and	Section 7
g) identification of any additional feasible and reasonable measures to those identified in the review of noise mitigation measures required by condition C13, that would be implemented with the objective of meeting the criteria outlined in the Environmental Criteria for Road Traffic Noise (Environment Protection Authority, 1999), when these measures would be implemented and how their effectiveness would be measured and reported to the Director General and the EPA.	Section 7
The Proponent shall provide the Director General and the EPA with a copy of the Operational Noise Report within 60 days of completing the operational noise monitoring referred to a) above and no later than 12 months after the date of the commencement of operation, or as otherwise agreed by the Director General.	-

2.2 Road traffic noise criteria

The MCoA require the road traffic noise to be assessed against the NSW *Environmental Criteria for Road Traffic Noise* (ECRTN) as this guideline was current at the time of project approval.

The ECRTN provides guidance for assessing traffic noise impacts through setting criteria for a range of development types and provides procedures for determining noise mitigation in situations where exceedances of the objectives occur.

The ECRTN provides a performance-based approach and defines highway development as either “new freeway” or “redevelopment of an existing freeway”. **Table 2** contains the road traffic noise criteria for existing residential land use developments affected by traffic noise from new and redeveloped freeways.

Table 2 ECRTN Daytime and night-time criteria for residential receivers

Type of Development	Daytime Criteria (7 am to 10 pm)	Night-time Criteria (10 pm to 7 am)	Where Criteria Are Already Exceeded
New freeway/arterial road corridor	LAeq(15hour) 55 dBA	LAeq(9hour) 50 dBA	The new road should be designed so as not to increase existing noise levels by more than 0.5 dBA. Where feasible and reasonable, noise levels from existing roads should be reduced to meet the noise criteria. In some instances this may be achievable only through long-term strategies such as improved planning, design and construction of adjoining land use developments; reduced vehicle emission levels through new vehicle standards and regulation of in-service vehicles; greater use of public transport; and alternative methods of freight haulage.
Redevelopment of existing freeway/arterial road	LAeq(15hour) 60 dBA	LAeq(9hour) 55 dBA	In all cases, the redevelopment should be designed so as not to increase existing noise levels by more than 2 dBA. Where feasible and reasonable, noise levels from existing roads should be reduced to meet the noise criteria. In many instances this may be achievable only through long-term strategies such as improved planning, design and construction of adjoining land use developments; reduced vehicle emission levels through new vehicle standards and regulation of in-service vehicles; greater use of public transport; and alternative methods of freight haulage.

The proposed criteria are targets applicable to the future volumes of traffic projected to occur in 10 years after opening the upgrade.

2.3 Environmental Noise Management Manual (ENMM)

The ENMM was published to provide guidance in managing and controlling road traffic generated noise and assist in implementing the ECRTN.

The ENMM discusses what is deemed to be “feasible and reasonable” in terms of additional noise mitigation where the ECRTN base criteria are exceeded and all “feasible and reasonable” traffic management and other road design opportunities have been exhausted. This includes quieter pavement surfaces and at house noise treatment of private dwellings.

The ENMM states that it is generally not reasonable to take action to reduce noise levels to the target noise levels if the noise levels with the proposal, ten years after project opening are predicted to be:

- Within 2dBA of ‘future existing’ noise levels
- Not acute (i.e. the noise levels are predicted to be less than 65 dBA LAeq(15hr) and 60 dBA LAeq(9hr).

Future existing noise levels refer to the noise levels at the ‘Year of Opening’ without the project implementation. In this instance it refers to noise levels in the year 2018 assuming the OH2Ku upgrade was not constructed.

2.4 Classification of the OH2Ku project

The project was assessed using the ENMM and ECRTN to determine the appropriate criteria to apply for each receiver based on the classification of the upgraded highway near each receiver. This would be either a ‘new freeway/arterial road corridor’, or ‘redevelopment of existing freeway/arterial road’. Classifications used in the SWTC were adopted.

The ENMM defines a ‘new road traffic noise source’ as being:

- a new road where a road of the same category (ie arterial, collector or local road) did not previously exist
- a new road within an existing but previously undeveloped road corridor or
- an alignment or realignment producing noise at a receptor from a different direction which makes a ‘significant contribution to noise exposure’.

To determine whether the noise contribution from the new emission direction is ‘significant’, the road traffic noise contribution of the existing alignment (after any road redevelopment or upgrade on this alignment) is subtracted from the combined noise exposure. If the new emission direction is found to produce a ‘significant’ contribution, the new alignment or realignment is a ‘new noise road traffic noise source’.

In instances where the most exposed facade of a residence does not have an existing road traffic noise exposure then the ‘new road’ criteria are applied.

This process can result in a different criteria being applied to different facades of the same residence depending on their orientation to the existing highway and the new sources of road traffic noise.

Accordingly, the receiver classifications adopted for this report are:

- New freeway/arterial road corridor receivers:

- receivers to the east and west of the upgrade from Fernbank Creek until the Blackman's Point Road interchange
- receivers to the east and west of the upgrade from the Bill Hill Road overpass until the Haydons Wharf Road on ramp, located about 600 metres north of the overpass
- Redevelopment of existing freeway/arterial road receivers:
 - receivers to the east and west of the upgrade from the start of the upgrade until Fernbank Creek
 - receivers to the east of the upgrade from the Blackman's Point Road interchange until the Bill Hill Road overpass
 - receivers to the east and west of the upgrade from the Haydons Wharf Road on ramp until the northern end of the upgrade.

In addition to the above criteria, the RTA's ENMM provides criteria associated with "acute" noise impacts. The acute noise thresholds are:

- LAeq(15hour) (day) ≥ 65 dBA
- LAeq(9hour) (night) ≥ 60 dBA

Where noise levels are predicted to be at or above the acute noise level thresholds, and cannot be mitigated by the road design using quieter pavement surfaces, noise walls or noise mounds, then architectural treatments of individual private dwellings are normally required to provide an acceptable indoor amenity.

The assessment results provided in **Appendix E and F** contain the relevant criteria used for each receiver.

2.5 Assessment scenarios

The impacts from the OH2Ku project in the EA and ONMR were found to be controlled by the 'Future Design' 2028 scenario (ie 10 years after opening).

The following scenarios have been used in the assessment of post construction road traffic noise levels:

- **2018 Year of Opening**
Using the re-forecast 2018 traffic data with the 'As-Built' design for the OH2Ku project.
- **2028 Future Design Build**
Using the re-forecast 2028 traffic data with the 'As-Built' design for the OH2Ku project.

3 Traffic noise mitigation

The operational noise impacts for the project were previously assessed at the Environmental Assessment (EA) and detailed design phases. The project noise mitigation strategy included the use of Stone Mastic Asphalt in key locations and the installation of at-house acoustic treatments where necessary. The strategy is summarised below, together with details of refinements made to the project design as it has progressed through detailed design and on to construction.

3.1 Stone Mastic Asphalt road pavement surfaces

The road surfaces used on the OH2Ku project include Plain Concrete Pavement (PCP) and 30mm Stone Mastic Asphalt (SMA). The PCP is used for the majority of the project, with SMA used for the following chainages, and structures.

- 4600 to 6120 – from Fernbank Creek Bridge to the Hastings River Bridge
- 11600 to 17800 – from Bill Hill Road to 250 metres south of the Haydons Wharf Road overpass
- All bridge decks.

3.2 At-house acoustic treatment

Mitigation measures have been installed at individual homes where residual noise impacts were predicted to remain above the relevant criteria after all 'feasible' and 'reasonable' noise mitigation approaches have been applied in the construction of the project. Treatments are a combination of architectural improvements and mechanical ventilation. The requirement for at-house acoustic treatments was assessed during the EA and detailed design. The number of eligible receivers identified by the EA was 59, and 52 identified in detailed design. Roads and Maritime identified additional receivers to those of the EA and detailed design with the total treated receivers being 70. A full breakdown of the receiver treatment is provided in **Table 12**.

The level of treatment offered depends on the level of the exceedance. **Table 3** provides a summary of the at-house treatment options considered for each eligible receiver on the project.

Table 3 At-House acoustic treatment guide

Treatment Type	Predicted Noise Exceedance above Traffic Noise Criteria dBA	Acoustic Treatments to be Considered (for habitable rooms)
1	5 dBA	Air conditioning with fresh air mechanical ventilation
2	6-10 dBA	Air conditioning with fresh air mechanical ventilation plus consideration of upgraded doors and windows, acoustic seals, and acoustic treatment of wall vents to the most-impacted facade(s) where significant benefit can be demonstrated.
3	>10 dBA	Air conditioning with fresh air mechanical ventilation plus upgraded doors and windows, acoustic seals, and acoustic treatment of wall vents to all impacted facades where significant benefit can be demonstrated.

4 Post - construction noise monitoring

The MCoA for the project requires that post construction noise monitoring be carried out to verify compliance of the project at monitoring sites which are representative of noise levels and impacts on the surrounding sensitive receivers.

4.1 Noise monitoring overview

The purpose of the unattended noise monitoring is to measure road traffic noise during the defined daytime and night-time periods. The monitoring was carried out at 12 locations in accordance with the procedures of the relevant EPA guidelines and Australian Standards.

Unattended noise loggers were placed near sensitive receivers over a minimum period of 10 days to measure the ambient noise levels. The unattended noise monitoring was carried out between 23 October 2018 and 5 November 2018 and traffic counts were carried out at the same time. The measurements were generally carried out at a height of 1.5 metres above the local ground level.

The unattended monitoring was supplemented with attended measurements at the same locations with observations recorded to assist in quantifying the acoustical environment at each monitoring location. During each of the attended noise measurements the observer noted the various noise sources and levels influencing the ambient noise environment.

4.2 Noise monitoring instrumentation

Long term unattended noise measurements were carried out with ARL Type NGARA noise loggers. All noise loggers were fitted with microphone wind shields and the calibration of the equipment was checked before and after each measurement survey. Audio files were recorded for the full duration of the noise survey at each location for subsequent detailed analysis where required.

All noise measurement instrumentation used in the surveys was designed to comply with the requirements of Australian Standard AS IEC 61672.12004 Electroacoustics – Sound level meters, Part 1: Specifications and carried appropriate and current NATA calibration certificates.

4.3 Weather conditions

Weather data recorded during the noise monitoring survey by the Roads and Maritime onsite weather station located at Telegraph Point, Port Macquarie (ref RMSN1AWS) was used to assist in identifying potentially adverse weather conditions, such as excessively windy or rainy periods. Weather affected data was removed in accordance with relevant guidelines. Weather data from the onsite weather station including mean wind speed and rainfall depth is presented as part of the noise logger results in **Appendix C**.

4.4 Noise monitoring locations

The 12 noise monitoring locations are a combination of monitoring locations previously used during the detailed design phase and locations adjacent to the new highway. The locations were chosen to validate the noise model and verify noise mitigation performance. The 12 locations were chosen in consultation with Roads and Maritime and are shown on the site plan in **Figure 1** and **Appendix B**.

The ECRTN criteria refers to traffic noise levels 1 metre from the dwelling façade. Accordingly, where the dwelling façade location is generally parallel to and unobstructed from traffic noise, and the location is not influenced by residential noise and the noise monitor can be conveniently placed 1 metre from the facade, this location may be used. Otherwise a free field location near the dwelling may be used.

In selecting monitoring locations, the Roads and Maritime Noise Model Validation Guideline (NMVG) notes that it is not practical or necessary to measure noise at all locations along the alignment and that the post-construction measured noise levels should be supplemented with an 'As-Built' post construction noise model.

Table 4 Noise monitoring locations

Loc.	Address	Logger Type and Serial No	Monitoring type	Monitoring period	Days of data retrieved
L1	9350 Pacific Highway, Cooperabung	ARL NGARA 87808F	Attended and unattended	23/10/2018 – 5/11/2108	14
L2	404 Cooperabung Drive, Cooperabung	ARL NGARA 87807B	Attended and unattended	22/10/2018 - 5/11/2108	15
L3	9273 Pacific Highway, Cooperabung	ARL NGARA 878012	Attended and unattended	22/10/2018 – 6/11/2108	16
L4	60 Haydens Wharf Road, Cooperabung	ARL NGARA 878093	Attended and unattended	23/10/2018 - 4/11/2108	13
L5	8 Haydens Wharf Road, Cooperabung	ARL NGARA 87809E	Attended and unattended	23/10/2018 - 6/11/2108	15
L6	13 Cooperabung Drive, Telegraph Point	ARL NGARA 878005F	Attended and unattended	23/10/2018 - 6/11/2108	15
L7	Hacks Ferry Road (Stoney Park), Telegraph Point	ARL NGARA 878049	Attended and unattended	22/10/2018 - 5/11/2108	15
L8	91 Moore Side Drive, Telegraph Point	ARL NGARA 8780EA	Attended and unattended	22/10/2018 - 5/11/2108	15
L9	61 Hosking Road, Blackman's Point	ARL NGARA 87807D	Attended and unattended	23/10/2018 - 2/11/2108	11
L10	19 Glen Ewan Road, Sancrox	ARL NGARA 878007	Attended and unattended	22/10/2018 - 6/11/2108	16
L11	47 Glen Ewan Road, Sancrox (Glenewen)	ARL NGARA 878079F	Attended and unattended	23/10/2018 - 6/11/2108	15
L12	28 Bushland Drive, Sancrox	ARL NGARA 87801E	Attended and unattended	23/10/2018 - 6/11/2108	14

4.5 Noise monitoring results

Full details of the noise monitoring results are presented in **Appendix C**, including equipment serial numbers, attended measurement results and observations, details of each logger location and charts showing noise levels against time for the duration of the monitoring. The charts also show the periods of inclement weather such as wind or rain and extraneous noise that have been excluded from the analysis.

4.5.1 Summary of noise monitoring results

The results of the noise monitoring have been processed with reference to the procedures contained in the ECRTN to establish representative noise levels during the daytime and night-time periods.

For the purpose of this assessment, only contributions from road traffic noise are relevant. The LAeq (15hour) and LAeq (9hour) noise levels for the post-construction road traffic noise unattended monitoring locations are summarised in **Table 5**.

Table 5 Summary of unattended noise monitoring results

Loc.	Address	Distance to Upgraded Road	Road Traffic Noise Indices (dBA)		Comment on extraneous noise
			Daytime LAeq(15hour) ¹	Night-time LAeq(9hour) ¹	
L1	9350 Pacific Highway, Cooperabung	75 m	66	65	Negligible limited to midday on 2/11/2018
L2	404 Cooperabung Drive, Cooperabung	525 m	49	50	On occasion as shown in the graphical results
L3	9273 Pacific Highway, Cooperabung	120 m	60	60	On occasion as shown in the graphical results
L4	60 Haydens Wharf Road, Cooperabung	435 m	46	48	Limited to 6.30-7.30pm on several days
L5	8 Haydens Wharf Road, Cooperabung	65 m	59	57	Negligible as shown in the graphical results
L6	13 Cooperabung Drive, Telegraph Point	1,415 m	54	49	Localised events occasion as shown in the graphical results
L7	Hacks Ferry Road (Stoney Park), Telegraph Point	1,100 m	53	46	Localised events occasion as shown in the graphical results
L8	91 Moore Side Drive, Telegraph Point	380 m	46	46	On occasion as shown in the graphical results
L9	61 Hosking Road, Blackman's Point	454 m	47	47	On occasion and on 24/10/18, 28/10/18
L10	19 Glen Ewan Road, Sancrox	120 m	54	53	On occasion as shown in the graphical results
L11	47 Glen Ewan Road, Sancrox	135 m	58	57	On occasion as shown in the graphical results
L12	28 Bushland Drive, Sancrox	200 m	58	62	Night-time insect affected

Note : 1. The LAeq(15hour) and LAeq(9hour) are energy based average noise levels.

A summary of the attended monitoring results from **Appendix C** is presented in **Table 6**, with typical maximum noise levels presented in the comments column.

Table 6 Summary of attended noise monitoring results

Loc.	Date	Start Time	Measured Noise Level		Comments and maximum noise levels in dBA
			LA90	LAeq	
L1	9350 Pacific Highway, Cooperabung				
	23/10/2018	11:31	54	65	Highway traffic noise 62-78, engine brake 73-78
	06/11/2018	04:33	43	64	Highway traffic noise 60-82, engine brake 76-77, insects 54
	06/11/2018	04:48	46	65	
L2	404 Cooperabung Drive, Cooperabung				
	22/10/2018	17:41	43	48	Highway traffic noise 48-63, local traffic noise 64
	06/11/2018	05:31	48	53	Highway traffic noise 50-61, local traffic noise 62-70, dogs 54-68, birds 50-66
	06/11/2018	05:47	47	53	
L3	9273 Pacific Highway, Cooperabung				
	22/10/2018	19:22	50	61	Highway traffic noise 64-73
	06/11/2018	00:15	41	61	Highway truck noise 64-70, birds 67-74
L4	60 Haydens Wharf Road, Cooperabung				
	23/10/2018	10:12	42	46	Highway traffic noise 47-51, wind 58, birds 45-48
	06/11/2018	00:56	43	49	Highway traffic noise 45-60, insects 45, dog 53
L5	8 Haydens Wharf Road, Cooperabung				
	23/10/2018	09:20	54	60	Highway traffic noise 59-70 , birds 54-56
	06/11/2018	01:32	43	58	Highway traffic noise 63-69
L6	13 Cooperabung Drive, Telegraph Point				
	23/10/2018	08:10	39	54	Local traffic noise 50-54, Highway traffic noise 45-51, birds 43-52
	06/11/2018	05:43	41	50	Local traffic noise 51-62, Highway traffic noise 45-47, dogs 62-69
L7	Hacks Ferry Road (Stoney Park), Telegraph Point				
	23/10/2018	08:30	39	49	Highway traffic noise 40-47, birds 43-72, dogs 51-54
	05/11/2018	22:45	41	48	Highway traffic noise 40-46, birds 43-60, insects 47
L8	91 Moore Side Drive, Telegraph Point				
	22/10/2018	17:00	41	46	Highway traffic noise 49-56, birds 47-60, lawnmower 43
	05/11/2018	22:00	40	45	Highway traffic noise 48-53
L9	61 Hosking Road, Blackman's Point				
	23/10/2018	09:30	41	45	Highway traffic noise 40-55, insects 44, birds 49-62
	06/11/2018	02:50	40	46	Highway traffic noise 45-51, insects 42-46, dogs 42-43
L10	19 Glen Ewan Road, Sancrox				
	22/10/2018	19:24	51	56	Highway traffic noise – light vehicles 55 Highway heavy vehicles 57-65, dogs 56-58
	22/10/2018	19:40	46	54	
	06/11/2018	02:15	42	54	Highway traffic noise – light vehicles 51-54 Highway heavy vehicles 55-68, bridge joint 52
	06/11/2018	02:30	37	53	
L11	47 Glen Ewan Road, Sancrox				
	23/10/2018	10:30	50	56	Highway traffic noise 48-68, bridge joint 58, bikes54-66

Loc.	Date	Start Time	Measured Noise Level		Comments and maximum noise levels in dBA
			LA90	LAeq	
	06/11/2018	02:22	39	51	Highway traffic noise 47-63, bridge joint 51
L12	28 Bushland Drive, Sancrox				
	23/10/2018	11:30	48	52	Highway traffic noise 47-60, insects 50-56, birds 49-63
	05/11/2018	23:51	54	57	Highway traffic noise 52-58, insects 55-56

5 Traffic data

5.1 Measured traffic

Traffic counting was carried out by Roads and Maritime at the same time as the noise monitoring at five locations on the main alignment across the extent of the project. A summary of the results is provided in **Table 7**. The traffic count summaries are 10 day averages, consistent with the noise logging period (23 October to 5 November 2018). The daytime period is defined as 7am to 10pm and night-time from 10pm to 7am in accordance with the ECRTN.

Table 7 2018 Traffic counting results

Site	Address	Period	Traffic Data ^{1,2,3}					
			Light Vehicles		Heavy Vehicles		Average Speed	
			NB	SB	NB	SB	NB	SB
1	Main Carriageway - South of Sancrox (400m south of Frogs Road)	Day 15hr	4333	4606	1130	1151	104	105
		Night 9hr	762	438	480	483	102	104
2	Main Carriageway - North of Sancrox (800m North of Express Spares)	Day 15hr	4028	3630	934	1147	105	105
		Night 9hr	570	428	471	479	103	103
3	Main Carriageway – 2 km North of Blackmans Point Road Overpass	Day 15hr	4595	4958	1299	1217	106	100
		Night 9hr	528	543	565	604	104	95
4	Main Carriageway – 2 km North of Haydons Wharf Road Overpass	Day 15hr	5035	5043	984	941	100	103
		Night 9hr	578	551	457	454	92	100
5	Main Carriageway – 600 m North of Yarrabee on ramp	Day 15hr	5181	5190	1003	1086	107	108
		Night 9hr	587	626	500	453	105	107

Notes : 1. At locations 1, 2 and 5 the traffic data is averaged over the period 24/10/18 to 4/11/18.
2. At location 3 the traffic data is averaged over the period 23/10/18 to 25/10/18.
3. At location 4 the traffic data is averaged over the period 27/10/18 to 4/11/18.

5.2 Traffic data comparison

Roads and Maritime provided updated two-way design traffic volumes based on the traffic counting results which are presented in **Table 8**. These 2018 design traffic volumes have been compared to the 2016 forecast opening year traffic volumes used in the EA and detailed design assessments and is also summarised in **Table 8**.

Table 8 Comparison of forecast post-construction Year 1 traffic to detailed design Year 1 traffic

Location	Period	2016 Forecast Year 1 Traffic Volumes from ONMR		2018 Forecast Traffic Volumes		Change in Traffic Volumes – (2016 to 2018)		Percentage Change in Traffic (2016 to 2018)	
		Light Vehicles	Heavy Vehicles	Light Vehicles	Heavy Vehicles	Light Vehicles	Heavy Vehicles	Light Vehicles	Heavy Vehicles
Main carriageway									
South of Sancrox Traffic Arrangement	Day 15hr	9550	1990	9000	2360	-550	370	-6%	19%
	Night 9hr	1300	960	1240	970	-60	10	-5%	1%
Sancrox Traffic Arrangement to Blackmans Point Road Interchange	Day 15hr	6940	2240	7670	2160	730	-80	11%	-4%
	Night 9hr	1000	920	1010	960	10	40	1%	4%
Blackmans Point Road Interchange to Haydons Wharf Road Half Interchange	Day 15hr	9360	2200	10370	1300	1010	-900	11%	-41%
	Night 9hr	1030	940	1520	990	490	50	48%	5%
Haydons Wharf Road Half Interchange to Yarrabee Road Traffic Arrangement	Day 15hr	10260	2350	9170	1740	-1090	-610	-11%	-26%
	Night 9hr	1140	1020	990	820	-150	-200	-13%	-20%
North of Yarrabee Road Traffic Arrangement	Day 15hr	10220	2350	10370	2180	150	-170	1%	-7%
	Night 9hr	1110	1020	1210	960	100	-60	9%	-6%
Sancrox Traffic Arrangement									
Northbound On Ramp	Day 15hr	460	150	60	150	-400	0	-87%	0%
	Night 9hr	50	40	50	10	0	-30	0%	-75%
Northbound Off Ramp	Day 15hr	1860	270	530	130	-1330	-140	-72%	-52%
	Night 9hr	300	100	120	20	-180	-80	-60%	-80%
Southbound Off Ramp	Day 15hr	470	290	70	30	-400	-260	-85%	-90%
	Night 9hr	60	110	30	10	-30	-100	-50%	-91%
Southbound On Ramp	Day 15hr	1680	150	1000	50	-680	-100	-40%	-67%
	Night 9hr	110	100	120	20	10	-80	9%	-80%
Blackmans Point Road Interchange									
Northbound On Ramp	Day 15hr	1730	120	1280	60	-450	-60	-26%	-50%
	Night 9hr	180	90	20	80	-160	-10	-89%	-11%
Northbound Off Ramp	Day 15hr	480	110	480	130	0	20	0%	18%
	Night 9hr	110	40	20	50	-90	10	-82%	25%
Southbound On Ramp	Day 15hr	470	150	430	120	-40	-30	-9%	-20%
	Night 9hr	110	60	10	70	-100	10	-91%	17%
Southbound Off Ramp	Day 15hr	1740	90	1350	90	-390	0	-22%	0%
	Night 9hr	50	30	10	90	-40	60	-80%	200%
Haydons Wharf Road Interchange									
Northbound On Ramp	Day 15hr	400	60	250	30	-150	-30	-38%	-50%
	Night 9hr	60	40	70	10	10	-30	17%	-75%
Southbound Off Ramp	Day 15hr	520	100	250	30	-270	-70	-52%	-70%

Location	Period	2016 Forecast Year 1 Traffic Volumes from ONMR		2018 Forecast Traffic Volumes		Change in Traffic Volumes – (2016 to 2018)		Percentage Change in Traffic (2016 to 2018)	
	Night 9hr	50	60	70	10	20	-50	40%	-83%
Yarrabee Road Traffic Arrangement									
Northbound On Ramp	Day 15hr	40	30	40	40	0	10	0%	33%
	Night 9hr	20	20	10	10	-10	-10	-50%	-50%
Northbound Off Ramp	Day 15hr	60	30	20	20	-40	-10	-67%	-33%
	Night 9hr	30	20	10	10	-20	-10	-67%	-50%
Southbound On Ramp	Day 15hr	90	30	50	40	-40	10	-44%	33%
	Night 9hr	30	30	10	10	-20	-20	-67%	-67%
Southbound Off Ramp	Day 15hr	80	40	20	20	-60	-20	-75%	-50%
	Night 9hr	20	20	10	10	-10	-10	-50%	-50%

Comparison of the forecast traffic in the ONMR with the revised traffic data prepared following the traffic counting shows that the design traffic volumes vary from the forecast opening year volumes in many locations. The differences are summarised as follows:

- South of Sancrox there is a minor reduction in the number of light vehicles during daytime and night-time of six and five percent respectively, however during the daytime heavy vehicles increased by 19 percent.
- From Sancrox to Blackmans Point Road there is a minor increase of 11 percent in the number of daytime light vehicles and four percent decrease in daytime heavy vehicles. During night-time there is a one percent increase in light vehicles and a four percent increase in heavy vehicles.
- From Blackmans Point Road to Haydons Wharf Road the number of light vehicles increases by 11 percent during the daytime and 48 percent during the night-time. However, the number of heavy vehicles decreases by 41 percent during the daytime and increases five percent during the night-time.
- From Haydons Wharf Road to Yarrabee Road the number of light vehicles decreases by 11 and 13 percent for daytime and night-time respectively, and the number of heavy vehicles decrease by 26 and 20 percent respectively.
- North of Yarrabee there is a minor increase of one percent in the number of daytime light vehicles and seven percent decrease in daytime heavy vehicles. During night-time there is a nine percent increase in light vehicles and a six percent increase in heavy vehicles.

In summary the changes in traffic volumes on the main carriageway will have a minor change to the predicted noise levels, except for the section south of Sancrox and from Blackmans Point Road interchange to Haydons Wharf Road half interchange. It is a general principle that for a 1dB change in traffic noise levels a 25 percent change in traffic volumes is required.

5.3 Revised 2028 future design traffic forecasts

The 2018 detailed design traffic volumes have been found to vary from those forecast in the EA and the ONMR. The traffic volumes for the assessment year of 2028 have been re-forecast using measured data and are included in **Table 9**, as well as the 2018 forecast volumes presented above for ease of comparison. The re-forecast traffic volumes for 2028 have been used to re-evaluate the noise impacts and noise mitigation on the project.

Table 9 Opening Year 2018 and future design Year 2028 traffic forecast

Location	Period	2018 Forecast Traffic Volumes		2028 Forecast Traffic Volumes	
		Light Vehicles	Heavy Vehicles	Light Vehicles	Heavy Vehicles
Main carriageway					
South of Sancrox Traffic Arrangement	Day 15hr	9000	2360	12980	3610
	Night 9hr	1240	970	1800	1480
Sancrox Traffic Arrangement to Blackmans Point Road Interchange	Day 15hr	7670	2160	11070	3320
	Night 9hr	1010	960	1460	1470
Blackmans Point Road Interchange to Haydons Wharf Road Half Interchange	Day 15hr	10370	1300	14950	1980
	Night 9hr	1520	990	2190	1520
Haydons Wharf Road Half Interchange to Yarrabee Road Traffic Arrangement	Day 15hr	9170	1740	13250	2650
	Night 9hr	990	820	1440	1240
North of Yarrabee Road Traffic Arrangement	Day 15hr	10370	2180	14960	3340
	Night 9hr	1210	960	1750	1470
Sancrox Traffic Arrangement					
Northbound On Ramp	Day 15hr	60	150	70	170
	Night 9hr	50	10	50	10
Northbound Off Ramp	Day 15hr	530	130	580	150
	Night 9hr	120	20	130	20
Southbound Off Ramp	Day 15hr	70	30	80	40
	Night 9hr	30	10	30	10
Southbound On Ramp	Day 15hr	1000	50	1090	60
	Night 9hr	120	20	130	20
Blackmans Point Road Interchange					
Northbound On Ramp	Day 15hr	1280	60	1480	70
	Night 9hr	20	80	20	90
Northbound Off Ramp	Day 15hr	480	130	560	150
	Night 9hr	20	50	20	50
Southbound On Ramp	Day 15hr	430	120	500	140
	Night 9hr	10	70	10	80
Southbound Off Ramp	Day 15hr	1350	90	1570	100
	Night 9hr	10	90	20	100
Haydons Wharf Road HalfInterchange					

Location	Period	2018 Forecast Traffic Volumes		2028 Forecast Traffic Volumes	
Northbound On Ramp	Day 15hr	250	30	260	30
	Night 9hr	70	10	70	10
Southbound Off Ramp	Day 15hr	250	30	260	30
	Night 9hr	70	10	70	10
Yarrabee Road Traffic Arrangement					
Northbound On Ramp	Day 15hr	40	40	50	40
	Night 9hr	10	10	10	20
Northbound Off Ramp	Day 15hr	20	20	20	20
	Night 9hr	10	10	10	10
Southbound On Ramp	Day 15hr	50	40	50	50
	Night 9hr	10	10	10	10
Southbound Off Ramp	Day 15hr	20	20	20	20
	Night 9hr	10	10	10	10

6 Noise Modelling

The 'Work As Executed' (WAE) construction design model for the project was provided by Lend Lease Engineering. It was reviewed and used to update the three-dimensional computer model for the OH2Ku project. The updated model is referred to as the 'As Built' model.

The measured 2018 traffic flows from **Section 5** were then included in the model to validate the model against the corresponding 2018 road traffic noise measurements from **Table 5**.

6.1 SoundPLAN and CORTN modelling parameters

Noise modelling of the project area was carried out using the UK Department of Transport, Calculation of Road Traffic Noise (CORTN 1988) algorithms in SoundPLAN noise modelling software.

The modelling allows for traffic volume and mix, type of road surface, vehicle speed, road gradient, reflections from building surfaces, ground absorption, and shielding from ground topography and physical noise barriers.

6.2 Design inputs

The various noise modelling design inputs and assumptions which have been used in this assessment are provided in **Table 10**. These design inputs are consistent with those specified by Roads and Maritime for the OH2Ku project.

Table 10 Design inputs and assumptions

Input / Assumption	Description	
Noise Modelling Scenarios		
Year 2018 (at opening) and Year 2028 (ten years after opening)	LAeq(15hour) daytime (7.00 am to 10.00 pm) and LAeq(9hour) night-time (10.00 pm to 7.00 am) Consistent with the requirements of ECRTN, ENMM.	
Acoustic Parameters		
Noise source heights / correction: Cars: Heavy vehicle Tyres: Engines: Exhausts:	0.5 m 0.5 m 1.5 m 3.6 m	A three source height noise model has been used and the heights are known to be representative of Australian conditions. Correction factors of -5.4dB were applied to the heavy vehicle tyre component, -2.4dB to the engine component and -8.4dB to the exhaust component.
Pavement corrections: Concrete: Dense graded asphalt: Stone mastic asphalt:	+3.0 dB +0.0 dB -2.0 dB	The pavement corrections were applied to the car source component and the heavy vehicle tyre component
Minimum receiver height: Ground: First:	1.5m 4.5m	

Input / Assumption	Description	
Ground Absorption: Grass: Bushland: Water:	75% 100% 0%	
Noise Contour Calculations: Max. Search Radius: Grid Space: Height above ground:	2500m 20m 1.5m	
Calibration: Daytime: Night-time:	-0.2 dB +0.5 dB	The daytime and night-time validation factors were added to the existing and future noise model based on the ONMR report. The differences show a general trend of the noise model being an under-prediction of 0.5 dB for the night-time period and an over prediction of 0.2 dB for the daytime period.
Safety Factor:	1.0 dB	Add a safety factor of 1.0 dB to the ‘build’ and ‘no-build’ noise levels. The safety factor does not contribute to the 2 dB feasible and reasonable allowance.
Facade Reflections: ARRB Australian condition correction:	+2.5 dB -1.7 dB Façade reflection -0.7 dB Free field	A 2.5 dB facade reflection in accordance with the UK developed CORTN model and ARRB corrections to account for Australian conditions are required to be added to the noise level predictions at 1 m from a façade and also for free field predictions.
Minimum Noise Mitigation Requirements		
SMA pavement on main carriageways and ramps:	Between Ch4.600 km and CH6.120km Between Ch11.600km and CH17.800km	
Additional Noise Mitigation Measures		
Nil		
Road, Road Surface, Topography		
Road Alignment	Road carriageway alignment for main highway, ramps and intersections as per the Lend Lease detailed design alignment (model issue on 5 June 2014 and updated by the WAE model supplied October 2018)	
Road Surface	All mainline bridgeworks have SMA pavement and a 650 mm parapet. For other areas on the main carriageways, a concrete pavement type has been applied. For all local roads and service roads, a dense graded asphalt road surface has been assumed in the noise.	
Ground Contours	All ground contours used in the modelling are as supplied by the Contractor.	
Traffic and Speeds		
Traffic Volumes	Traffic volumes for Year 2018 and Year 2028 (ten years after opening)	

Input / Assumption	Description	
Traffic Speeds:		
Main-line daytime:	115km/h	A speed of 80 km/h has been assumed for all ramps. For model validation measured speeds concurrent with the traffic counting are used.
Main-line night-time:	120km/h	
Local roads, service roads and ramps:	Posted traffic speeds	For noise assessment the posted traffic speeds are used.
Receivers		
Receiver Locations	Sensitive receiver locations are as per those identified in the EA and Detailed Design Operational Noise Assessment	
Receiver Heights:	Ground floor: 1.5m above ground Second floor: 4.5m above ground	

6.3 Validation of noise model

Single point receiver calculations were carried out using the model to predict the road traffic noise levels at all post construction noise monitoring locations. **Table 11** provides a summary of the road traffic noise model calibration results at each location and a summary of the differences between the predicted road traffic noise levels and the measured data.

Noise levels at six locations were affected by extraneous noise or noise from other nearby roads. Since the detailed design model only included the noise sources associated with the OH2Ku project, noise levels at these locations were not suitable for use in validating the existing road traffic model. A discussion of noise logger measurements that were not acceptable for use in calibrating the model is presented after the table.

Table 11 Comparison of 2018 predicted and measured noise levels for long term unattended monitoring

ID	Address	2018 measured road traffic noise		2018 predicted noise level		Difference ¹		Notes
		Day	Night	Day	Night	Day	Night	
		L _{Aeq} (15hour)	L _{Aeq} (9hour)	L _{Aeq} (15hour)	L _{Aeq} (9hour)	L _{Aeq} (15hour)	L _{Aeq} (9hour)	
L1	9350 Pacific Highway, Cooperabung	65.4	64.2	63.3	60.5	-2.1	-3.7	-
L2	404 Cooperabung Drive, Cooperabung	49.0	50.0	48.0	45.3	-1.0	-4.7	See Section 6.3.1
L3	9273 Pacific Highway, Cooperabung	60.4	59.6	59.2	56.6	-1.2	-3.0	-
L4	60 Haydens Wharf Road, Cooperabung	46.2	47.6	51.0	49.2	4.8	1.6	See Section 6.3.2
L5	8 Haydens Wharf Road, Cooperabung	58.5	57.1	60.0	58.5	1.5	1.4	-
L6	13 Cooperabung Drive, Telegraph Pt.	53.5	48.5	42.7	41.6	-10.8	-6.9	See Section 6.3.3
L7	Hacks Ferry Road (Stoney Park), Telegraph Point	52.9	45.9	43.4	42.3	-9.5	-3.6	See Section 6.3.3
L8	91 Moore Side Drive, Telegraph Point	46.2	47.6	47.9	46.6	1.7	0.9	-

ID	Address	2018 measured road traffic noise		2018 predicted noise level		Difference ¹		Notes
L9	61 Hosking Road, Blackman's Point	47.4	47.2	51.1	49.1	3.7	1.9	See Section 6.3.2
L10	19 Glen Ewan Road, Sancrox	53.6	52.9	52.3	51.2	-1.3	-1.7	-
L11	47 Glen Ewan Road, Sancrox	57.8	56.9	57.1	55.9	-0.6	-1.0	-
L12	28 Bushland Drive, Sancrox	57.9	62.1	54.6	52.9	-3.3	-9.2	See Section 6.3.4
Median Difference ¹						-0.3	-1.2	
Standard Deviation ¹						1.6	2.0	

Note 1: Difference is Predicted minus Measured. A negative difference indicates the predicted level of road traffic noise is lower than the measured data, a positive difference indicates the predicted level is higher. Consistent with the Sections 6.3.1 to 6.3.4 differences shaded and in ***italic*** are excluded from the median difference and standard deviation calculation.

6.3.1 404 Cooperabung Drive

Noise logger L2 is 525 m from the upgraded highway and affected by local traffic during the survey and has been excluded from the validation process.

6.3.2 60 Haydons Wharf Road Cooperabung and 61 Hoskins Drive Blackmans Point

Noise logger L4 is 435 m from upgraded highway and Logger L9 is 450 m from the upgraded highway. At both locations the upgraded highway is in cut and there is bushland between the road and receiver. The algorithm accuracy is reduced under these conditions and the validation prediction was found to be over predicting traffic noise and was excluded from the validation process. Note when the noise source is shielded from the receiver (road in in cut) the level of noise attenuation predicted is very sensitive to ground contour precision in the model.

6.3.3 13 Cooperabung Drive and Stoney Park, Telegraph Point

Noise loggers L6 and L7 are more than 1 km from the Highway and affected by localised noise, and have been excluded from the validation process. It is noted these logger locations are closer to the old Pacific Highway than the upgraded highway, and were selected for comparison with the noise levels prior to the upgrade. As such they are not expected to be suitable for validation.

6.3.4 28 Bushland Drive, Sancrox

Noise logger L12 was affected by insect noise as identified by the attended measurements. Furthermore examination of the graphical results indicates extraneous insect noise is present from typically 7pm until 2 am or 4am. The presence of insect noise was confirmed by listening to the survey noise recordings. The noise logger location away from the dwelling was requested by the resident. The noise logger was excluded from the validation process.

At the above six locations excluded from the model validation, the locations are either too distant from the highway traffic noise source, affected by extraneous noise, or shielded from the traffic noise source. The measured noise levels are therefore not considered representative of contribution of traffic noise from the upgraded highway during the monitoring period.

The Roads and Maritime ENMM notes that “it should be recognised that noise prediction modelling has some accuracy limitations and will commonly produce acceptable errors of around 2 dBA”.

The above results show that the difference between the measured and predicted noise levels at usable validation locations are within the acceptable range of 2 dB, with the exception of the night-time prediction at L1 and L3 where the model under predicts by 3.7 dB 3.0 dB respectively.

Location L1 is at the northern end of the project and near to a section of road with a relatively steep gradient. Observations during the monitoring noted that maximum noise levels events occur in this area due to trucks engine braking. Location L3 is also similarly affected by the engine braking. The presence of truck engine braking is considered the likely cause of the noise model under prediction at these two locations.

With reference to the above discussion, it is concluded that the model is performing as expected and is valid for use as an As-Built model to review the noise impacts and mitigation design for the project. The median difference of -0.3 dB and -1.2 dB for daytime and night-time compares to median differences of +0.2 dB and -0.5 dB in the ONMR. The differences in the calibration factors between the ONMR and this comparison are 0.5 to 0.7 dB. Therefore, to maintain consistency between the two assessments ONMR calibration factors are used in the Post Construction Noise Assessment of **Section 7**.

7 Post construction noise assessment

Traffic noise contour maps have been prepared for night-time and daytime periods for the year of opening (2018) and design year (2028) and are presented in Appendix D of this report.

The traffic noise levels predicted in the ONMR for each receiver was compared to the traffic noise levels measured and predicted for each receiver in this assessment. The comparison showed some inconsistencies between predicted noise levels and in the contour maps created using the updated As Built model.

A detailed review of the modelling prepared for the ONMR and Post Construction Noise assessment was carried out to identify what caused the inconsistencies. It was found that the predicted noise levels presented in the ONMR did not correspond to the façade that was experiencing the highest noise level from the upgraded highway.

The following actions were carried out to clarify the inconsistencies and included within this report:

- The ECRTN assessment of the ONMR for years 2016 and 2026 has been updated using the project dominant façade. Future existing 2016 noise levels, the ECRTN criteria and year of opening (2016) and design year (2026) have been updated. The updated results are presented in **Appendix E**
- An ECRTN assessment for the 'As Built' design for years 2018 and 2028 has been completed, with the results presented in **Appendix F**.
- **Appendix G** provides a comparison between the updated ONMR and 'As –built' predicted noise levels.
- Mitigation measures have been reviewed to determine the suitability of the installed at house noise treatments in relation to the updated ONMR ECRTN assessment and the 'As Built' design ECRTN assessment.

7.1 Mitigation review

Properties identified as eligible for mitigation by the updated ONMR for years 2016 and 2026 and the As Built design for years 2018 and 2028 are presented in **Table 12**. The table shows if the property qualifies for at house treatment and the maximum predicted exceedance level. The maximum predicted exceedance level is determined as the higher of the predicted noise level from either the updated ONMR or the 'As Built' design. The table also shows the 'project treated level of exceedance'. This is the basis on which properties have been treated by Roads and Maritime and is based on the predictions contained in the ONMR or the EA. These exceedance levels determine the level of mitigation required as explained in **Table 3** of **Section 3.2**.

Table 12 Property treatment summary

NCA	Receiver ID	Qualification for treatment ¹	Maximum exceedance level	Treatment level applied	Has the property been treated by the project	Project treated level of exceedance	Treatment level required
11	361	BOTH	8.6	2	YES	6.8	2
11	373	BOTH	4.5	2	YES	7.5	1
11	377	BOTH	3.6	1	YES	3.5	1
11	654	BOTH	2.5	2	YES	5.5	1
12	363	BOTH	4.9	2	YES	8	1

NCA	Receiver ID	Qualification for treatment ¹	Maximum exceedance level	Treatment level applied	Has the property been treated by the project	Project treated level of exceedance	Treatment level required
12	364	ONMR Only	3.4	2	YES	6.5	1
12	365	BOTH	4.6	2	YES	4	1
12	367	BOTH	1.7	1	YES	1.7	1
12	374	BOTH	8.9	3	YES	11.2	2
12	375	BOTH	7.9	2	YES	9.5	2
12	378	BOTH	2	1	YES	2.5	1
12	380	BOTH	0.8	1	YES	0.8	1
13	315	BOTH	16.4	3	YES	13.4	3
13	322	As Built ONLY	2.4	1	YES	3.5	1
13	323	As Built ONLY	4.8	1	YES	3.5	1
13	840	As Built ONLY	4.4	1	YES	4	1
14	259	BOTH	6.4	3	YES	12	2
14	341	BOTH	4.6	2	YES	4.3	1
14	647	BOTH	7.3	2	YES	5	2
14	2025	As Built ONLY	0.9	1	YES	0.2	1
15	204	BOTH	6.3	2	YES	8.5	2
15	205	EA		1	YES	2.5	1
15	266	BOTH	4.8	2	YES	8	1
15	270	RMS		1	YES	2	1
15	271	RMS		1	YES	2	1
15	311	BOTH	9	2	YES	9	2
15	632	BOTH	6.7	3	YES	10.5	2
16	255	RMS		1	YES	0	1
16	256	RMS		1	YES	1	1
16	610	RMS		1	YES	1	1
17	116	RMS		1	YES	1	1
17	119	RMS		1	YES	1	1
17	123	RMS		1	YES	2.5	1
17	125	BOTH	1.2	1	YES	3	1
17	126	BOTH	2.5	2	YES	5	1
17	128	BOTH	4.3	2	YES	6	1
17	129	BOTH	2	1	YES	4	1
17	130	BOTH	1.1	1	YES	3.5	1
17	131	As Built ONLY	0.9	1	YES	2.5	1
17	135	RMS		1	YES	2	1
17	583	RMS		2	YES	2	1

NCA	Receiver ID	Qualification for treatment ¹	Maximum exceedance level	Treatment level applied	Has the property been treated by the project	Project treated level of exceedance	Treatment level required
17	846	EA		1	YES	3.5	1
18	850	RMS		1	YES	0.5	1
19	74	BOTH	2.5	1	YES	3	1
19	75	BOTH	2.9	2	YES	4.5	1
19	76	BOTH	8.7	3	YES	11	2
19	77	BOTH	4.1	2	YES	5	1
19	80	BOTH	5.3	2	YES	6	2
19	855	BOTH	1	1	YES	1.5	1
19	2063	BOTH	1.2	1	YES	0.8	1
20	82	BOTH	11.7	3	YES	11.1	3
20	83	BOTH	4.9	3	YES	10.4	1
20	84	BOTH	7.8	2	YES	9	2
20	85	BOTH	6.5	2	YES	8.5	2
20	88	As Built ONLY	1.5	1	YES	2	1
20	91	As Built ONLY	1.7	1	YES	0.5	1
20	93	RMS		1	YES	3.5	1
20	96	BOTH	11.5	3	YES	11	3
20	103	As Built ONLY	2.5	1	YES	4	1
20	107	BOTH	5	2	YES	3	1
20	567	RMS		1	YES	1	1
20	802	RMS		1	YES	3	1
20	860	BOTH	2.2	2	YES	1.7	1
20	2065	BOTH	5.6	1	YES	3.2	2
21	20	BOTH	2.9	1	YES	2.9	1
21	43	BOTH	1	1	YES	1	1
21	61	ONMR Only	2.6	1	YES	3	1
21	63	ONMR Only	1.7	2	YES	0.3	1
21	68	ONMR Only	1.1	1	YES	1	1
21	529	BOTH	3	1	YES	3.4	1

Note: 1. BOTH – Identified by both the ONMR and As Built Assessments; EA – Identified by the EA; RMS – Identified by Roads and Maritime

7.1.1 Discussion

The results presented in **Table 12** are summarised as follows:

- A total of 70 properties have been treated by Roads and Maritime of which
 - 42 properties were identified by both the ONMR and this assessment

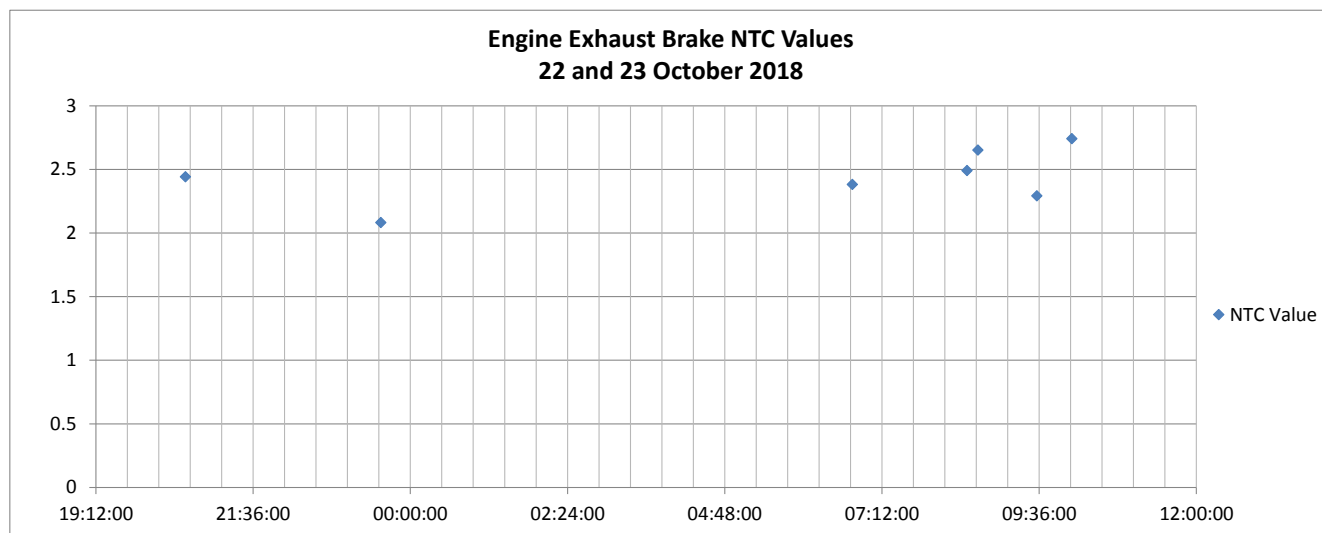
- four properties were identified uniquely by the ONMR
- 10 properties were identified uniquely by this assessment (As Built);
- 14 properties were identified by Roads and Maritime Services during the detailed design phase
- All properties treated have the appropriate level of mitigation as determined by the maximum exceedance level, and as explained in Table 3 of Section 3.2., with the exception of receiver ID 2065 which has a predicted maximum exceedance level of 5.6 dB, marginally above 5 dB. The treatment level of mitigation applied to ID 2065 should be reviewed.
- The comparison of **Appendix G** has identified one property where there is an increase in noise of more than 2 dB, being receiver ID2063. This property has been treated, and as identified in **Table 12** and the appropriate level of mitigation has been applied to the property.

7.2 Engine braking assessment

An engine braking assessment was undertaken to determine the number of engine braking events that exceeded a National Transportation Commission (NTC) value of 2.

Engine braking events were monitored where the upgraded roadway is in decline adjacent to noise monitoring location L1, as agreed with Roads and Maritime. An ARL Type NGARA noise logger was used with the microphone located 7 m of the road edge. Audio recordings were triggered with an NTC value greater than 2 from 7.30 pm on the 22 October until 11.00 am on 23 October 2018. The audio recordings were played-back and discarded if an engine braking event was not audible. A summary of the engine braking noise monitoring results are presented in **Figure 2**.

Figure 2 Engine brake NTC value and event distribution



As presented in **Figure 2**, a total of seven engine braking events were identified with NTC values between 2 and 3. No engine braking events greater than the NTC recommended value of 3 were recorded.

8 Operational noise complaints and enquiries

As required by CoA E1, the project is required to provide details of any complaints and enquiries received in relation to operational noise from the project between the date of commencement and the date the Post Construction Operational Noise Report was prepared. The complaints record provided by Roads and Maritime is presented in **Table 13**.

Table 13 Residential complaints

Address	Complaint	Response
Haydons Wharf Road, Cooperabung	Resident advising that he thought that the road noise near Haydons Wharf Rd was much more after the speed limit was recently raised to 100km/hr. He said the noise from the exhaust brakes on Cooperabung Hill has decreased once the 80km/hr limit was changed to 100km/hr. He was also under the impression that there was asphalt to be placed on top of the concrete, north of Haydons Wharf Rd.75 m	13/4/2018 - Resident was advised that Roads and Maritime are about to enter the operational noise phase, and his details will be included on the list of people that have concerns with noise. It was also noted that there was never any plans to asphalt that section of highway. Resident seemed satisfied with this explanation
Haydons Wharf Road, Cooperabung	1/05/2018 –Resident called to say that the noise at his property was louder than he had expected. He also said that that only the southern side of the house is getting the noise treatment and there seems to be noise coming from the north that is impacting on the lounge room.	1/05/2018 - The noise monitoring process and process of checking against models from the design phase was explained. Resident seemed satisfied with this explanation and no further correspondence was deemed necessary.
Pacific Highway, Cooperabung	1/6/2018 - Tennant at the residential property, called to say the noise at the house was very loud and she was considering moving.	1/6/2018 - Noise assessment process was explained and the tenant had no further questions.
Federation Way, Telegraph Point	27/7/2018 - Resident called to talk to someone about the increased noise level since opening to 110km/hr	30/7/2018 returned call to explain the noise assessment process that will begin within the next couple of months. Resident said that the noise is louder than they expected and they are concerned that it maybe worse in summer when they live with the house doors and windows open. We informed resident that once the noise assessment is completed someone from RMS will be in touch to explain what the results mean. Resident was satisfied with the response and thanked us for the call.

9 Conclusion

The purpose of this study is to address Condition E1 of the Conditions of Approval for the project, which requires carrying out operational noise monitoring to compare actual noise performance of the project against noise performance predicted in the ONMR. The findings of the study are summarised as follows:

Noise criteria

Operational noise requirements for OH2Ku were derived in accordance with the Minister's Conditions of Approval, the EPA's ECRTN and Road and Maritime's ENMM.

Noise monitoring

Unattended and attended noise monitoring was conducted at a total of 12 locations. The results of the noise monitoring have been processed in accordance with the procedures contained in the ECRTN and ENMM and are presented within the body of this report.

Traffic counting and model validation

Roads and Maritime conducted traffic counts simultaneously with noise logging for validation of the existing traffic noise model. The two way traffic volumes and speeds provided by Roads and Maritime were used in the 'As Built' noise model. Noise level measurement show good correlation between noise level predictions for the As Built design, with the exception of receivers at the northern end where the road is at a decline and exhaust brakes are used, where higher noise levels are expected.

Noise modelling and mitigation review

Road traffic noise emission levels for OH2Ku were predicted using the 'As Built' noise model using design traffic volumes provided by Roads and Maritime. Scenarios modelled for the noise assessments include the 'Year of Opening' (2018) and 'Design Year' (2028) for both day and night-time periods. Post construction noise road traffic noise levels modelled were compared against the previously determined noise levels, as detailed in the Operational Noise Management Report (ONMR).

The comparison between ONMR noise levels and Year of Opening' (2018) and 'Design Year' (2028) and showed inconsistencies in the ONMR that were due to façade calculation errors. The ECRTN assessment of the ONMR was subsequently updated and compared with the ECRTN assessment for the 'As Built' design.

Roads and Maritime has provided noise mitigation to 70 properties. All properties treated have the appropriate level of mitigation as determined by the maximum exceedance level, as explained **Section 3.2.**, with the exception of ID 2065. The treatment level of mitigation applied to ID 2065 would be reviewed by Roads and Maritime.

APPENDIX A

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

2 'A' Weighted Sound Pressure Level

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

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

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

Sound Pressure Level (dBA)	Typical Source	Subjective Evaluation
130	Threshold of pain	Intolerable
120	Heavy rock concert	Extremely noisy
110	Grinding on steel	
100	Loud car horn at 3 m	Very noisy
90	Construction site with pneumatic hammering	
80	Kerbside of busy street	Loud
70	Loud radio or television	
60	Department store	Moderate to quiet
50	General Office	
40	Inside private office	Quiet to very quiet
30	Inside bedroom	
20	Recording studio	Almost silent

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

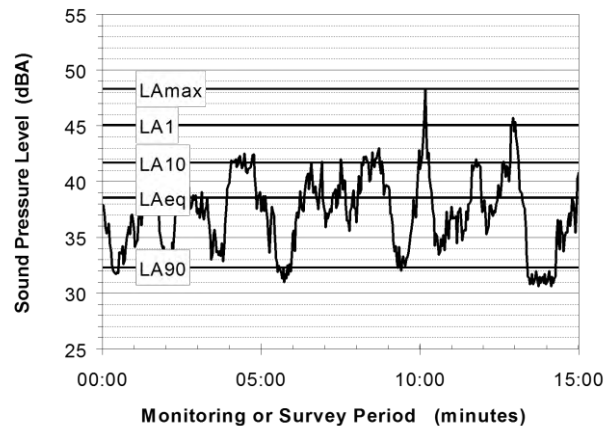
The Sound Power of a source is the rate at which it emits acoustic energy. As with Sound Pressure Levels, Sound Power Levels are expressed in decibel units (dB or dBA), but may be identified by the symbols SWL or Lw, or by the reference unit 10^{-12} W.

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_{A1} The noise level exceeded for 1% of the 15 minute interval.
- L_{A10} The noise level exceeded 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

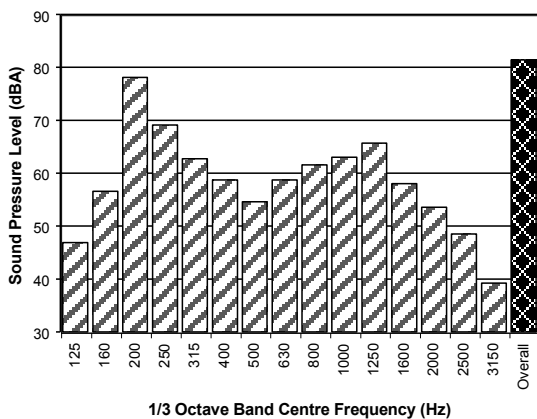
Frequency analysis is the process used to examine the tones (or frequency components) which make up the overall noise or vibration signal. This analysis was traditionally carried out using analogue electronic filters but is now normally carried out using Fast Fourier Transform (FFT) analysers.

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 $20 \log (V/V_0)$, where V_0 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

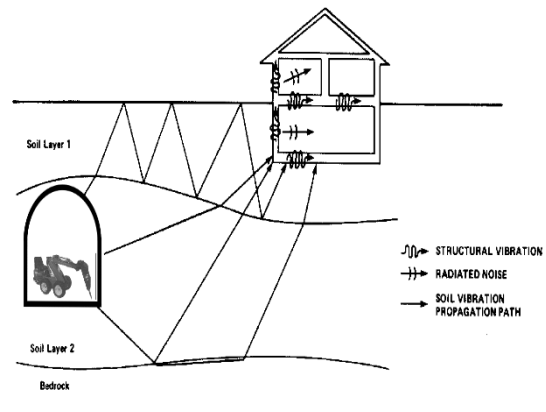
The term 'over-pressure' is used to describe the air pressure pulse emitted during blasting or similar events. The peak level of an event is normally measured using a microphone in the same manner as linear noise (ie unweighted), at frequencies both in and below the audible range.

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.

APPENDIX B

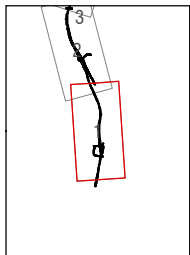
Site Plan



\\au.slrl.local\Corporate\Projects-SLR\610-Sydney\610-Sydney\GISData\GISData\Out\61012331_AppendixB_Portal.mxd



The content contained within this document may be based on third party data. SLR Consulting Australia Pty Ltd does not guarantee the accuracy of such information.



- Noise Sensitive Receivers (Residences)
- Non Noise Sensitive Receivers (Garages, sheds etc.)
- Noise Logging Locations
- Upgrade Alignment

Oxley Highway to Kundaberg

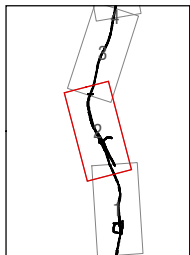
Site Plan



\\au.slrl.local\Corporate\Projects-SLR\610-Sydney\610-Sydney\GISData\Out\61012331_AppendixB_Portal.mxd



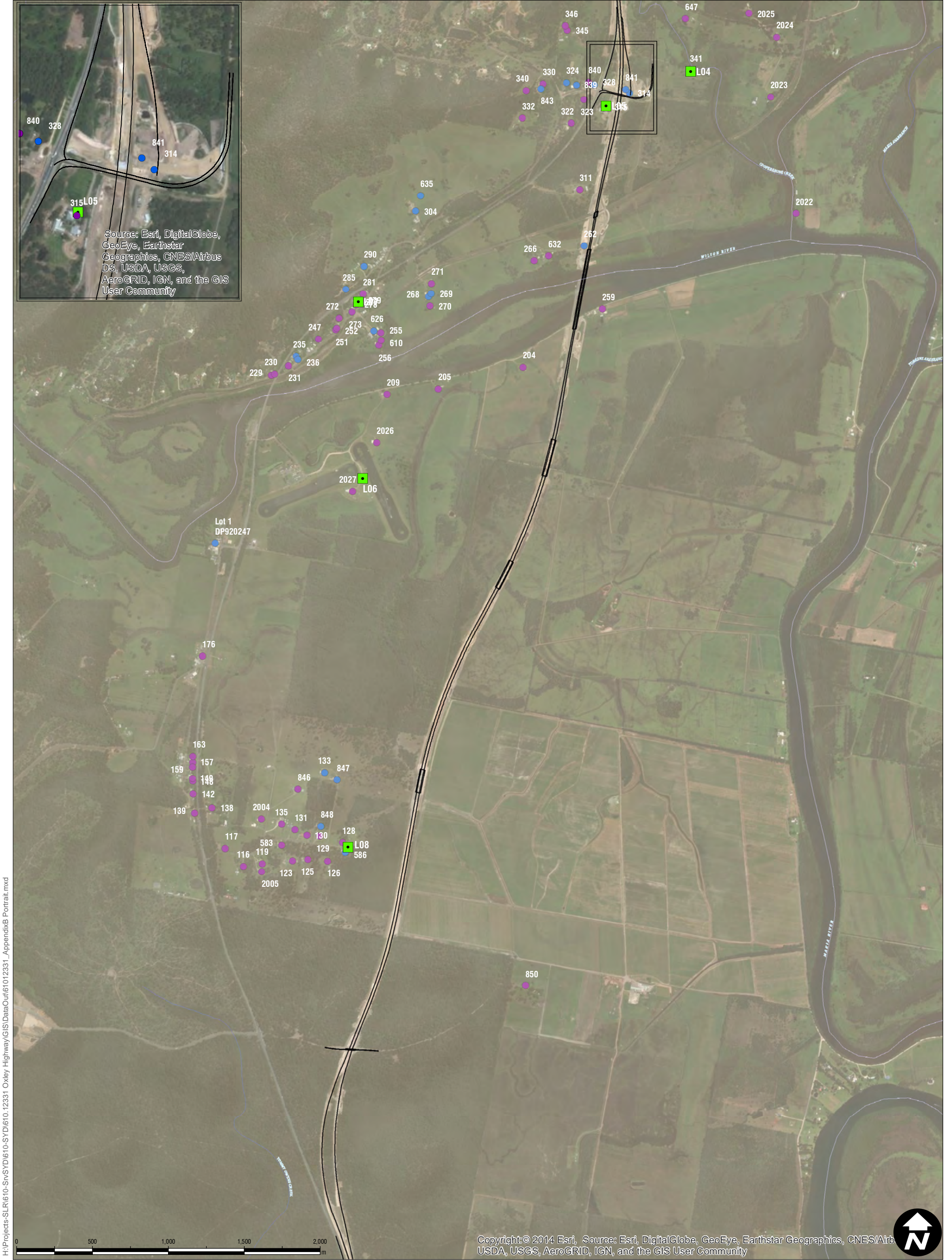
The content contained within this document may be based on third party data.
SLR Consulting Australia Pty Ltd does not guarantee the accuracy of such information.



- Noise Sensitive Receivers (Residences)
- Non Noise Sensitive Receivers (Garages, sheds etc.)
- Noise Logging Locations
- Upgrade Alignment

Oxley Highway to Kundaberg

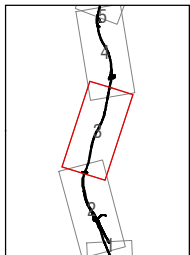
Site Plan



H:\Projects\SLR\610-Srv\SYD\610-SYD\610_12331 Oxley Highway\GIS\Data\Out\61012331_AppendixB Portrait.mxd



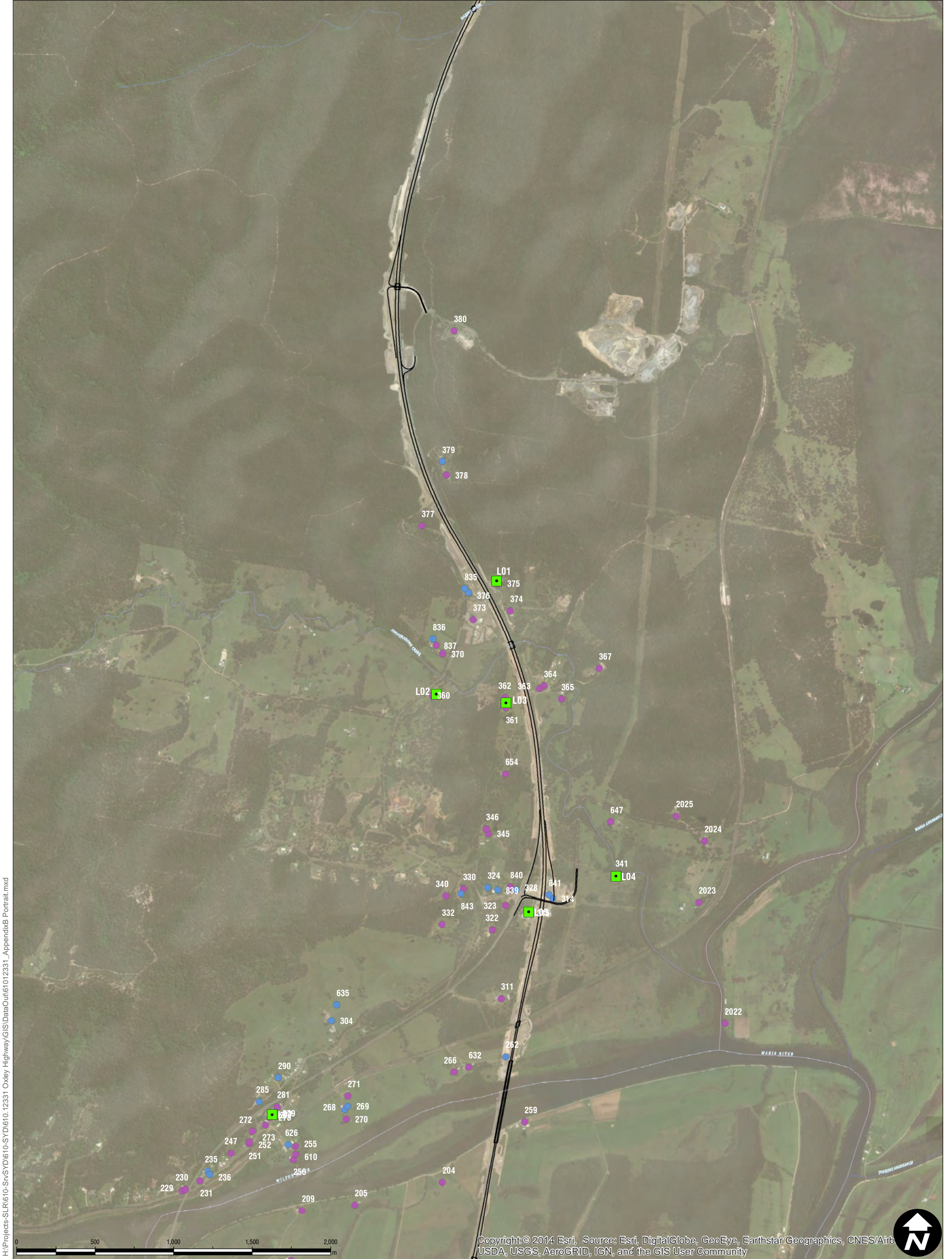
The content contained within this document may be based on third party data. SLR Consulting Australia Pty Ltd does not guarantee the accuracy of such information.



- Noise Sensitive Receivers (Residences)
- Non Noise Sensitive Receivers (Garages, sheds etc.)
- Noise Logging Locations
- Upgrade Alignment

Oxley Highway to Kundaberg

Site Plan

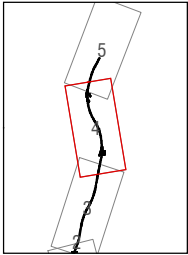


H:\Projects\SLR\610-Srv\SYD\610-SYD\610_12331 Oxley Highway\GIS\DataOut\61012331_AppendixB Portrait.mxd

Copyright © 2014 Esri, Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airb
USDA, USGS, AeroGRID, IGN, and the GIS User Community



The content contained within this document may be based on third party data.
SLR Consulting Australia Pty Ltd does not guarantee the accuracy of such information.



- Noise Sensitive Receivers (Residences)
- Non Noise Sensitive Receivers (Garages, sheds etc.)
- Noise Logging Locations
- Upgrade Alignment

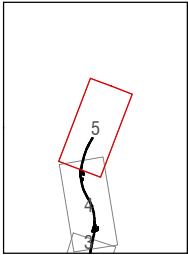
Oxley Highway to Kundaberg

Site Plan

H:\Projects\SLR\610-Srv\SYD\610-SYD\610-12331 Oxley Highway\GIS\DataOut\61012331_AppendixB Portrait.mxd



The content contained within this document may be based on third party data.
SLR Consulting Australia Pty Ltd does not guarantee the accuracy of such information.





- Noise Sensitive Receivers (Residences)
- Non Noise Sensitive Receivers (Garages, sheds etc.)
- Noise Logging Locations
- Upgrade Alignment

Oxley Highway to Kundaberg

Site Plan

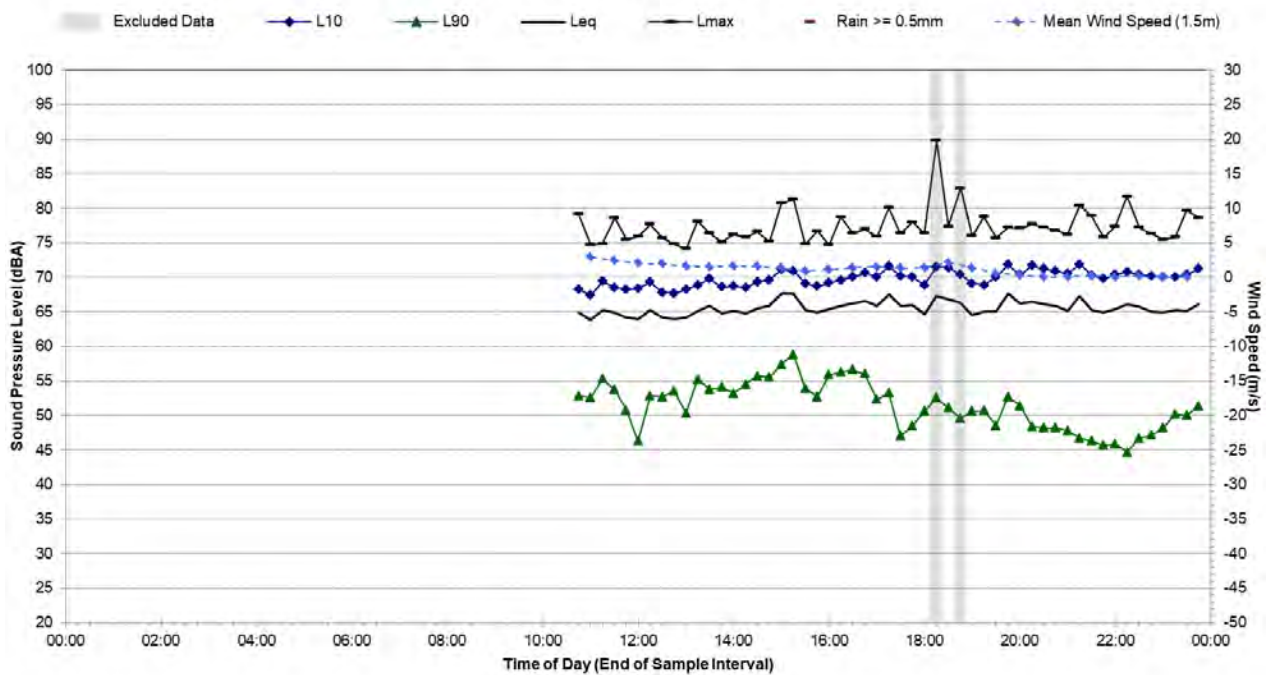
APPENDIX C

Ambient Noise Logging Results

Noise Monitoring Location	L.01				Map of Noise Monitoring Location
Noise Monitoring Address	9350 Pacific Highway, Cooperabung				
Logger Device Type: ARL NGARA, Logger Serial: 87808F Sound Level Meter Device Type: Brüel and Kjær 2270, Sound Level Meter Serial No: 2487418					
Recorded Noise Levels (LAmax): 23/10/2018: Light vehicle traffic: 62-68 dBA, Truck passbys: 71-78 dBA, Constant flow: 63-64 dBA. Engine Brakes: 73-78 dBA 06/11/2018: Light vehicle traffic: 60-69 dBA, Truck passbys: 69-82 dBA, Engine brake 77 dBA, Exhaust release 76 dBA Insects: 54 dBA, Background: 39-40 dBA.					
Ambient Noise Logging Results – NPfI Defined Time Periods					Photo of Noise Monitoring Location
Monitoring Period	Noise Level (dBA)				
	RBL	LAeq	L10	L1	
Daytime	54	66	69	73	
Evening	44	65	70	74	
Night-time	43	64	70	74	
Ambient Noise Logging Results – RNP Defined Time Periods					
Monitoring Period	Noise Level (dBA)				
	LAeq(period)		LAeq(1hour)		
Daytime (7am-10pm)	66		67		
Night-time (10pm-7am)	64		67		
Attended Noise Measurement Results					
Date	Start Time	Measured Noise Level (dBA)			
		LA90	LAeq	LAmax	
23/10/2018	11:31	54	65	78	
06/11/2018	04:33	43	64	80	
06/11/2018	04:48	46	65	82	

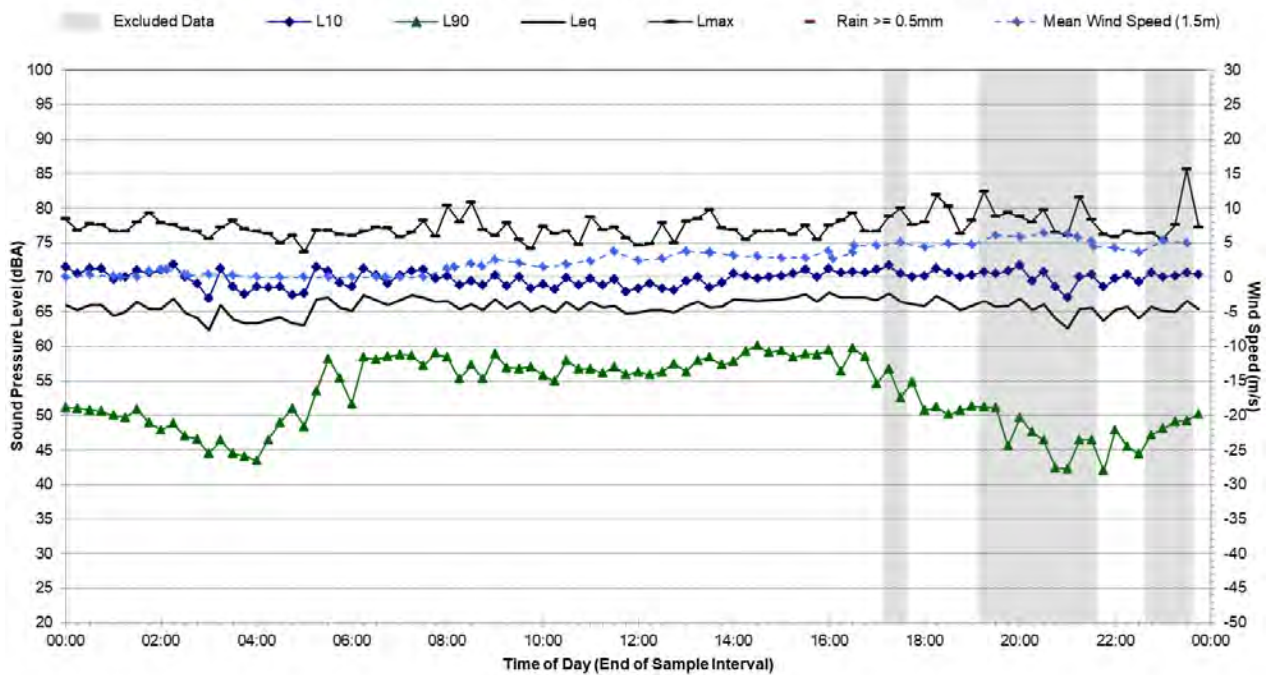
Statistical Ambient Noise Levels

L01 - 9350 Pacific Highway, Cooperabung - Tuesday, 23 October 2018



Statistical Ambient Noise Levels

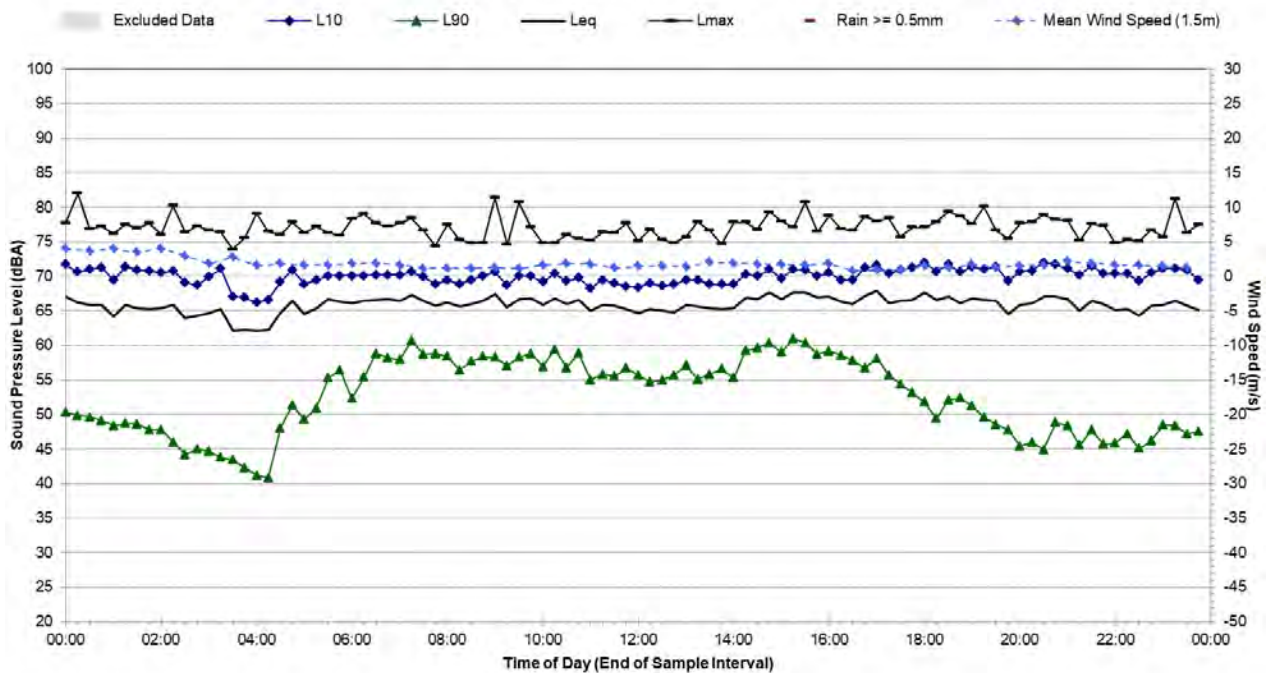
L01 - 9350 Pacific Highway, Cooperabung - Wednesday, 24 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

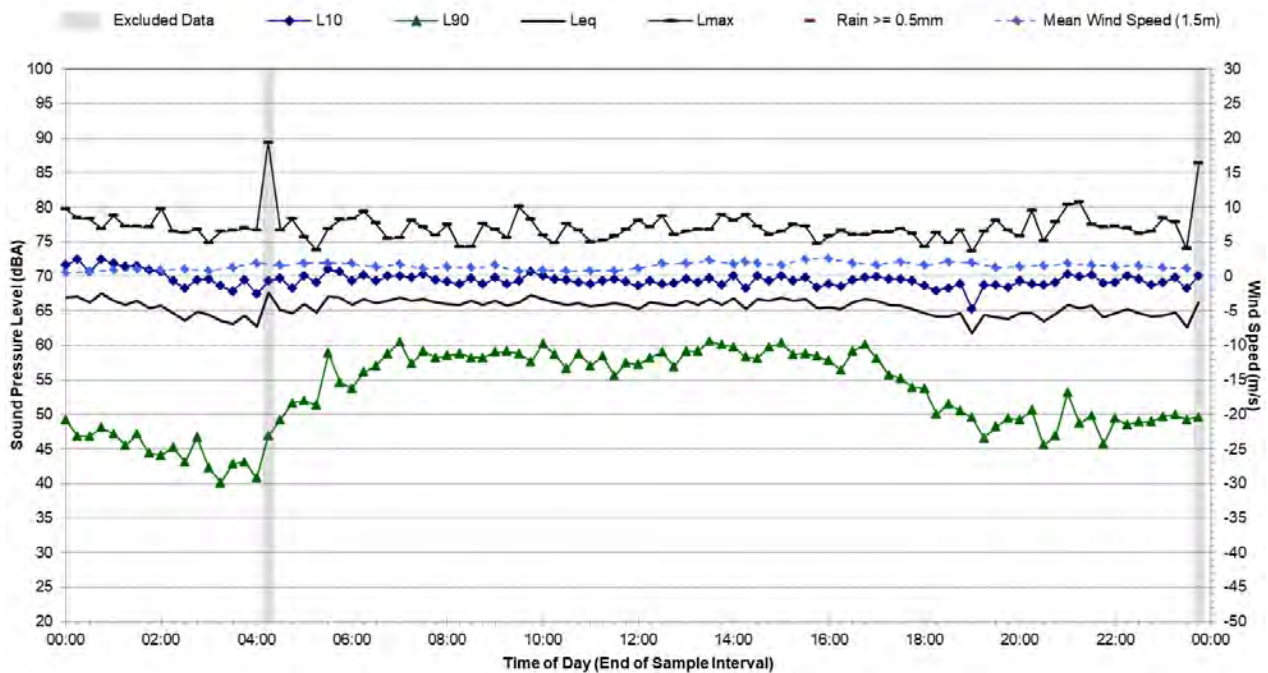
Statistical Ambient Noise Levels

L01 - 9350 Pacific Highway, Cooperabung - Thursday, 25 October 2018



Statistical Ambient Noise Levels

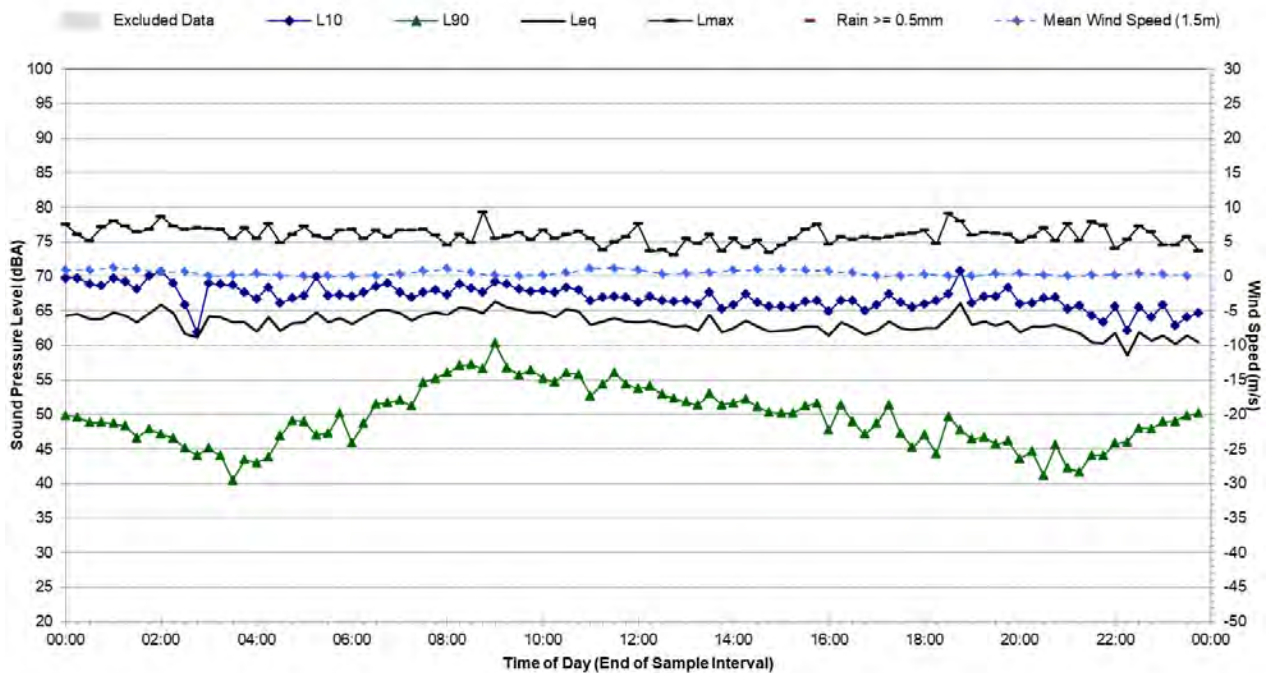
L01 - 9350 Pacific Highway, Cooperabung - Friday, 26 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

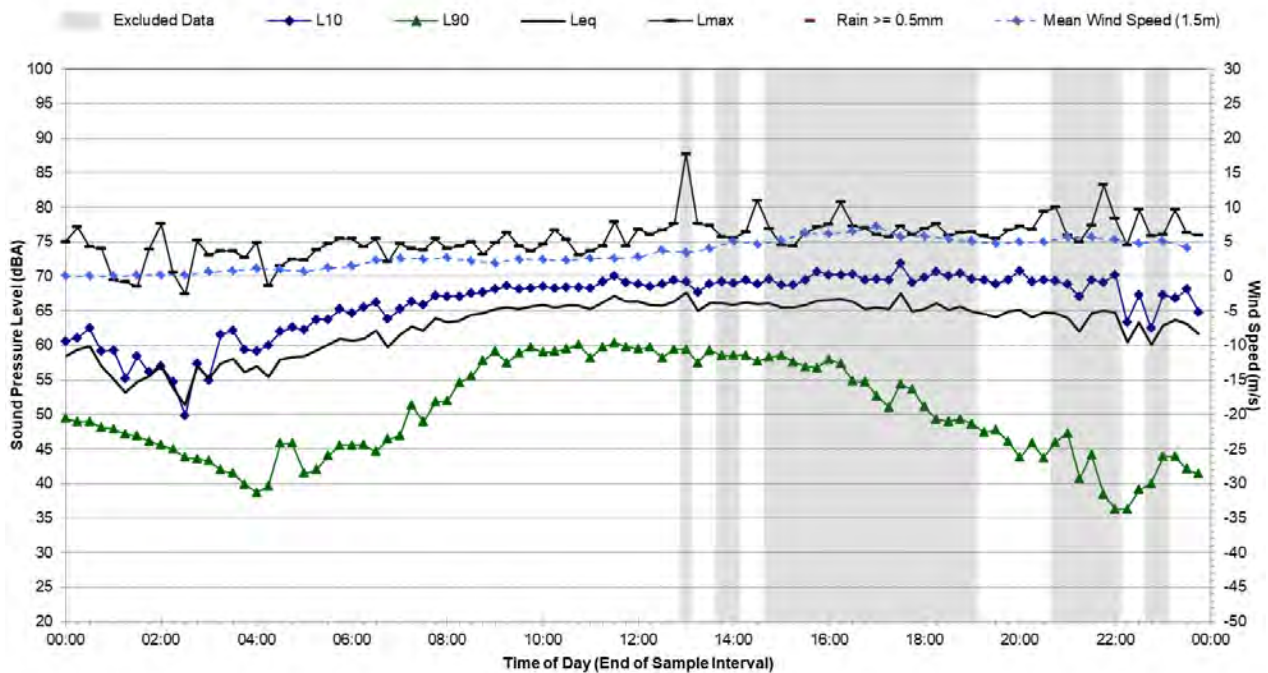
Statistical Ambient Noise Levels

L01 - 9350 Pacific Highway, Cooperabung - Saturday, 27 October 2018



Statistical Ambient Noise Levels

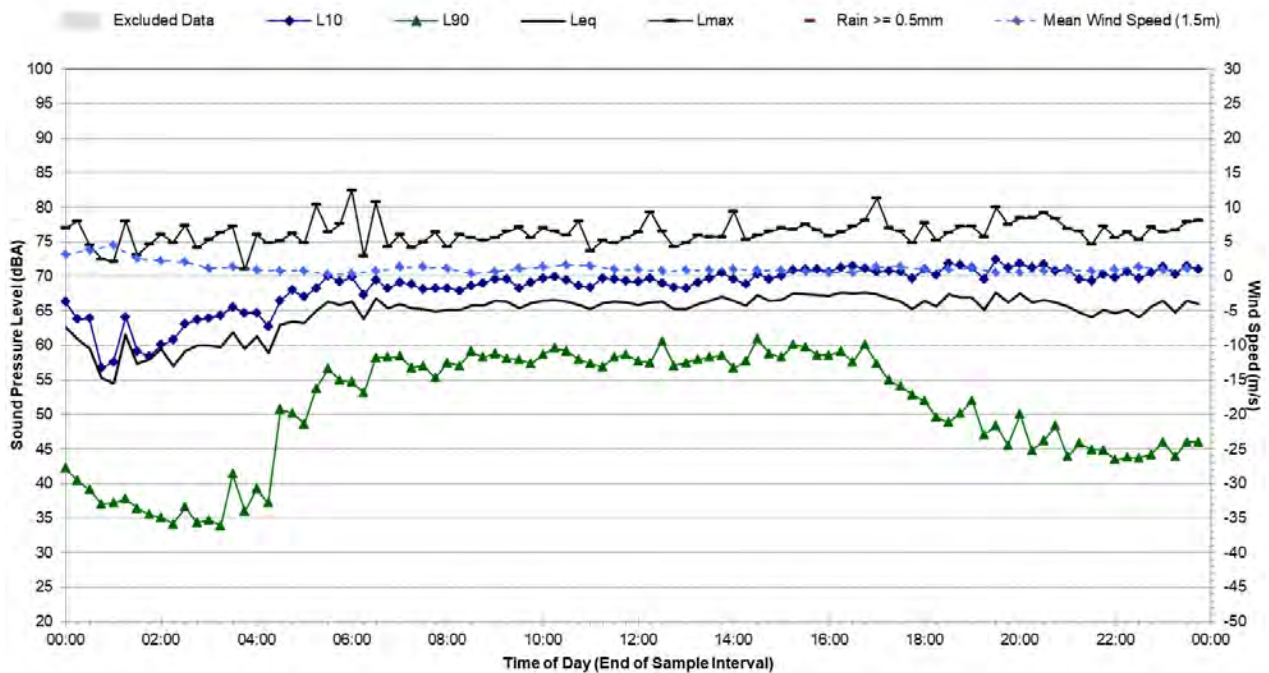
L01 - 9350 Pacific Highway, Cooperabung - Sunday, 28 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

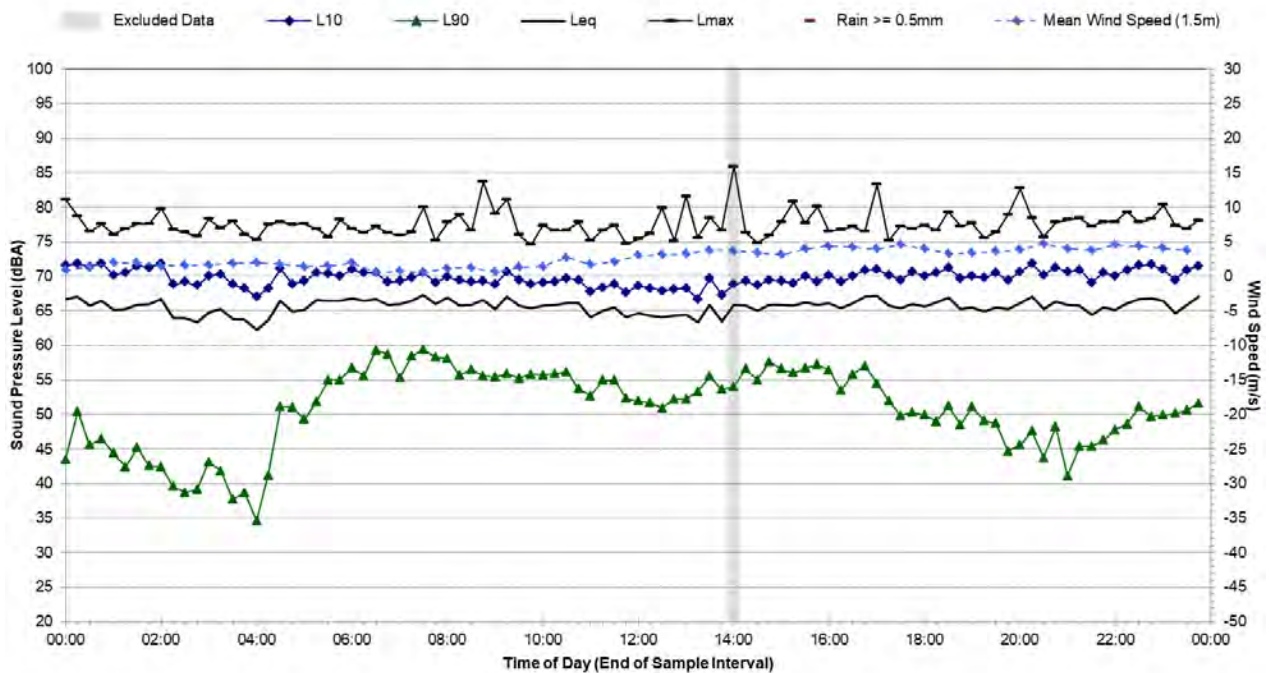
Statistical Ambient Noise Levels

L01 - 9350 Pacific Highway, Cooperabung - Monday, 29 October 2018



Statistical Ambient Noise Levels

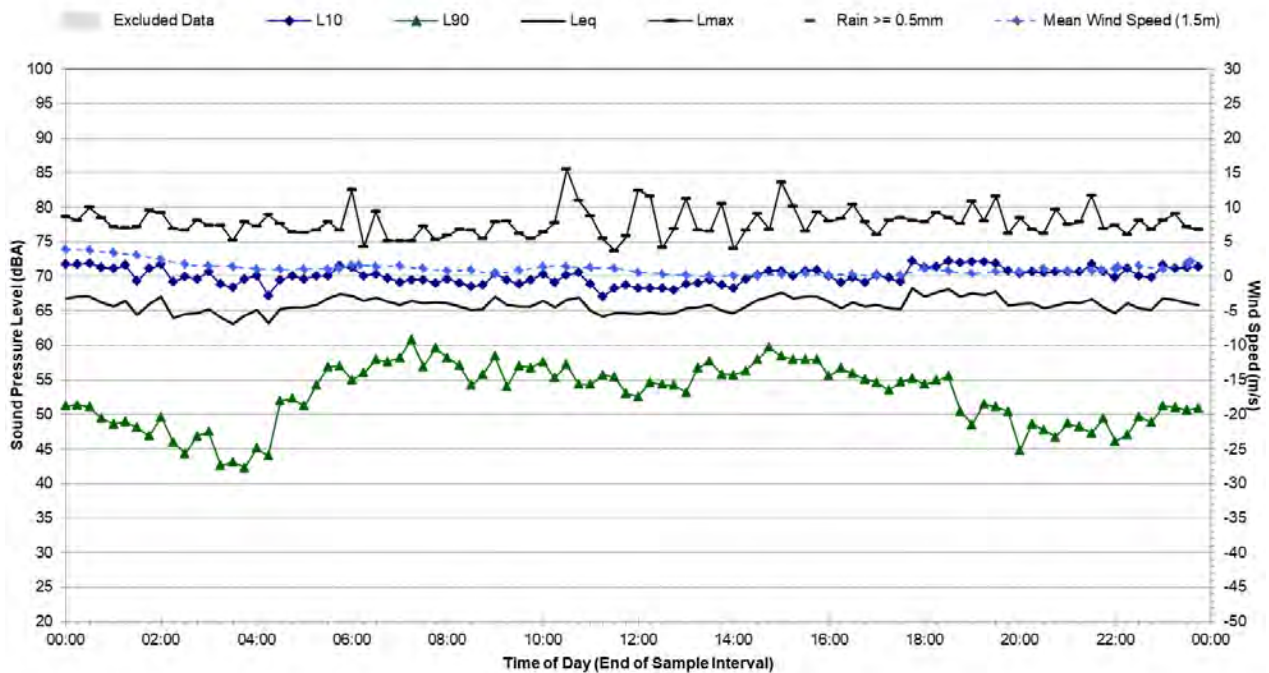
L01 - 9350 Pacific Highway, Cooperabung - Tuesday, 30 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

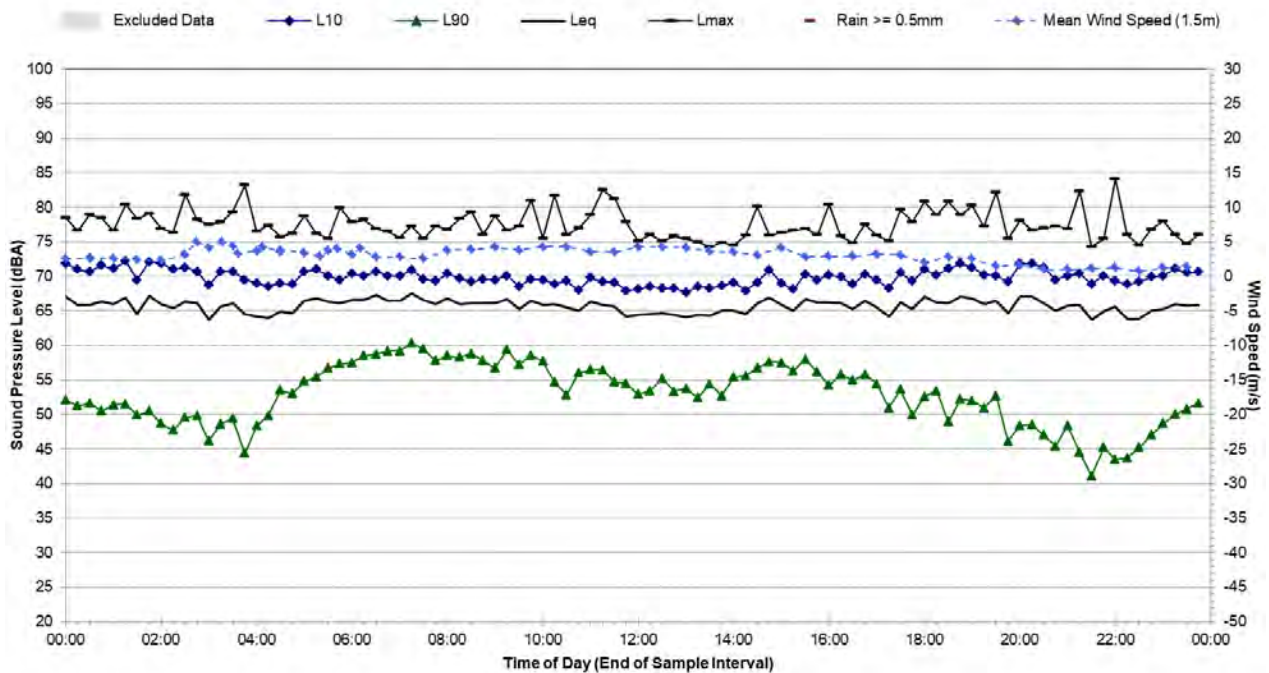
Statistical Ambient Noise Levels

L01 - 9350 Pacific Highway, Cooperabung - Wednesday, 31 October 2018



Statistical Ambient Noise Levels

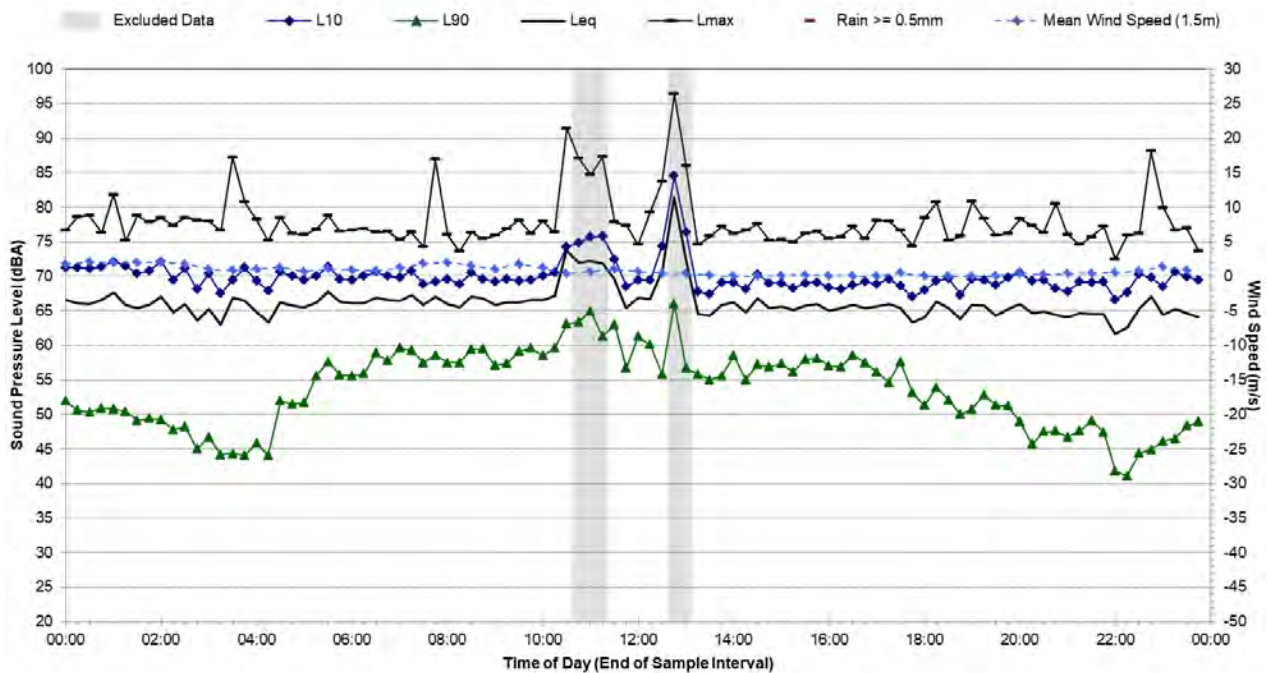
L01 - 9350 Pacific Highway, Cooperabung - Thursday, 1 November 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

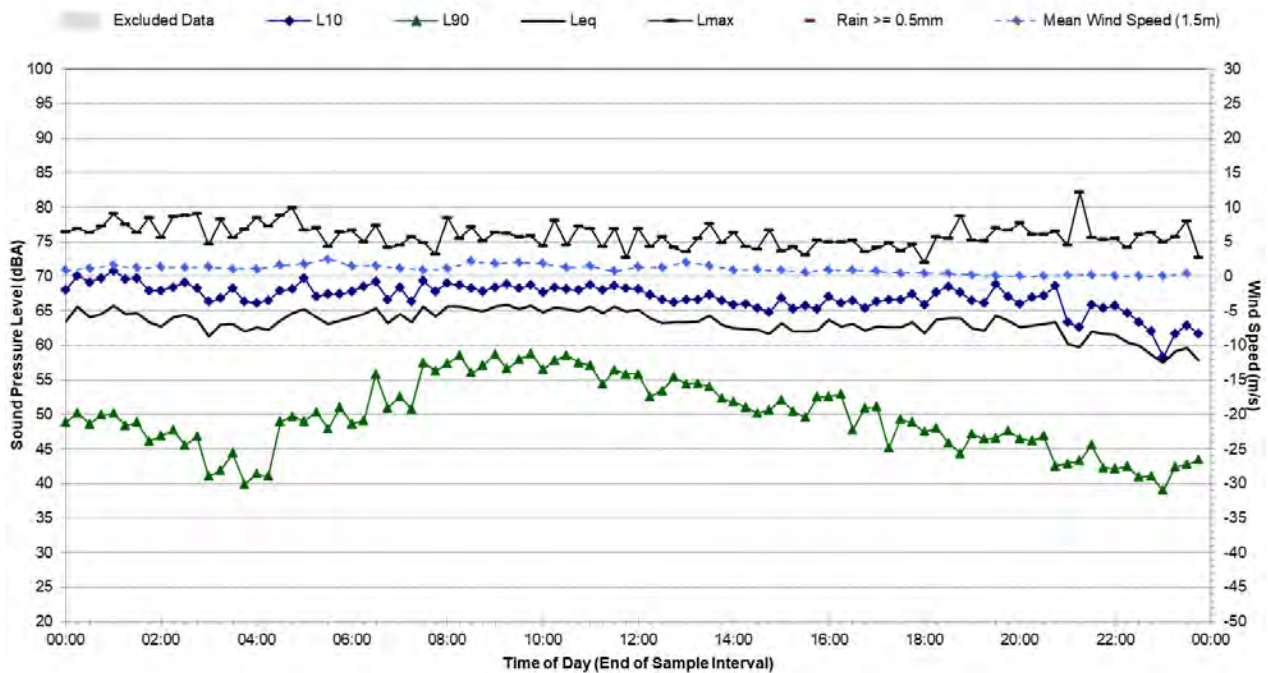
Statistical Ambient Noise Levels

L01 - 9350 Pacific Highway, Cooperabung - Friday, 2 November 2018



Statistical Ambient Noise Levels

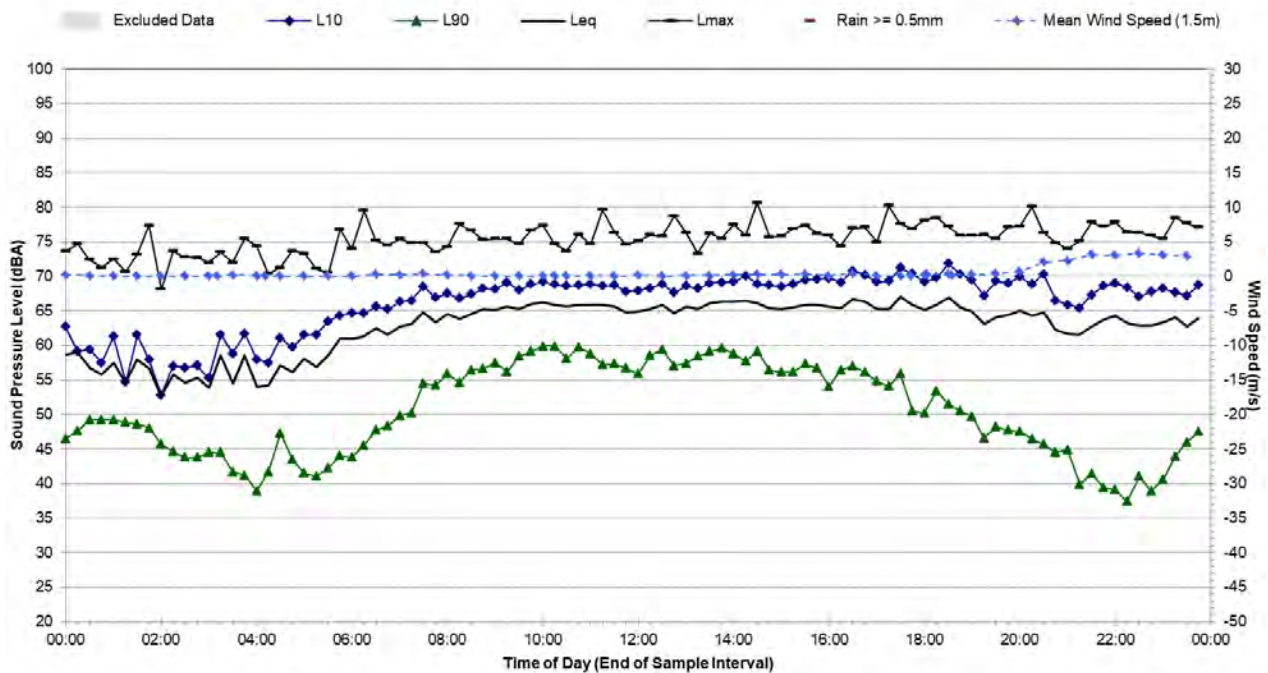
L01 - 9350 Pacific Highway, Cooperabung - Saturday, 3 November 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

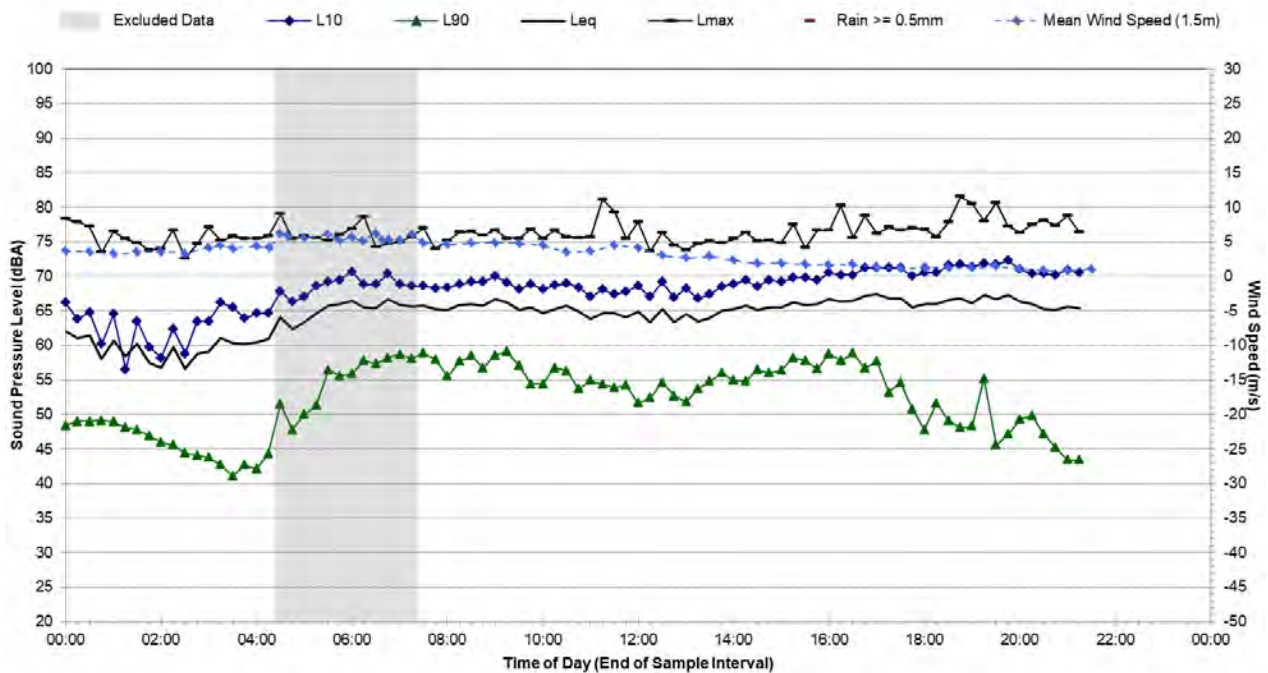
Statistical Ambient Noise Levels

L01 - 9350 Pacific Highway, Cooperabung - Sunday, 4 November 2018





Statistical Ambient Noise Levels

L01 - 9350 Pacific Highway, Cooperabung - Monday, 5 November 2018

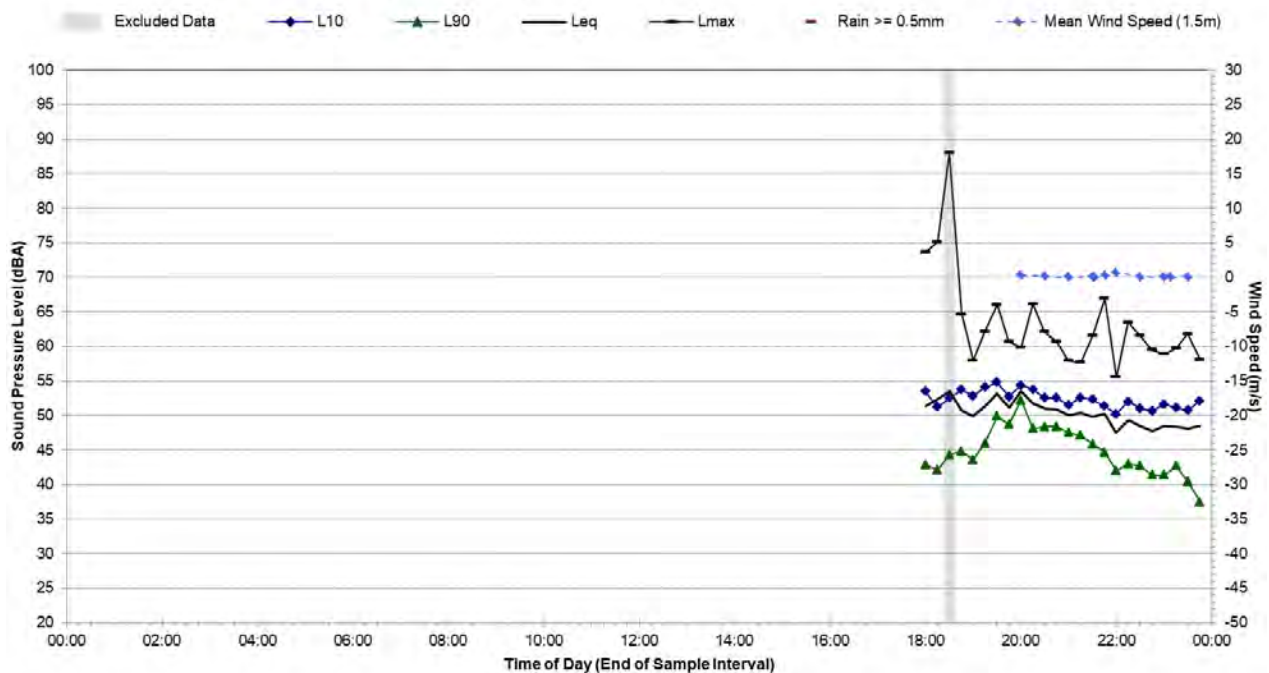


Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

Noise Monitoring Location	L.02				Map of Noise Monitoring Location
Noise Monitoring Address	404 Cooperabung Drive, Cooperabung				
Logger Device Type: ARL NGARA, Logger Serial: 87807B Sound Level Meter Device Type: Brüel and Kjær 2270, Sound Level Meter Serial No: 2487418					
Recorded Noise Levels (LAmax): 22/10/2018: Constant light vehicle traffic from highway: 48-52 dBA, Highway trucks: 59-63 dBA Nearby car passbys: 64 dBA, Nearby children: 60 dBA, Birds: 54-59 dBA. 06/11/2018: Light vehicle traffic: 50-53 dBA, Truck passbys: 55-61 dBA, Nearby car: 62-70 dBA, Dogs barking: 54-68 dBA, Birds: 50-66 dBA, Background: 45-47 dBA.					
Ambient Noise Logging Results – NPfl Defined Time Periods					Photo of Noise Monitoring Location
Monitoring Period	Noise Level (dBA)				
	RBL	LAeq	L10	L1	
Daytime	41	49	51	55	
Evening	39	52	52	55	
Night-time	35	49	50	54	
Ambient Noise Logging Results – RNP Defined Time Periods					
Monitoring Period	Noise Level (dBA)				
	LAeq(period)		LAeq(1hour)		
Daytime (7am-10pm)	50		53		
Night-time (10pm-7am)	49		53		
Attended Noise Measurement Results					
Date	Start Time	Measured Noise Level (dBA)			
		LA90	LAeq	LAmax	
22/10/2018	17:41	43	48	65	
06/11/2018	05:31	48	53	70	
06/11/2018	05:47	47	53	68	

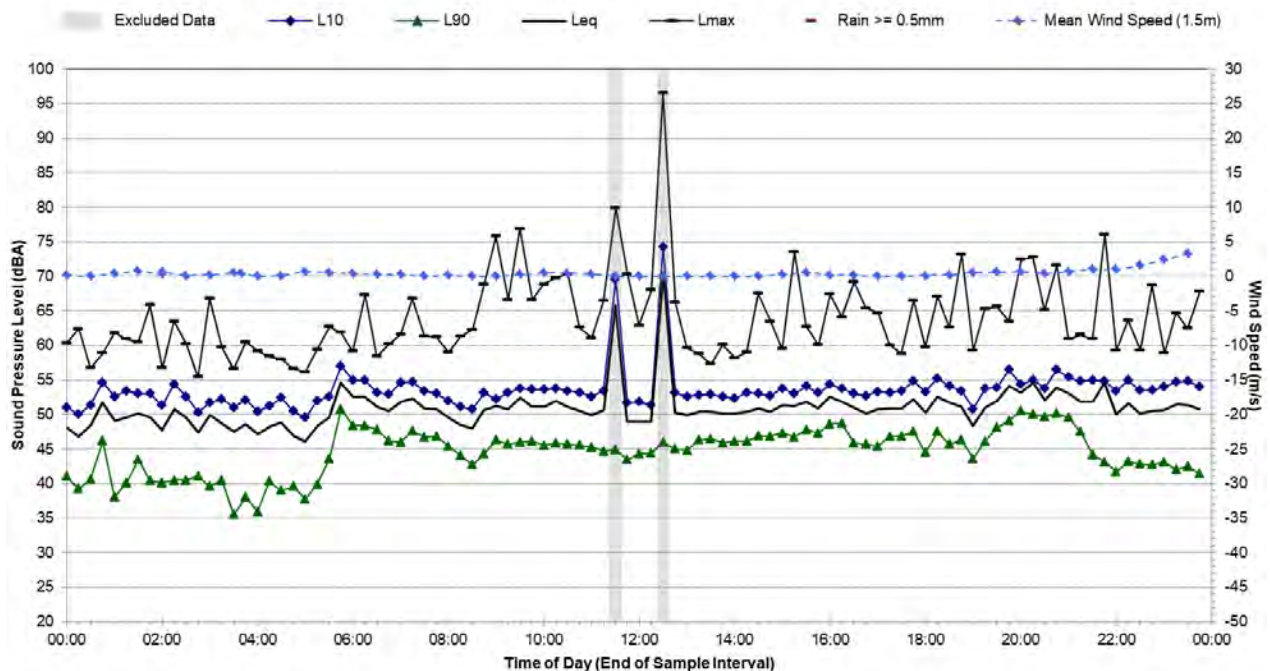
Statistical Ambient Noise Levels

L02 - 404 Cooperabung Drive, Cooperabung - Monday, 22 October 2018



Statistical Ambient Noise Levels

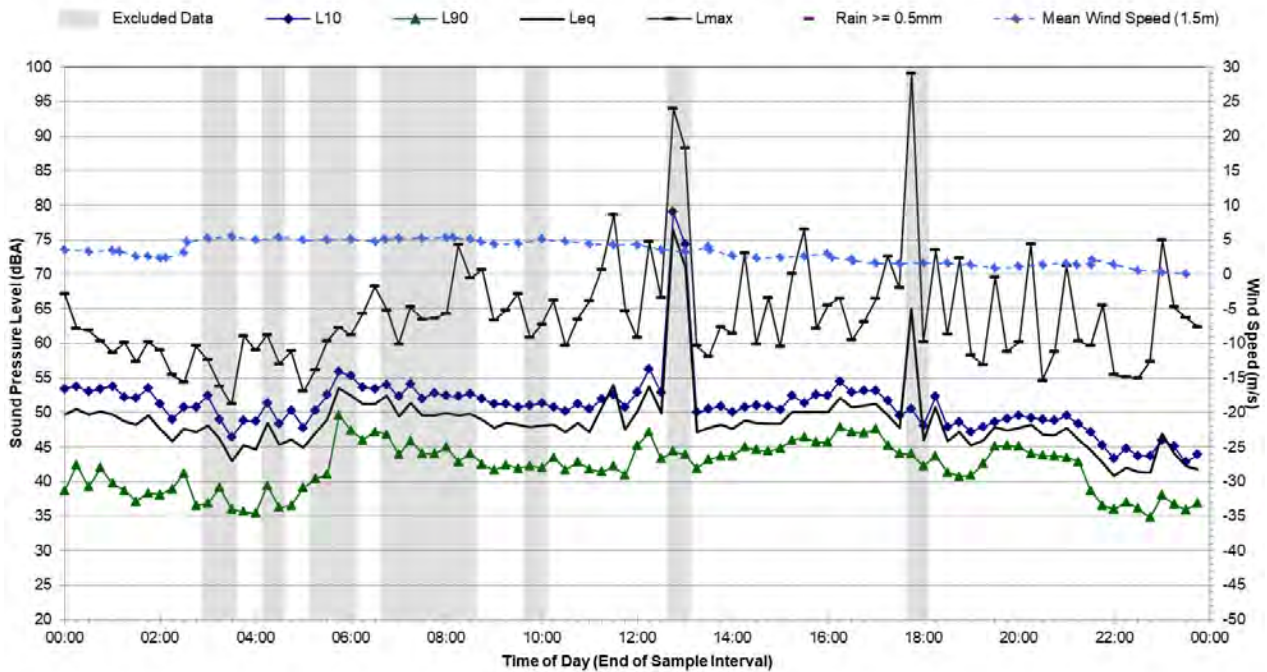
L02 - 404 Cooperabung Drive, Cooperabung - Tuesday, 23 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

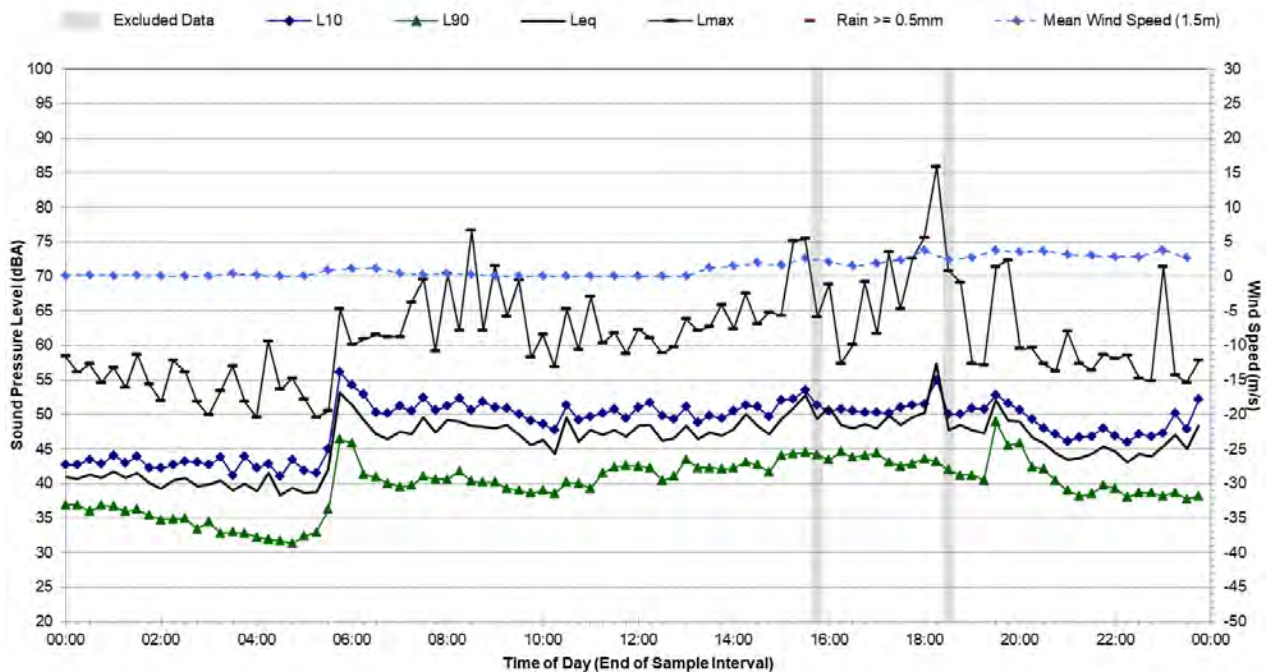
Statistical Ambient Noise Levels

L02 - 404 Cooperabung Drive, Cooperabung - Wednesday, 24 October 2018



Statistical Ambient Noise Levels

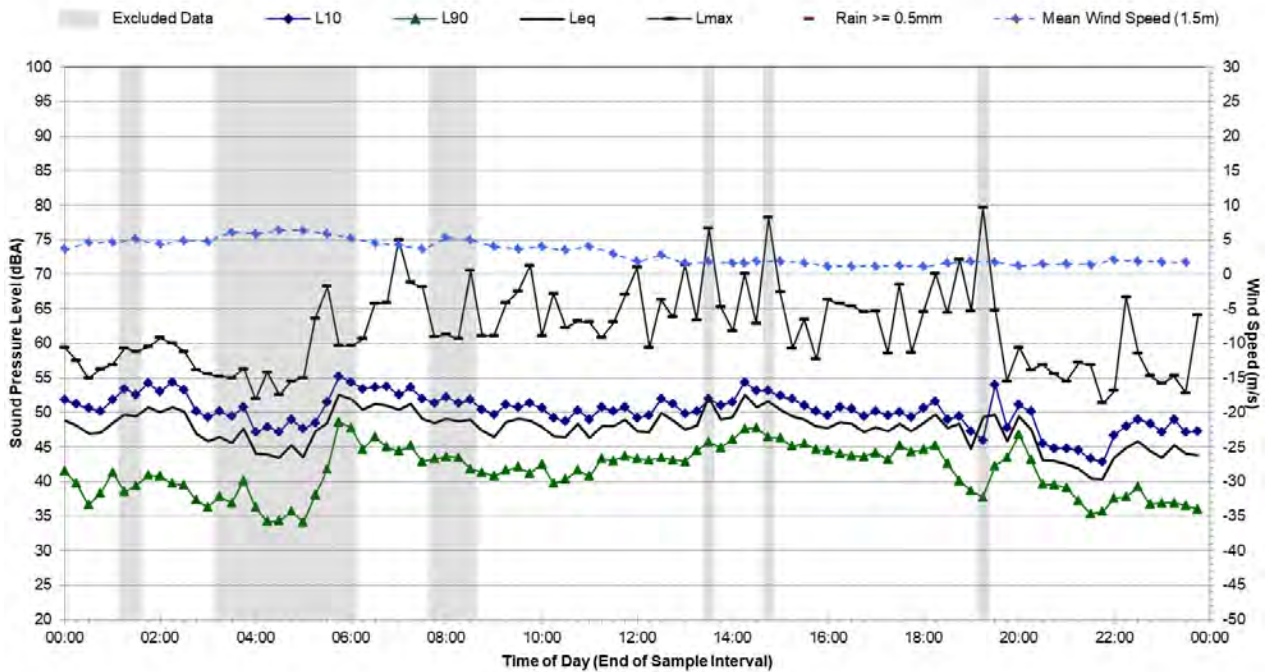
L02 - 404 Cooperabung Drive, Cooperabung - Thursday, 25 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

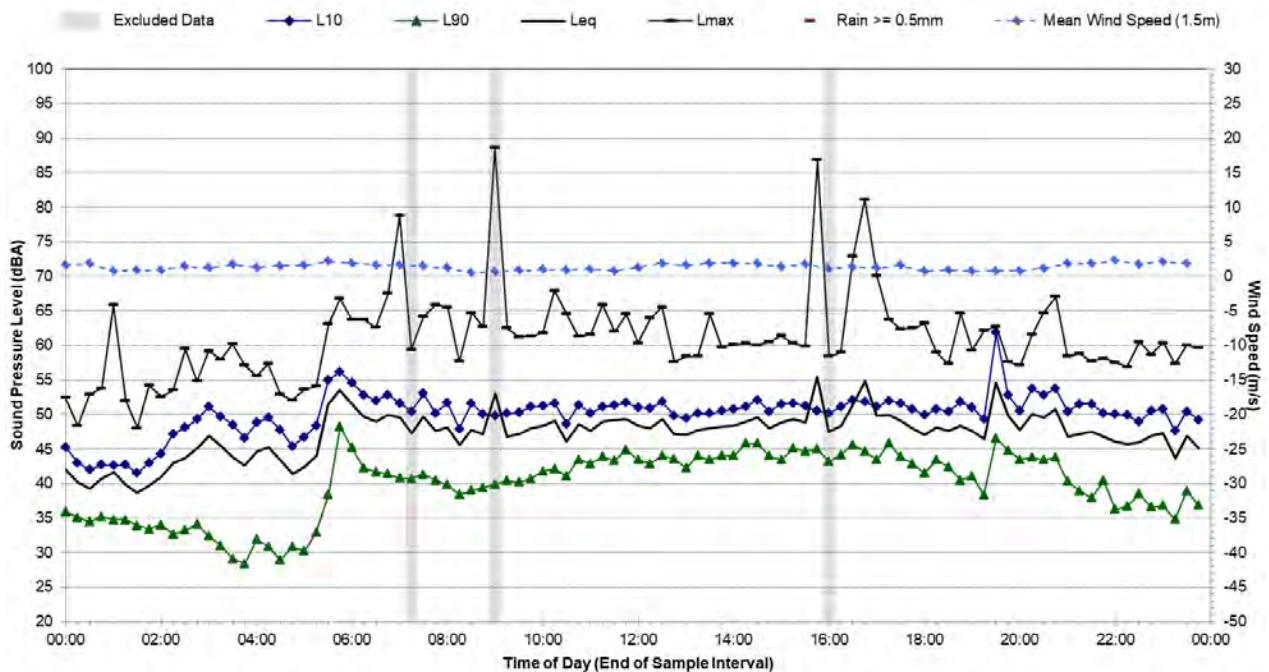
Statistical Ambient Noise Levels

L02 - 404 Cooperabung Drive, Cooperabung - Friday, 26 October 2018



Statistical Ambient Noise Levels

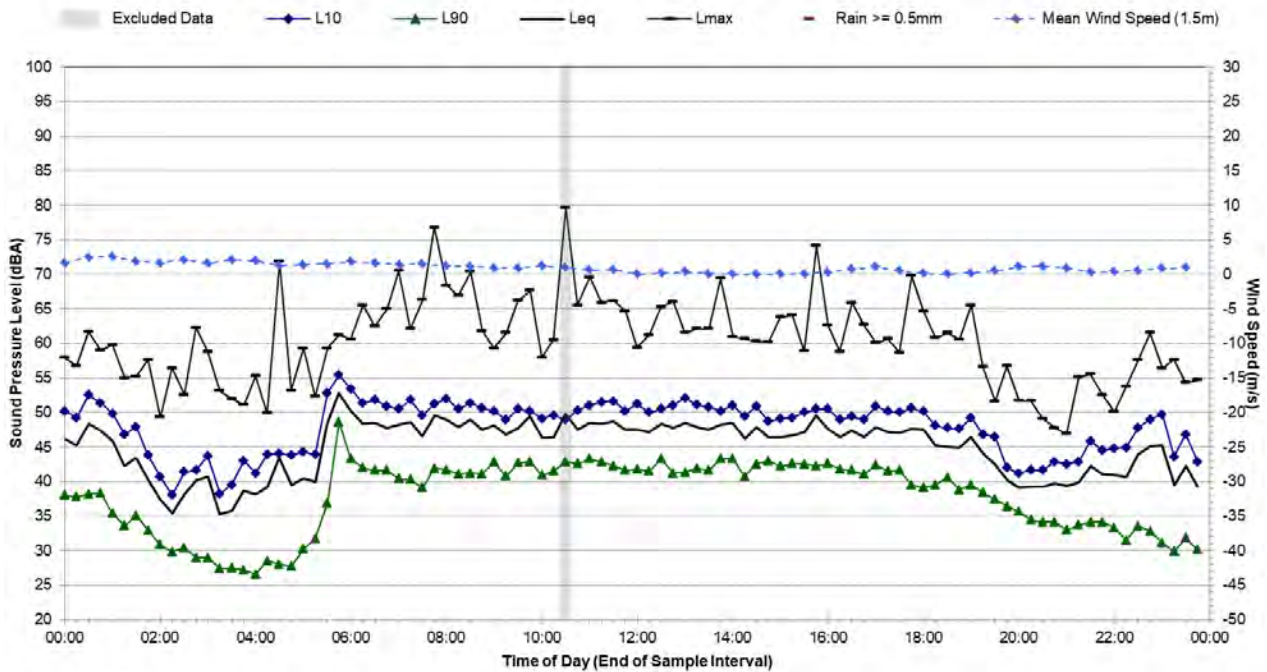
L02 - 404 Cooperabung Drive, Cooperabung - Saturday, 27 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

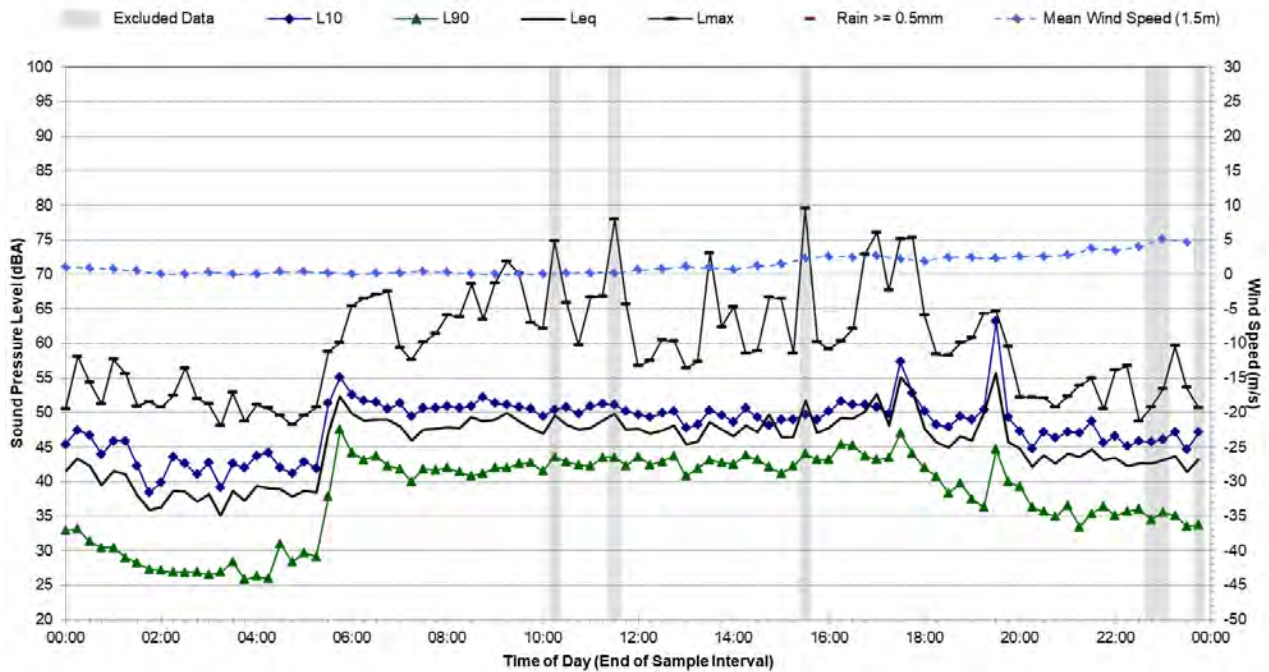
Statistical Ambient Noise Levels

L02 - 404 Cooperabung Drive, Cooperabung - Sunday, 28 October 2018



Statistical Ambient Noise Levels

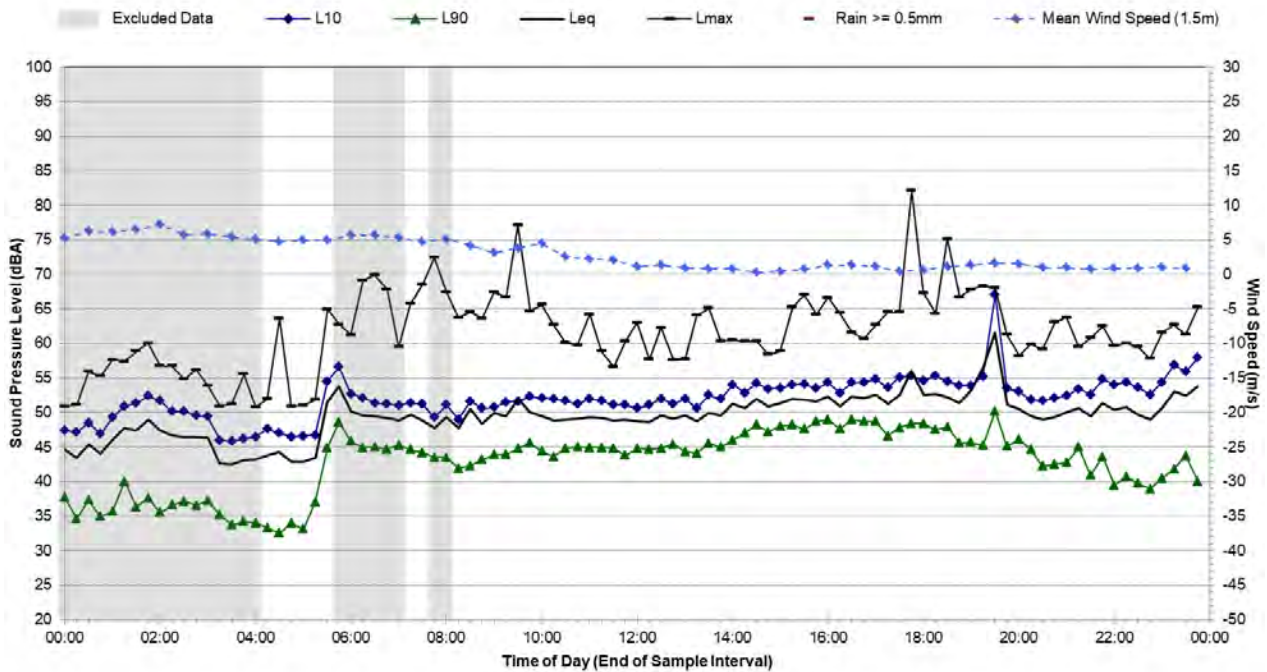
L02 - 404 Cooperabung Drive, Cooperabung - Monday, 29 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

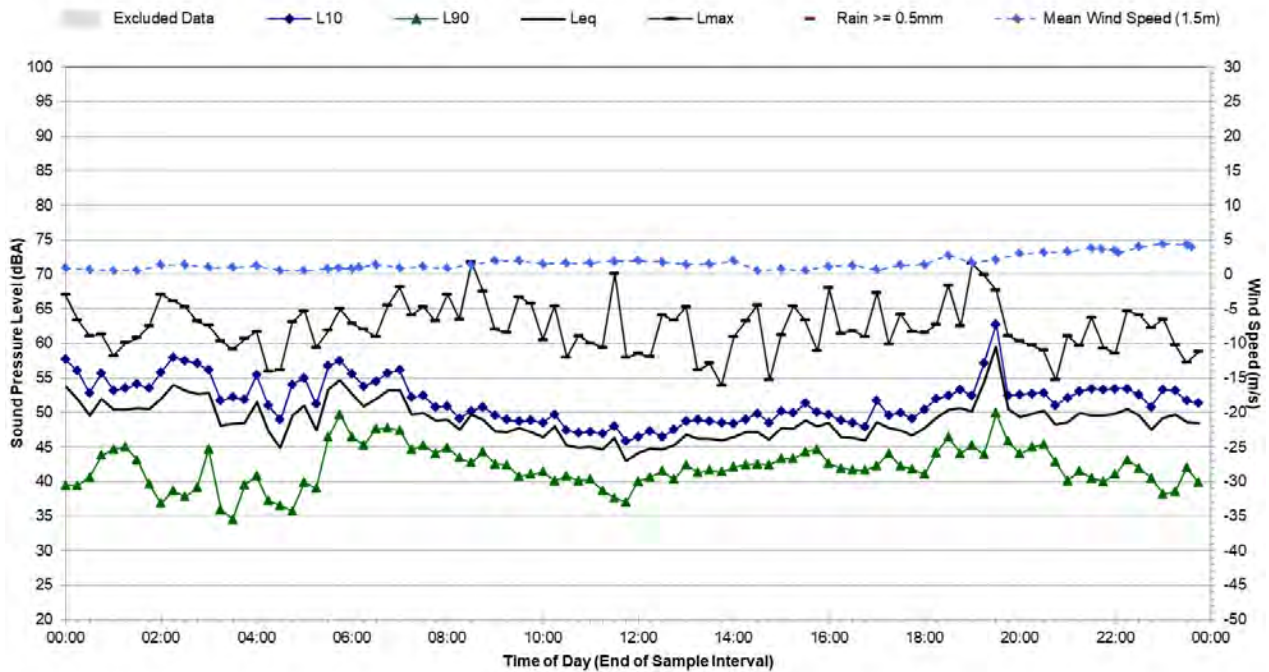
Statistical Ambient Noise Levels

L02 - 404 Cooperabung Drive, Cooperabung - Tuesday, 30 October 2018



Statistical Ambient Noise Levels

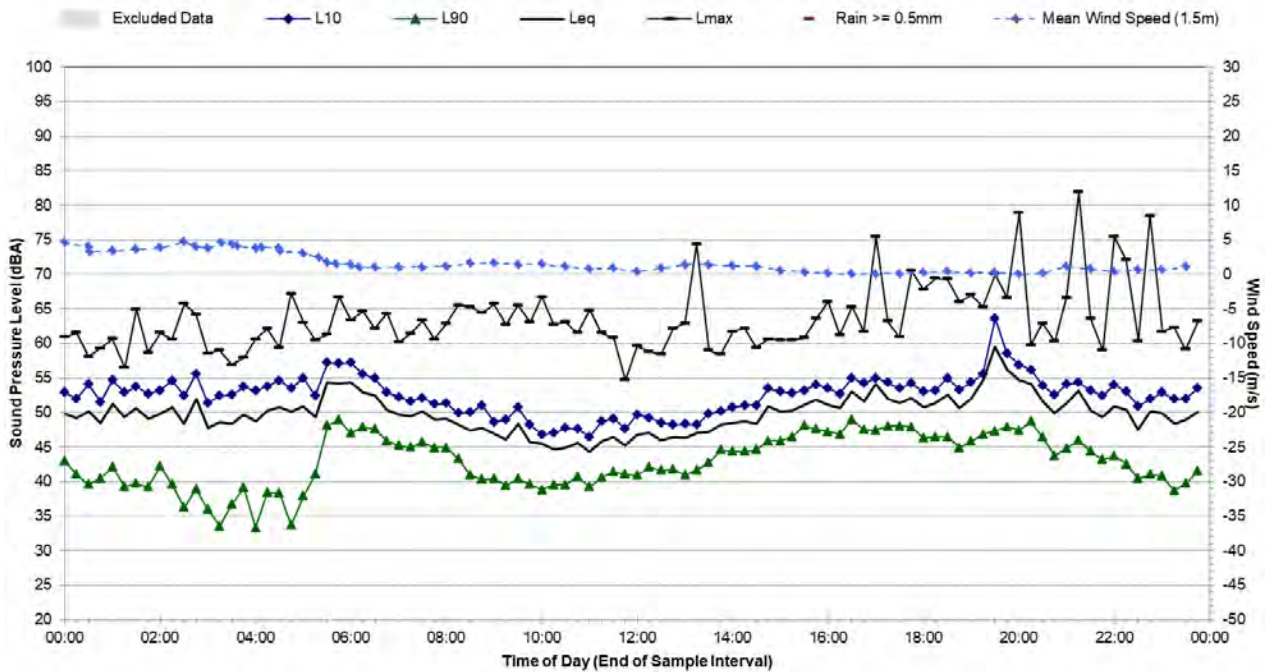
L02 - 404 Cooperabung Drive, Cooperabung - Wednesday, 31 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

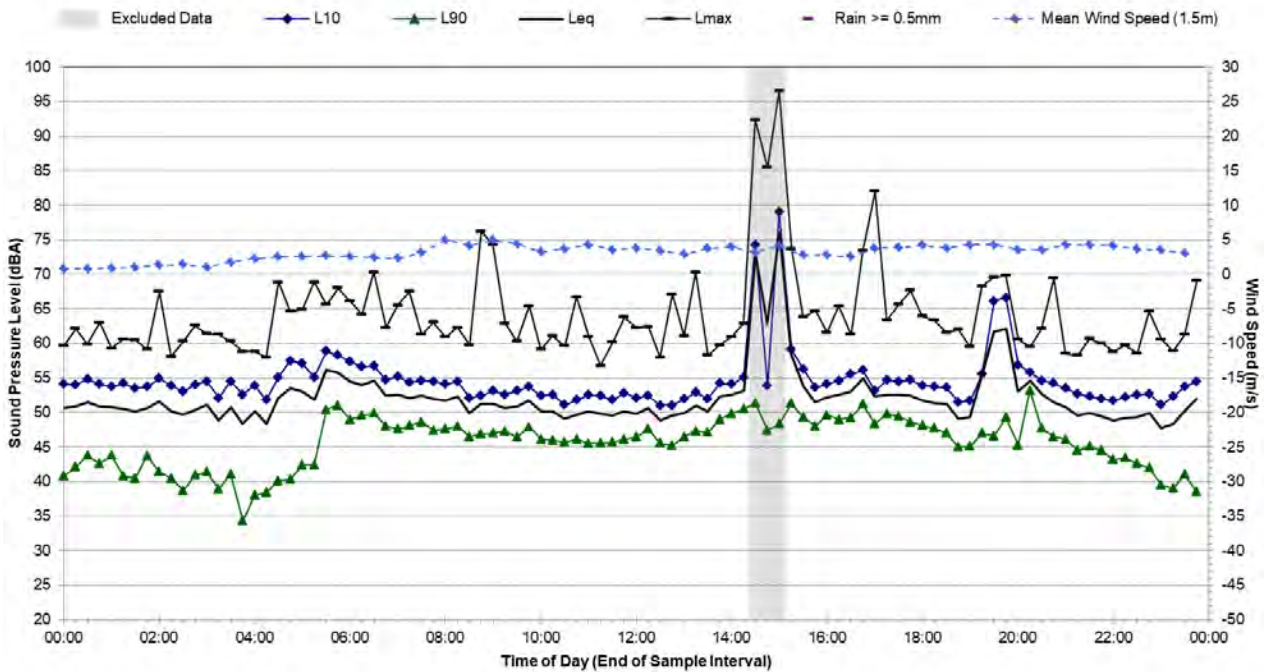
Statistical Ambient Noise Levels

L02 - 404 Cooperabung Drive, Cooperabung - Thursday, 1 November 2018



Statistical Ambient Noise Levels

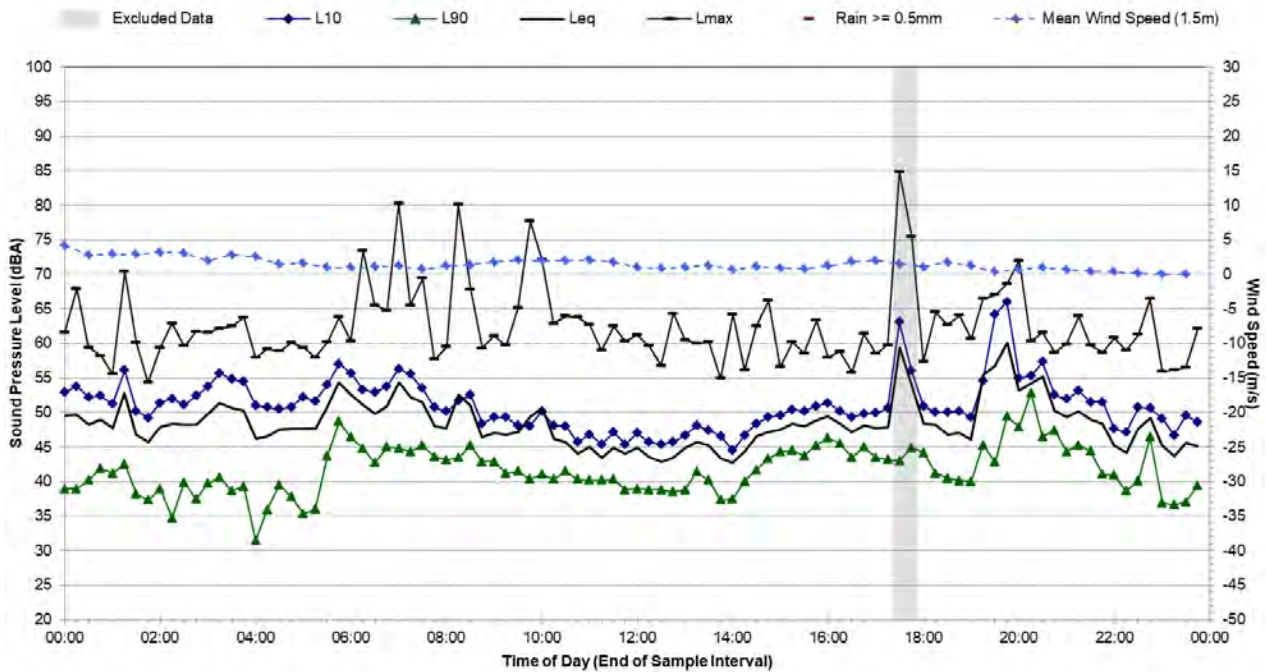
L02 - 404 Cooperabung Drive, Cooperabung - Friday, 2 November 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

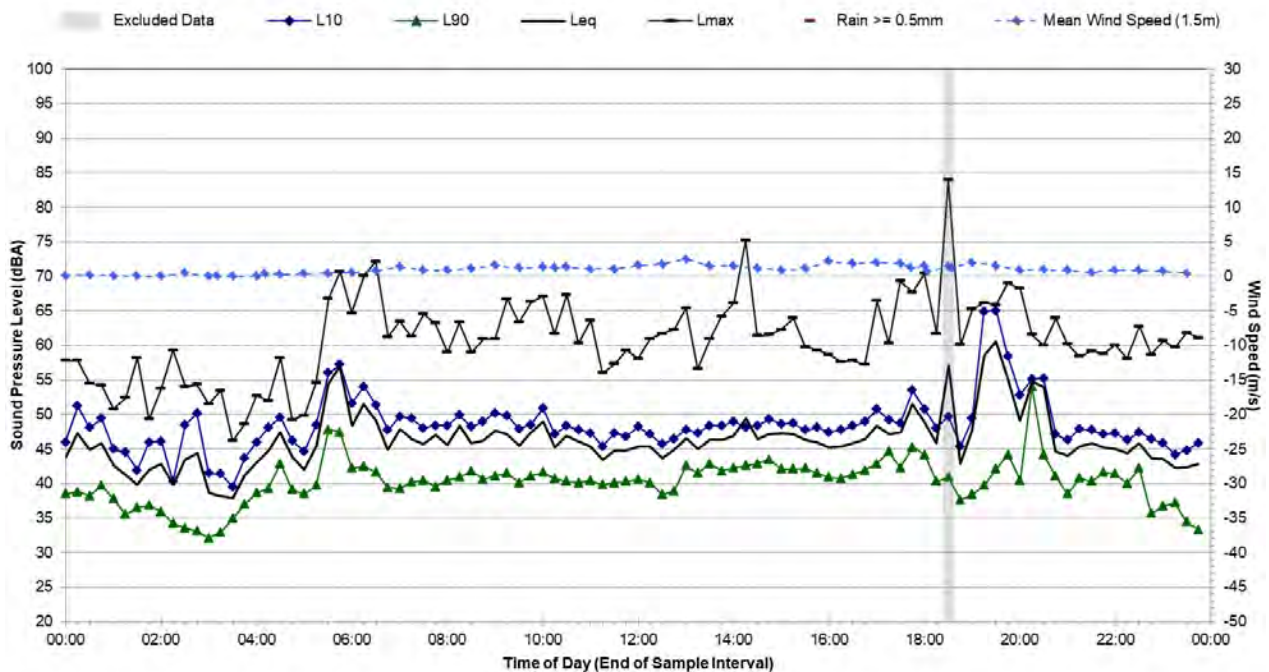
Statistical Ambient Noise Levels

L02 - 404 Cooperabung Drive, Cooperabung - Saturday, 3 November 2018



Statistical Ambient Noise Levels

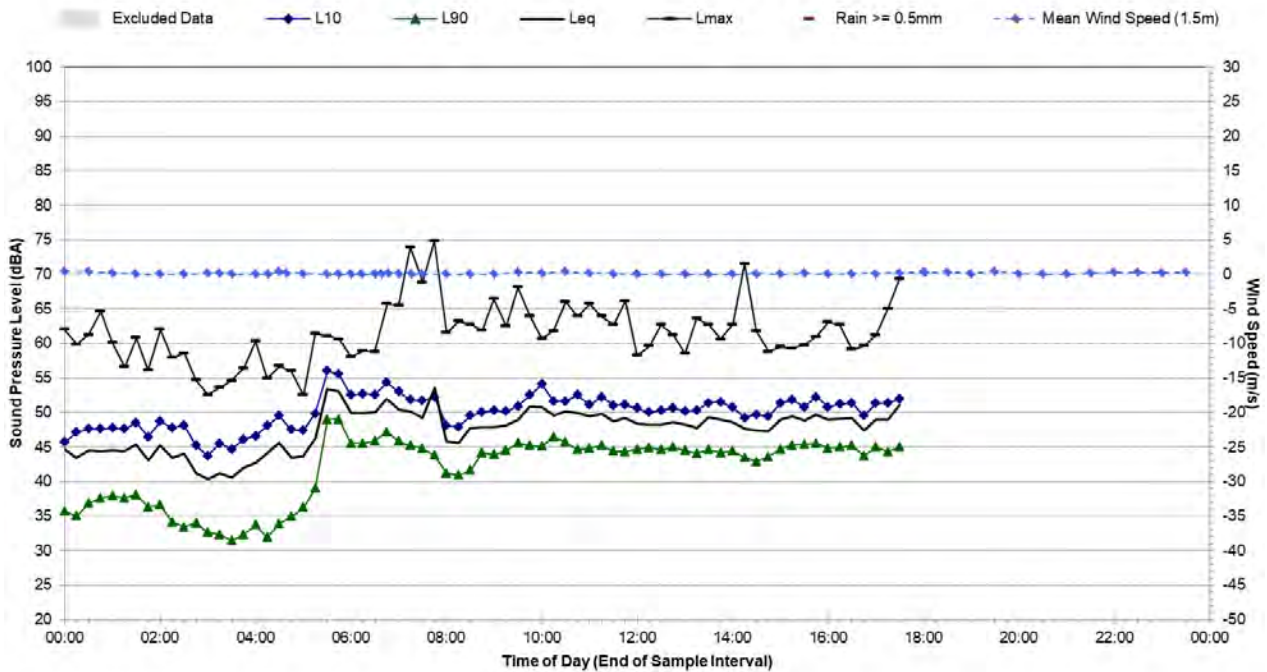
L02 - 404 Cooperabung Drive, Cooperabung - Sunday, 4 November 2018





Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

Statistical Ambient Noise Levels

L02 - 404 Cooperabung Drive, Cooperabung - Monday, 5 November 2018

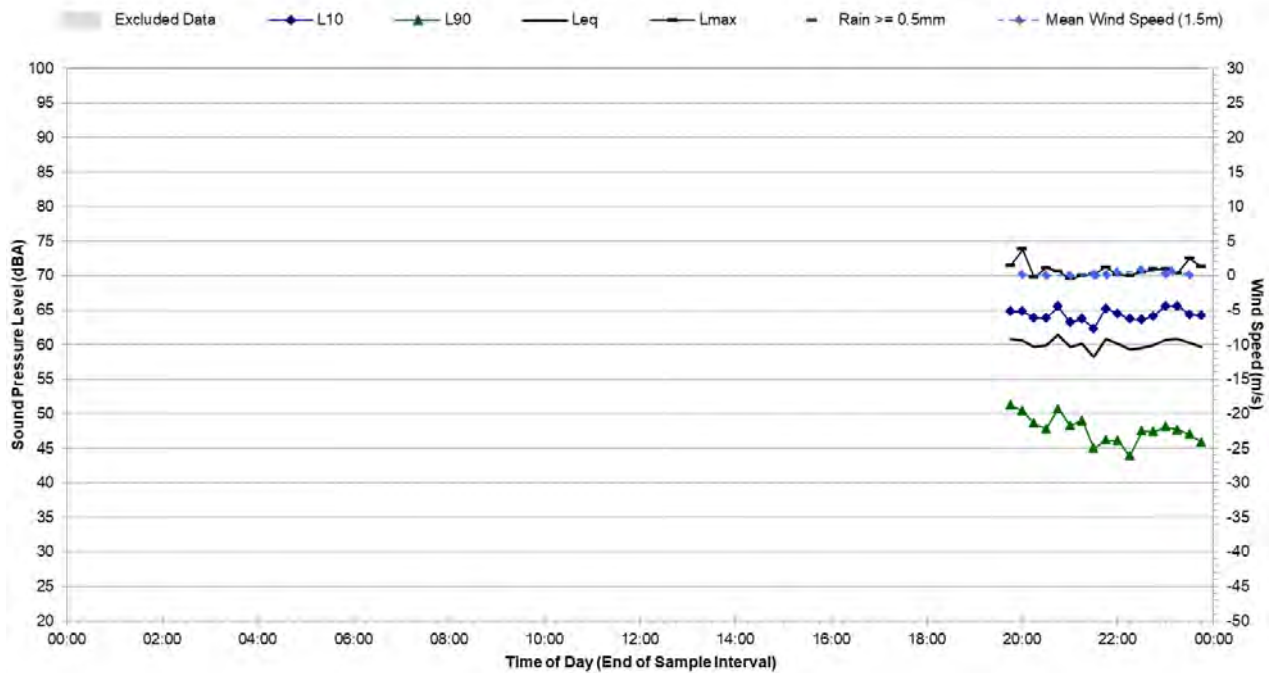


Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

Noise Monitoring Location	L.03				
Noise Monitoring Address	9273 Pacific Highway, Cooperabung				
Logger Device Type: ARL NGARA, Logger Serial: 878012 Sound Level Meter Device Type: Brüel and Kjær 2270, Sound Level Meter Serial No: 2487418					
Recorded Noise Levels (L _{Amax}): 22/10/2018: Light vehicle traffic: 64-66 dBA, Truck passbys: 68-73 dBA, Background: 54 dBA. 06/11/2018: Truck passbys: 64-70 dBA, Birds: 67-74 dBA.					
Ambient Noise Logging Results – NPfI Defined Time Periods					
Monitoring Period	Noise Level (dBA)				
	RBL	LAeq	L10	L1	
Daytime	53	61	64	67	
Evening	47	61	65	68	
Night-time	39	60	64	68	
Ambient Noise Logging Results – RNP Defined Time Periods					
Monitoring Period	Noise Level (dBA)				
	LAeq(period)		LAeq(1hour)		
Daytime (7am-10pm)	61		63		
Night-time (10pm-7am)	60		62		
Attended Noise Measurement Results					
Date	Start Time	Measured Noise Level (dBA)			
		LA90	LAeq	L _{Amax}	
22/10/2018	19:22	50	61	73	
06/11/2018	00:15	41	61	74	

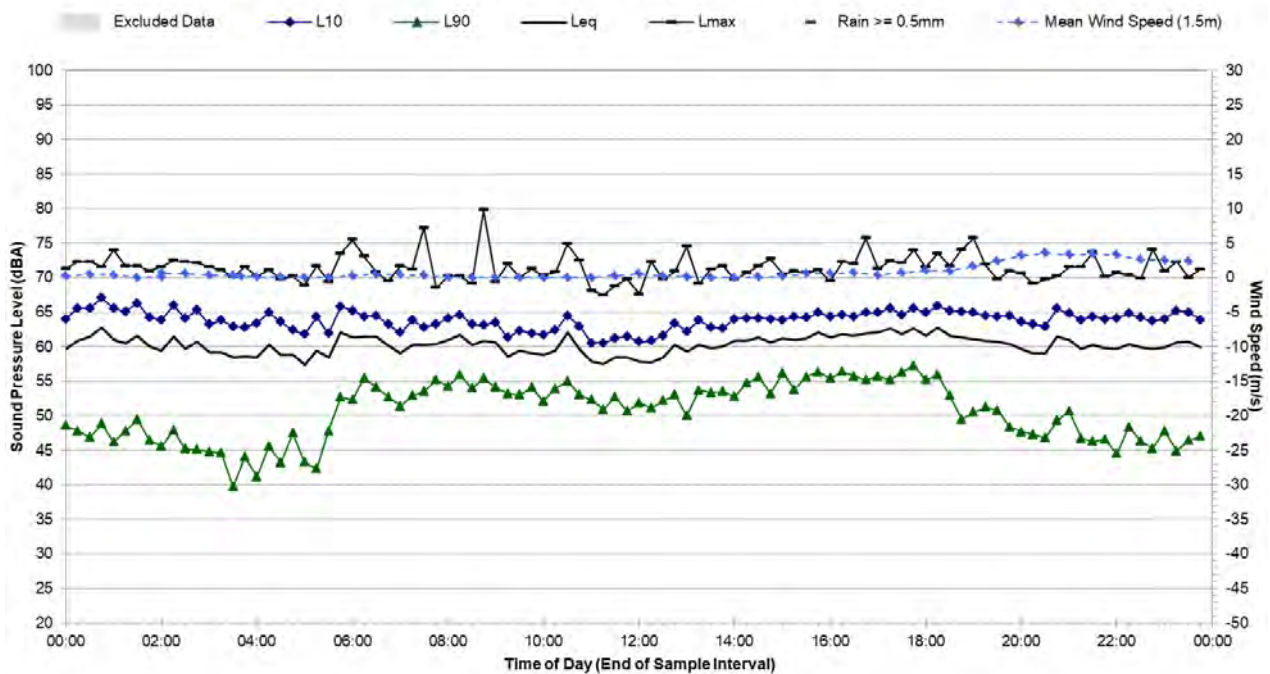
Statistical Ambient Noise Levels

Location L3 - 9273 Pacific Highway - Monday, 22 October 2018



Statistical Ambient Noise Levels

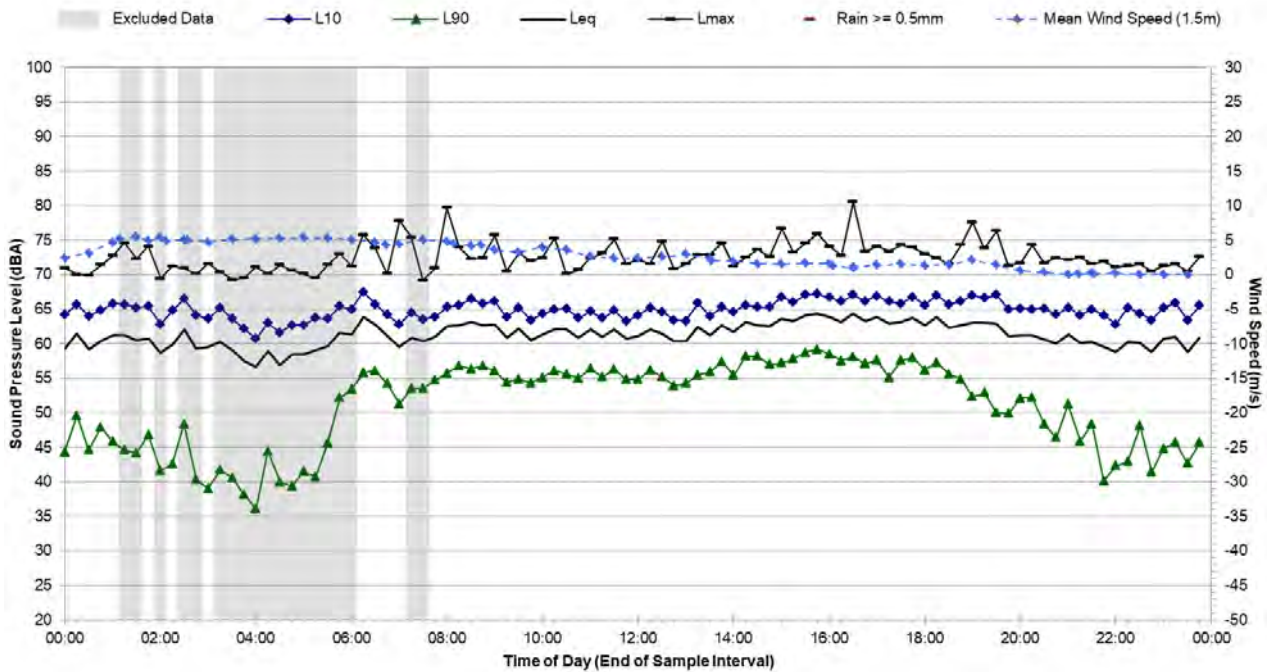
Location L3 - 9273 Pacific Highway - Tuesday, 23 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

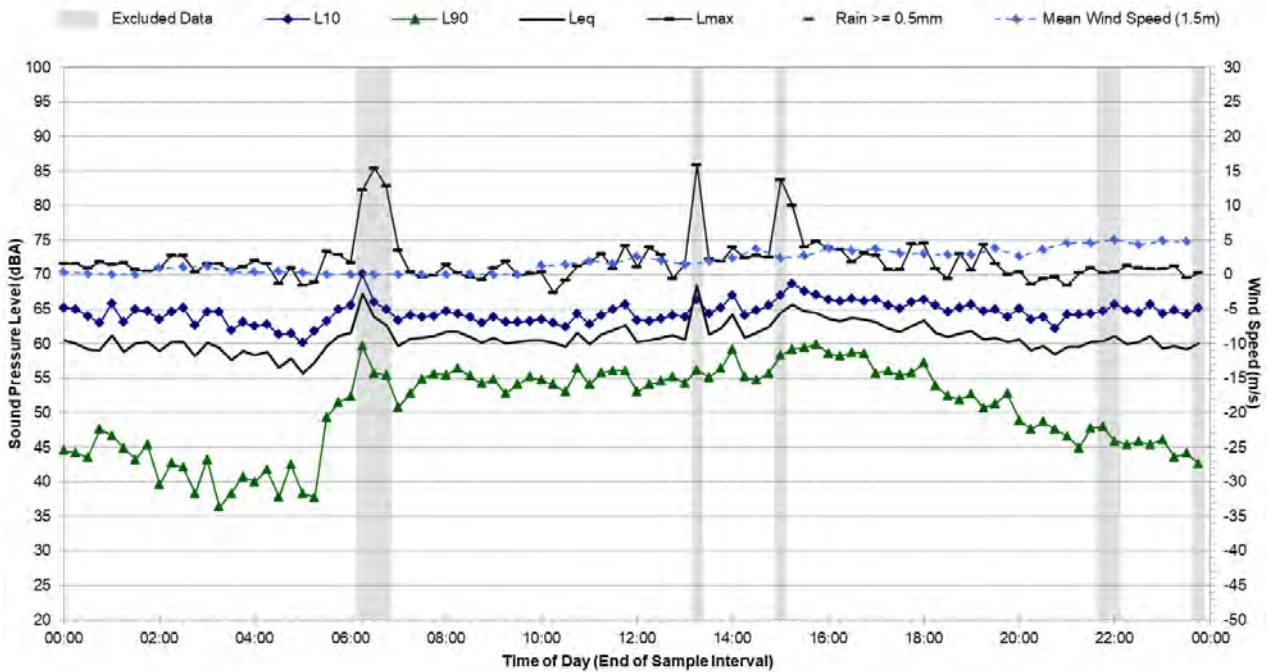
Statistical Ambient Noise Levels

Location L3 - 9273 Pacific Highway - Wednesday, 24 October 2018



Statistical Ambient Noise Levels

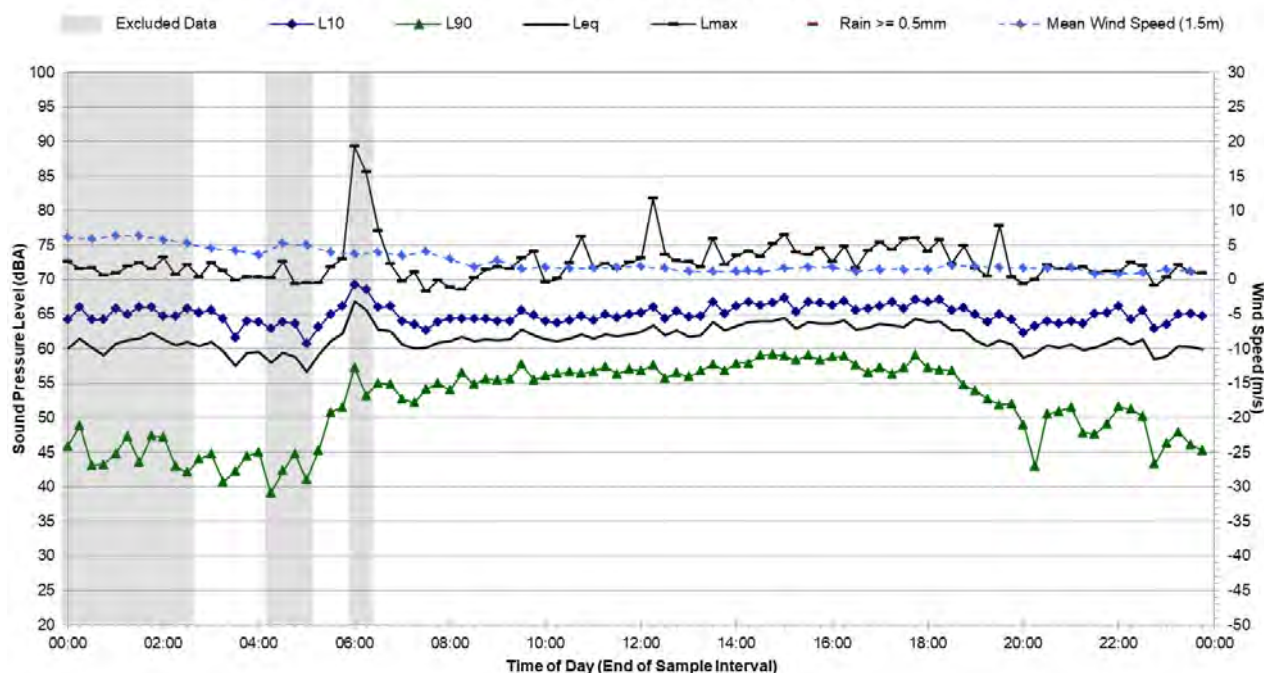
Location L3 - 9273 Pacific Highway - Thursday, 25 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

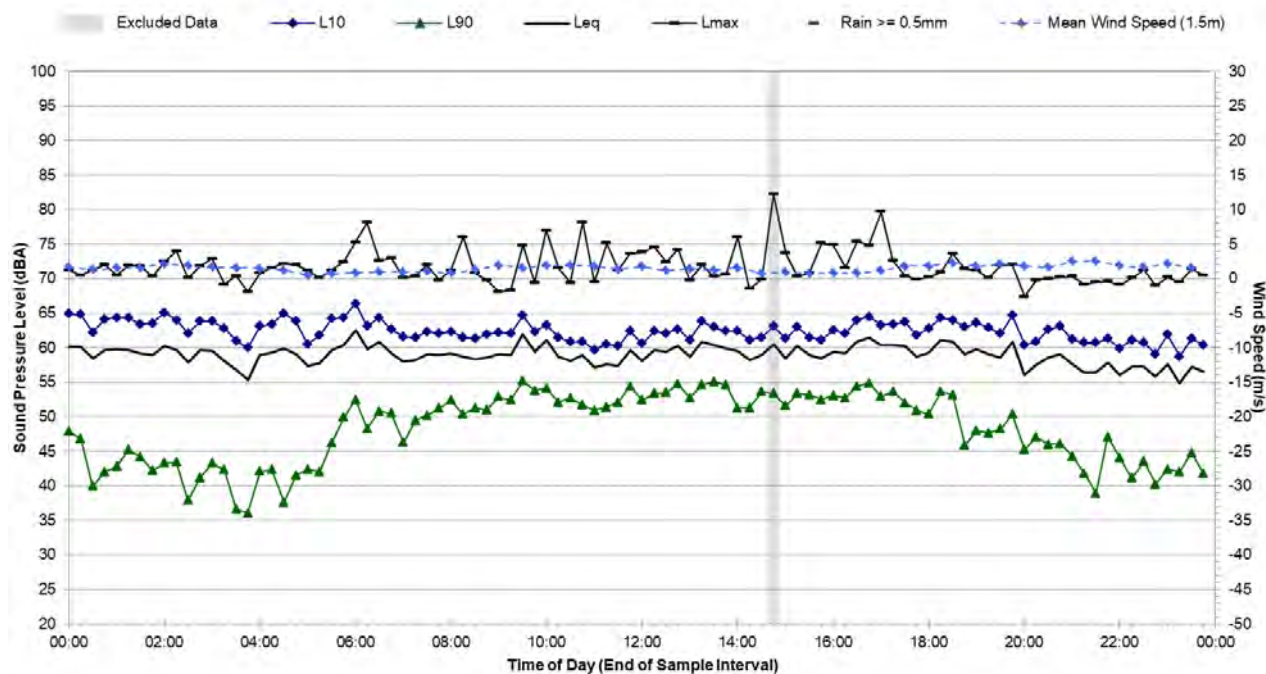
Statistical Ambient Noise Levels

Location L3 - 9273 Pacific Highway - Friday, 26 October 2018



Statistical Ambient Noise Levels

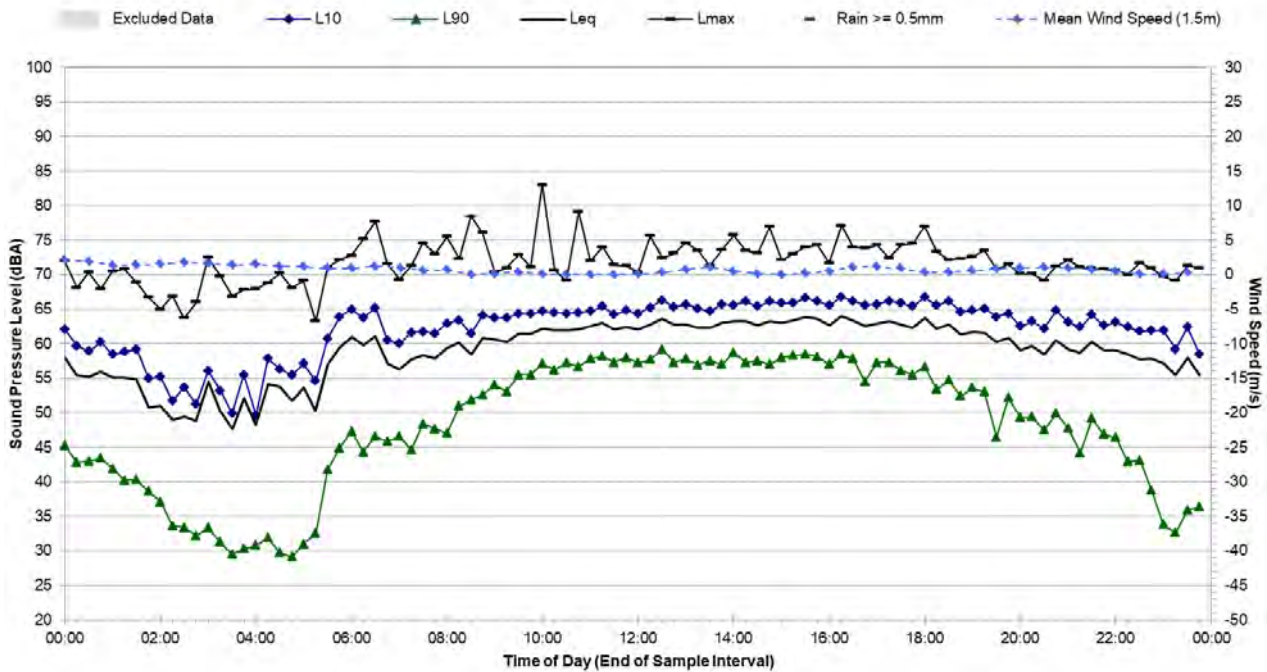
Location L3 - 9273 Pacific Highway - Saturday, 27 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

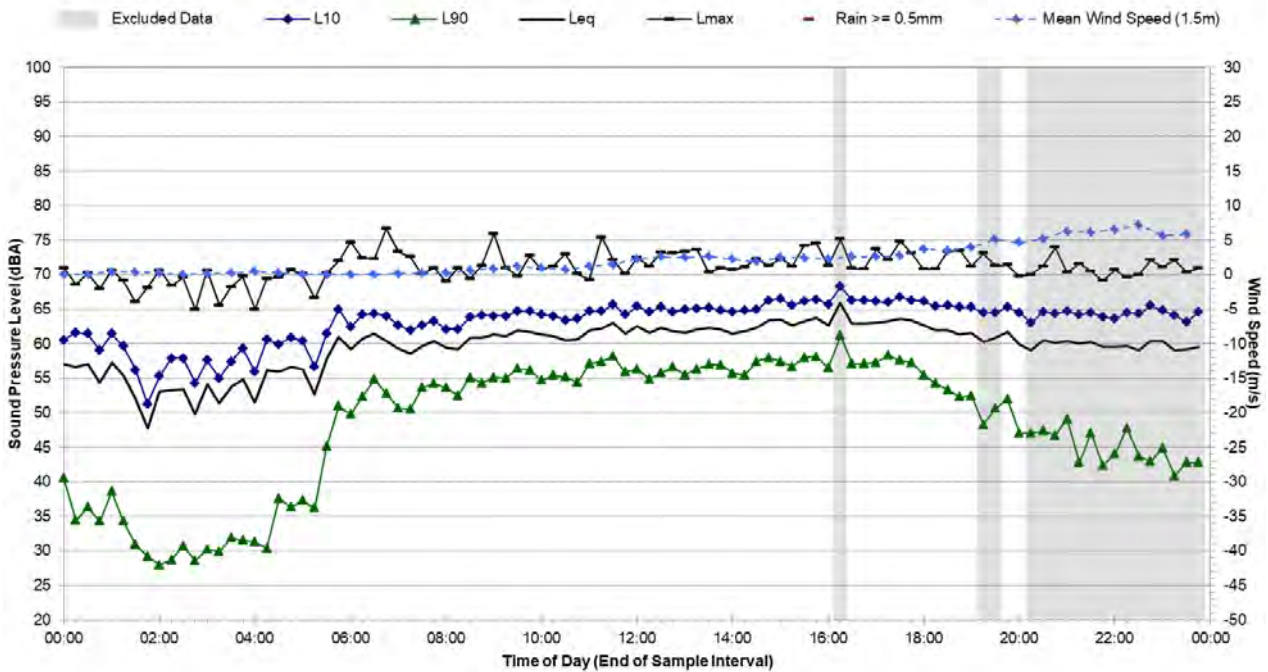
Statistical Ambient Noise Levels

Location L3 - 9273 Pacific Highway - Sunday, 28 October 2018



Statistical Ambient Noise Levels

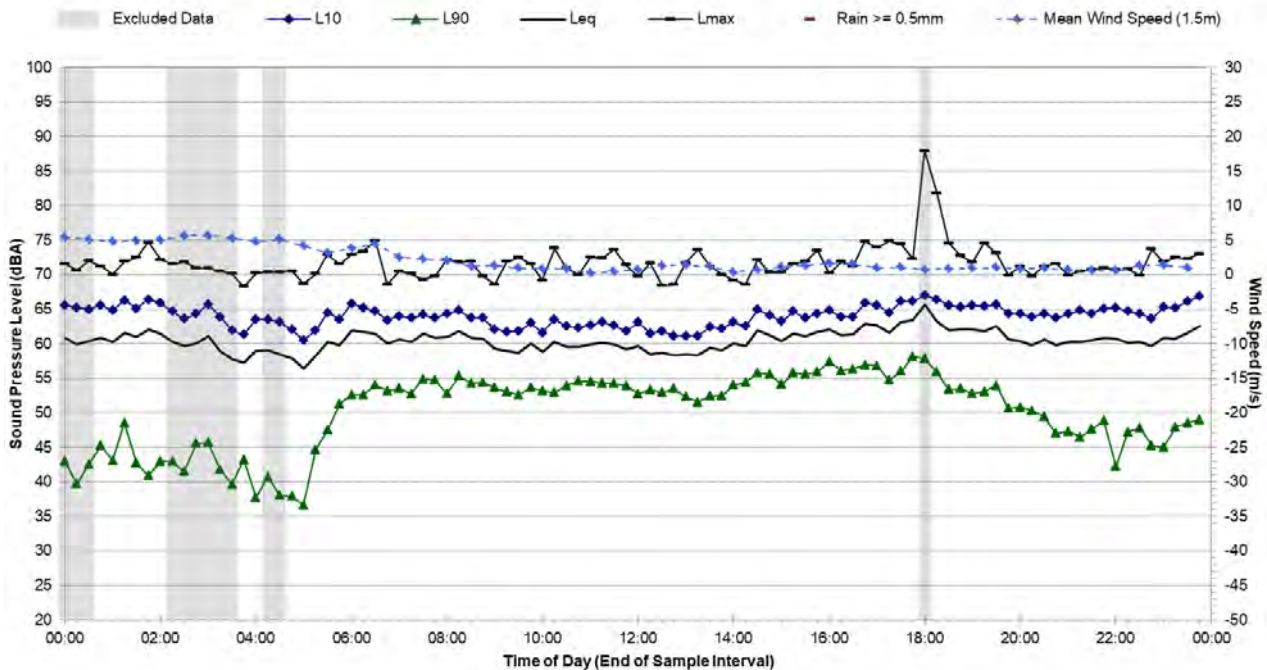
Location L3 - 9273 Pacific Highway - Monday, 29 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

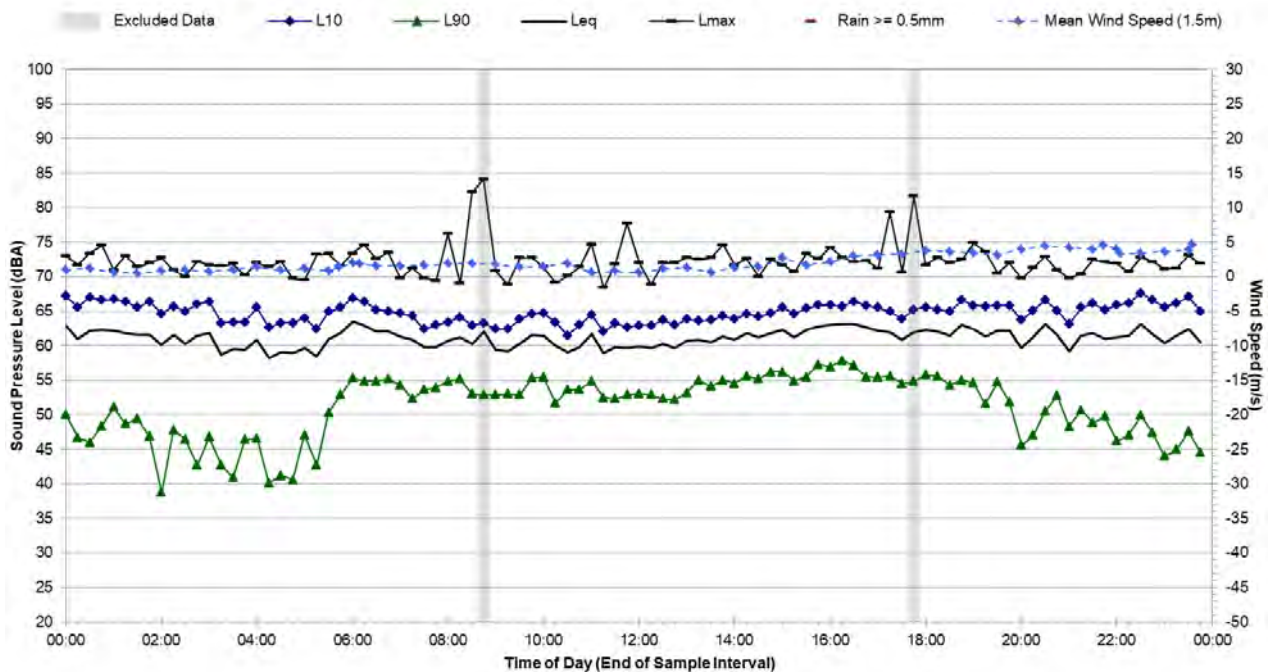
Statistical Ambient Noise Levels

Location L3 - 9273 Pacific Highway - Tuesday, 30 October 2018



Statistical Ambient Noise Levels

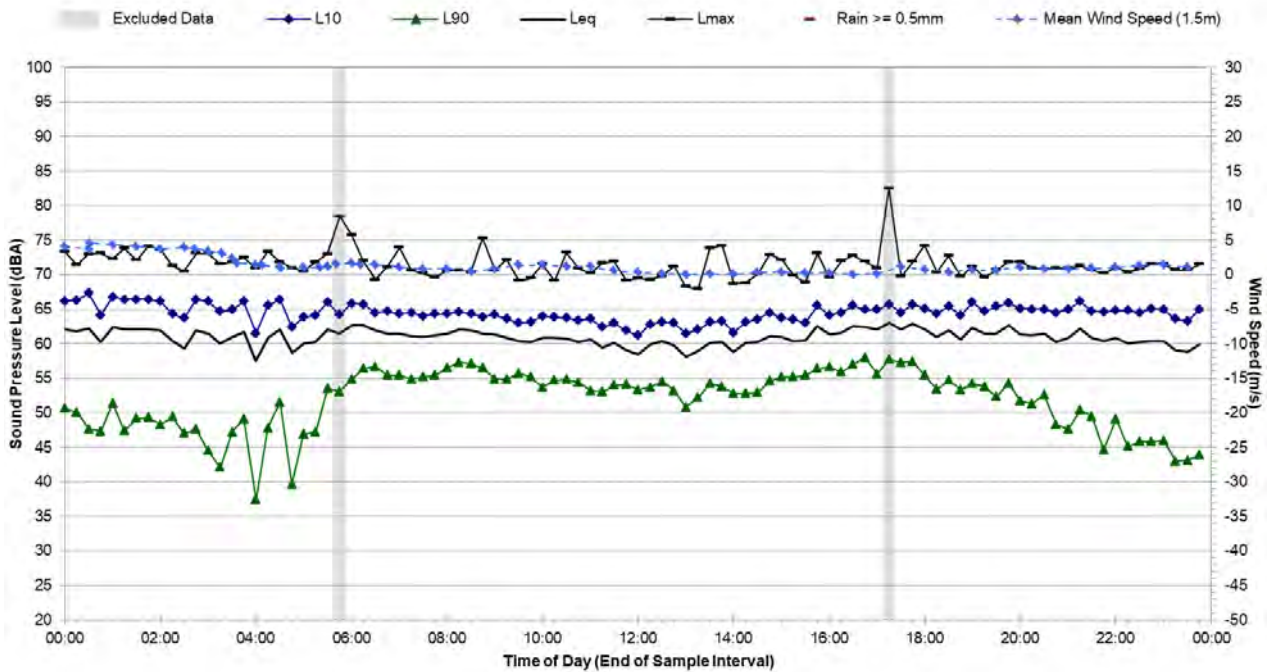
Location L3 - 9273 Pacific Highway - Wednesday, 31 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

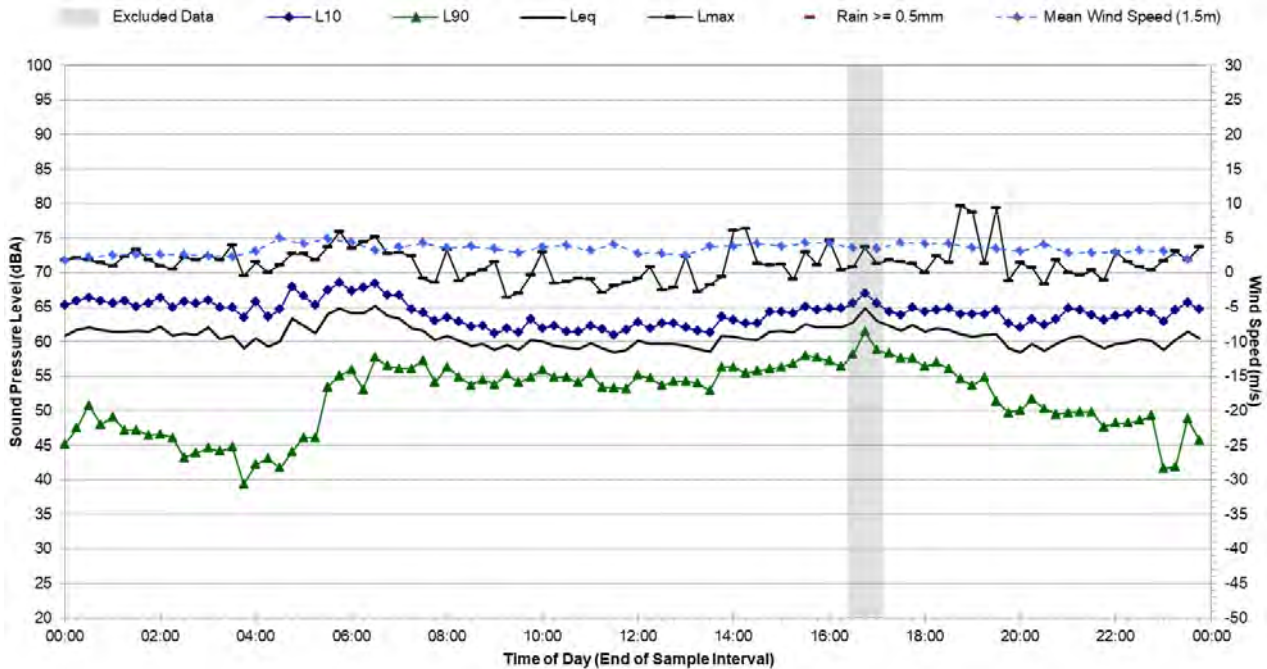
Statistical Ambient Noise Levels

Location L3 - 9273 Pacific Highway - Thursday, 1 November 2018



Statistical Ambient Noise Levels

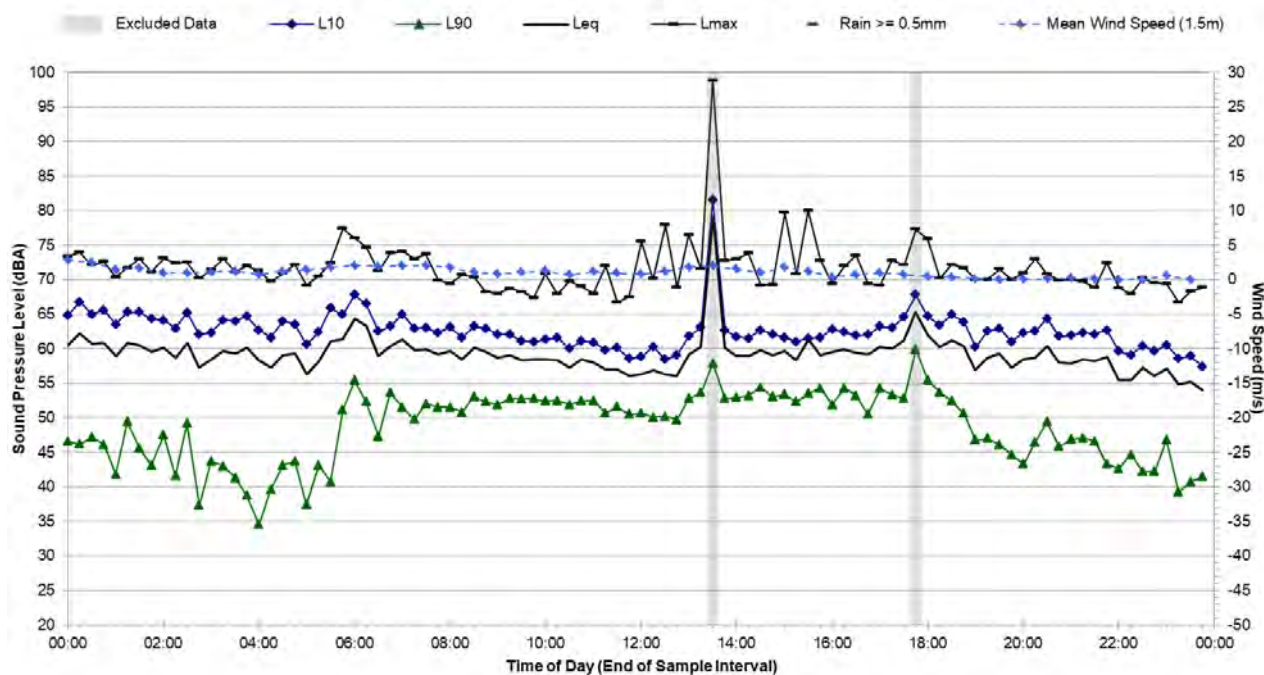
Location L3 - 9273 Pacific Highway - Friday, 2 November 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

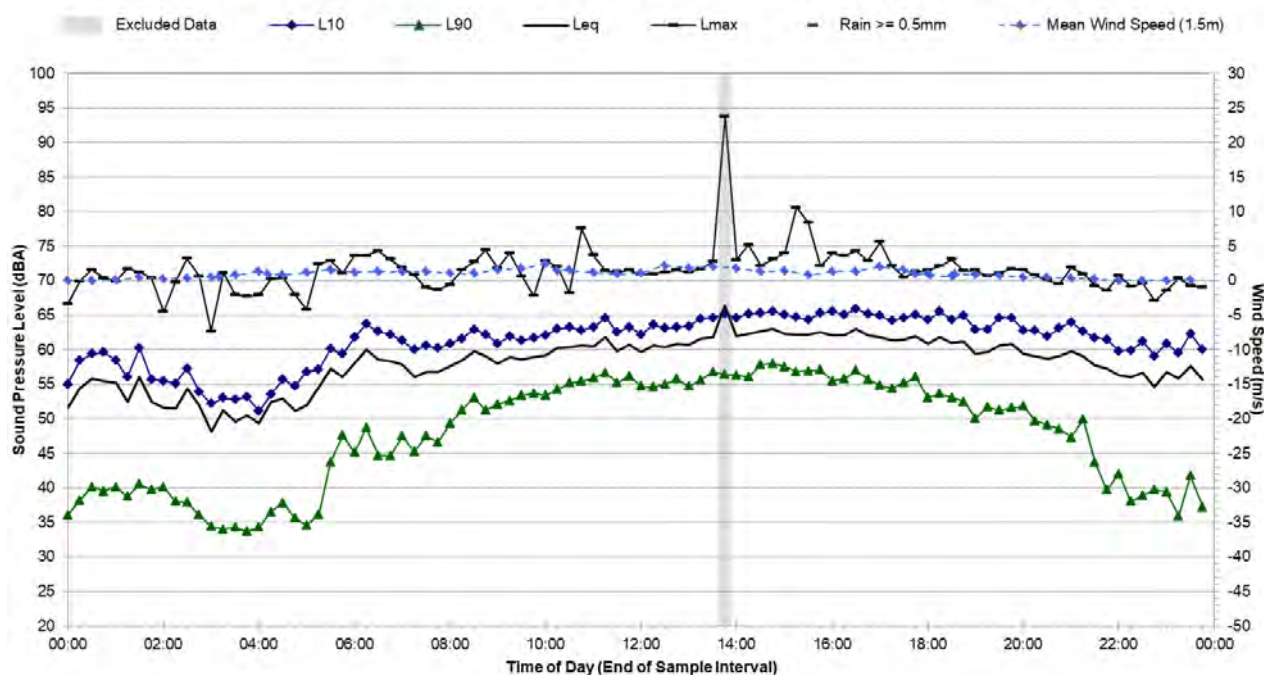
Statistical Ambient Noise Levels

Location L3 - 9273 Pacific Highway - Saturday, 3 November 2018



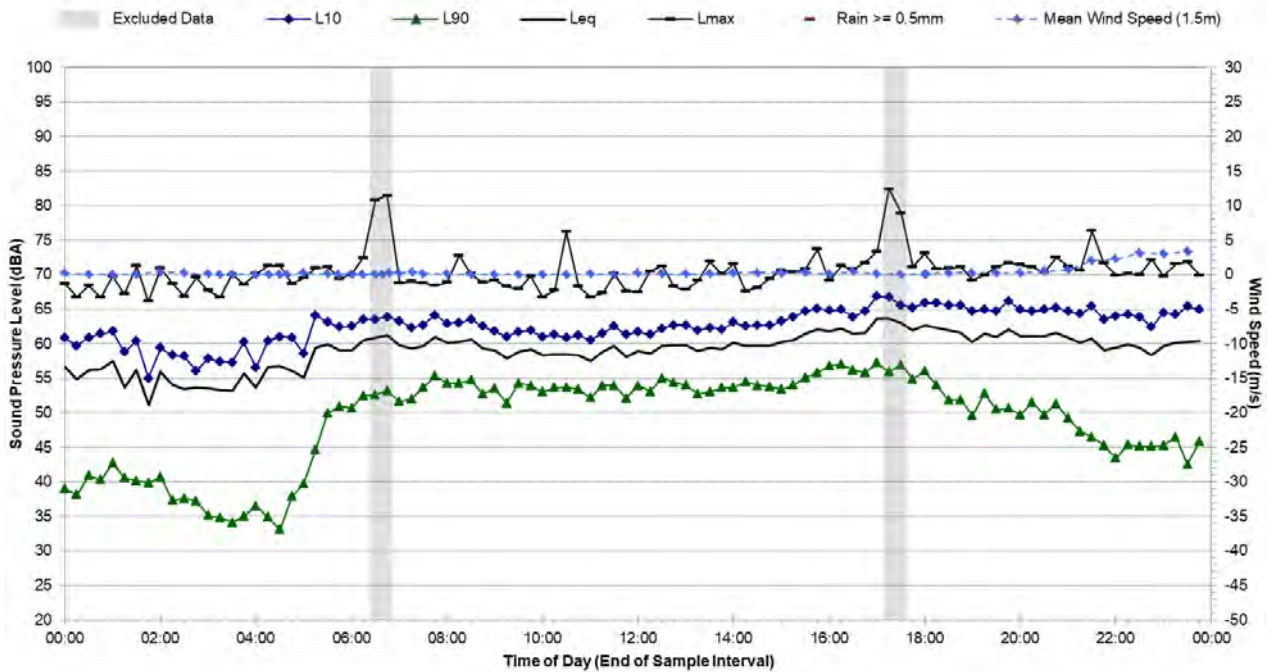
Statistical Ambient Noise Levels

Location L3 - 9273 Pacific Highway - Sunday, 4 November 2018

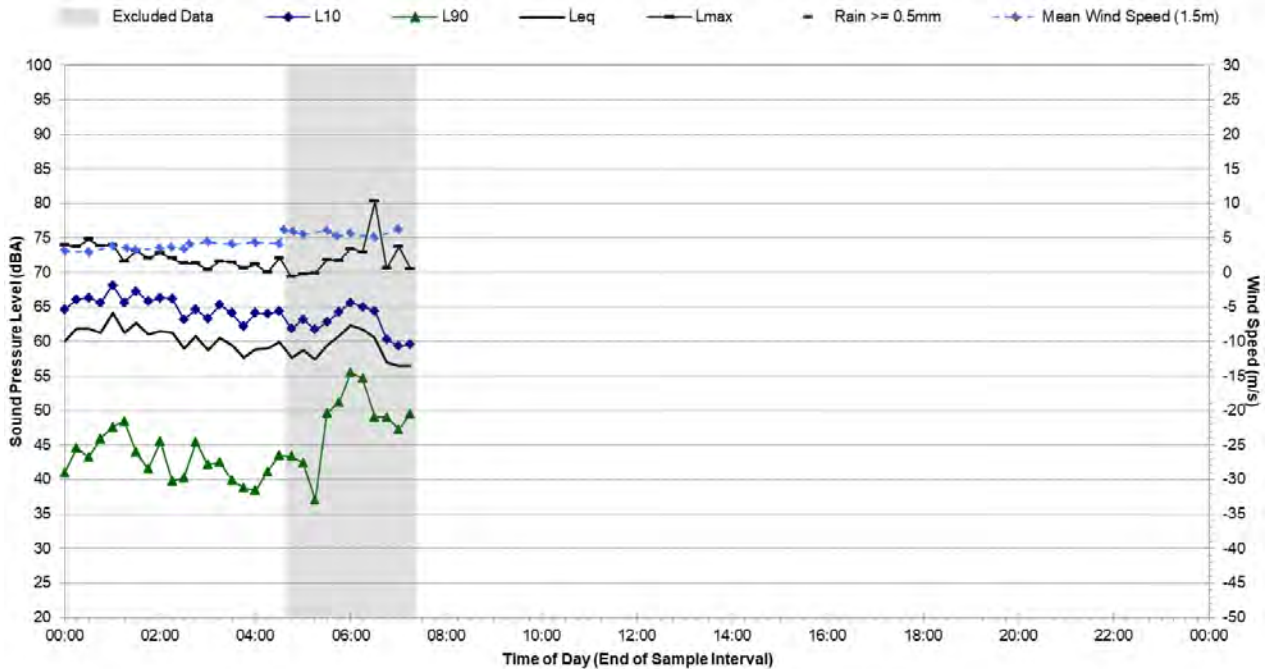


Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.



Statistical Ambient Noise Levels Location L3 - 9273 Pacific Highway - Monday, 5 November 2018



Statistical Ambient Noise Levels Location L3 - 9273 Pacific Highway - Tuesday, 6 November 2018

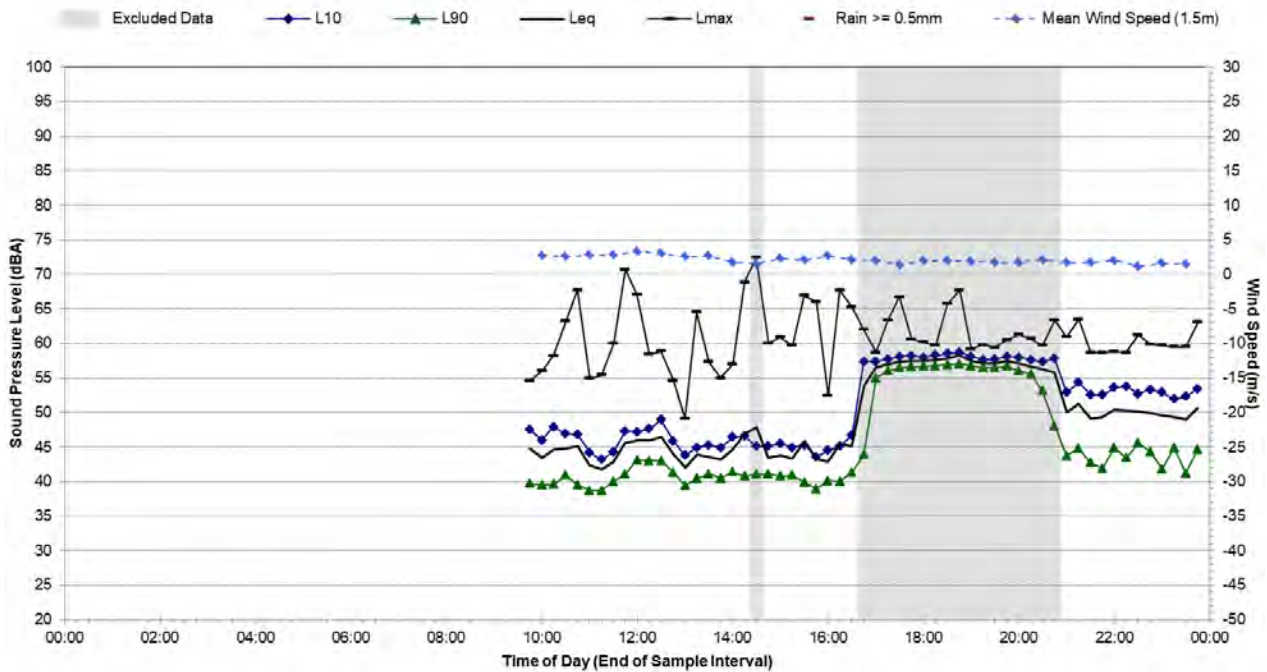


Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

Noise Monitoring Location		L.04			Map of Noise Monitoring Location				
Noise Monitoring Address		64 Haydens Wharf Road, Cooperabung							
Logger Device Type: ARL NGARA, Logger Serial: 878093 Sound Level Meter Device Type: Brüel and Kjær 2270, Sound Level Meter Serial No: 2487418									
Recorded Noise Levels (LAmax): 23/10/2018: Insects & Birds: 45-48 dBA, Wind gusts: up to 58 dBA, Light vehicle traffic: 47 dBA, Truck passbys: 48-51 dBA. 06/11/2018: Dog: 53 dBA, Trucks 55 to 60 dBA, Car wheel flutter 55 dBA, Background insects + dist traffic : 45 dBA									
Ambient Noise Logging Results – NPfI Defined Time Periods						Photo of Noise Monitoring Location			
Monitoring Period		Noise Level (dBA)							
		RBL	LAeq	L10	L1				
Daytime		38	47	47	52				
Evening		40	48	50	54				
Night-time		37	48	51	54				
Ambient Noise Logging Results – RNP Defined Time Periods									
Monitoring Period		Noise Level (dBA)							
		LAeq(period)		LAeq(1hour)					
Daytime (7am-10pm)		47		51					
Night-time (10pm-7am)		48		51					
Attended Noise Measurement Results									
Date		Start Time		Measured Noise Level (dBA)					
				LA90	LAeq	LAmax			
23/10/2018		10:12		42	46	58			
06/11/2018		00:56		43	49	60			

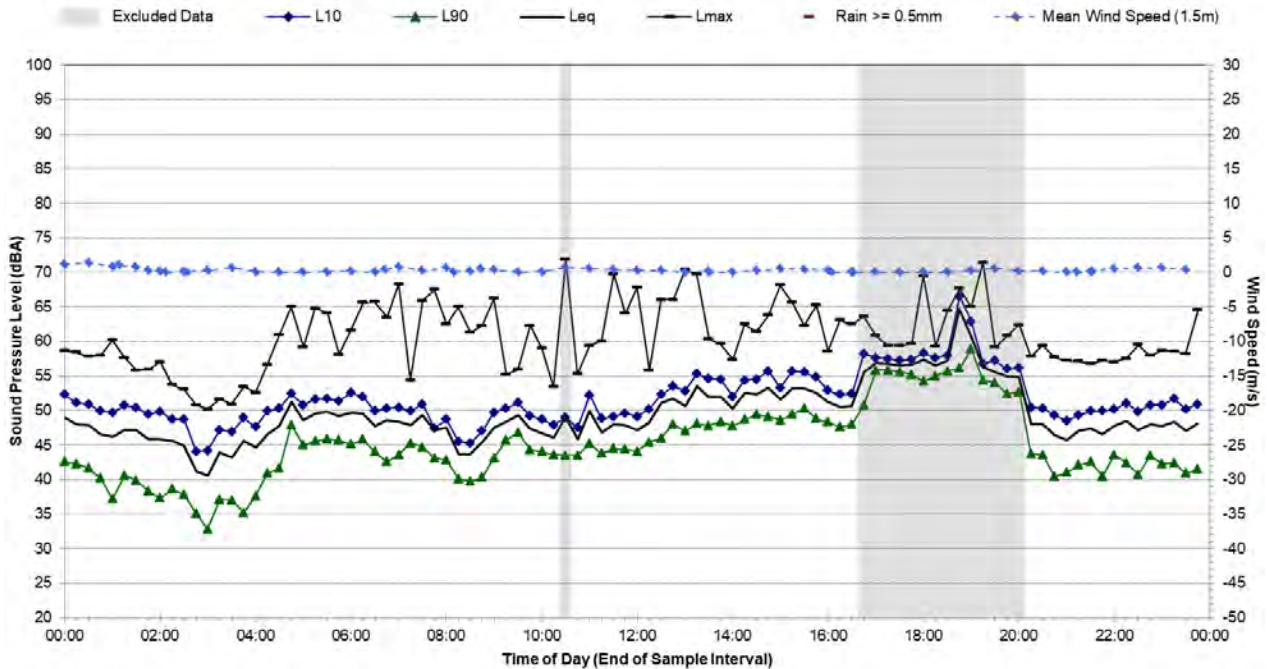
Statistical Ambient Noise Levels

L04 - 64 Haydens Wharf Road, Cooperabung - Tuesday, 23 October 2018



Statistical Ambient Noise Levels

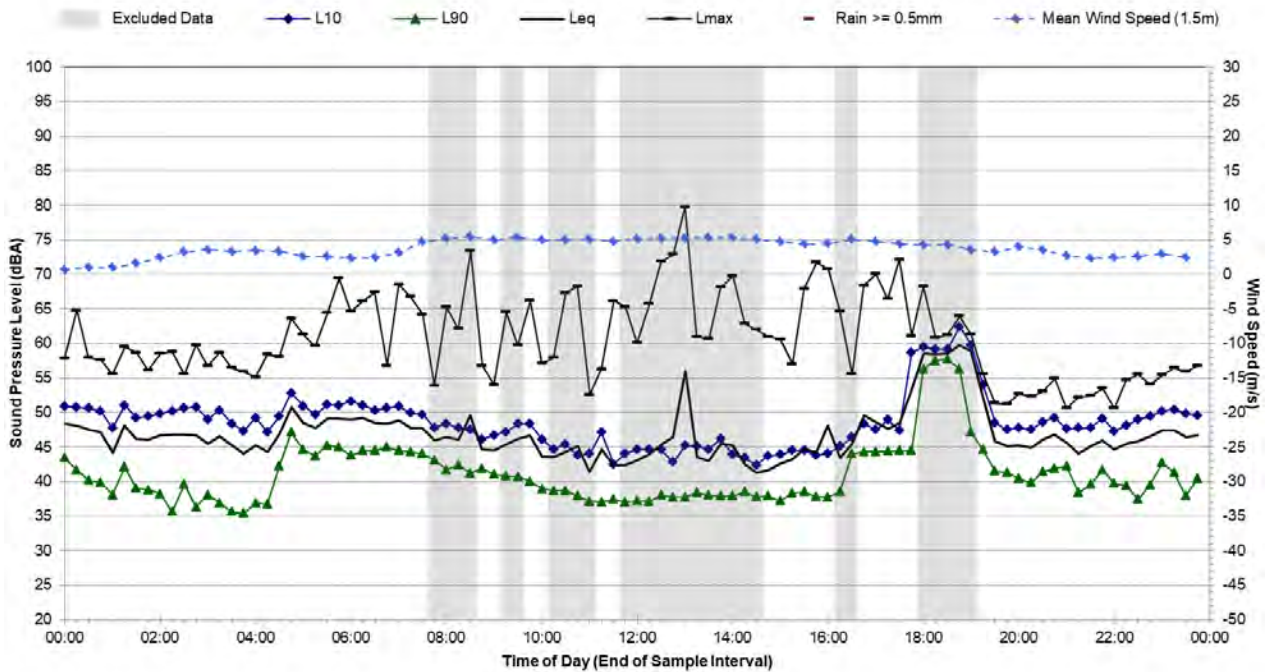
L04 - 64 Haydens Wharf Road, Cooperabung - Wednesday, 24 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

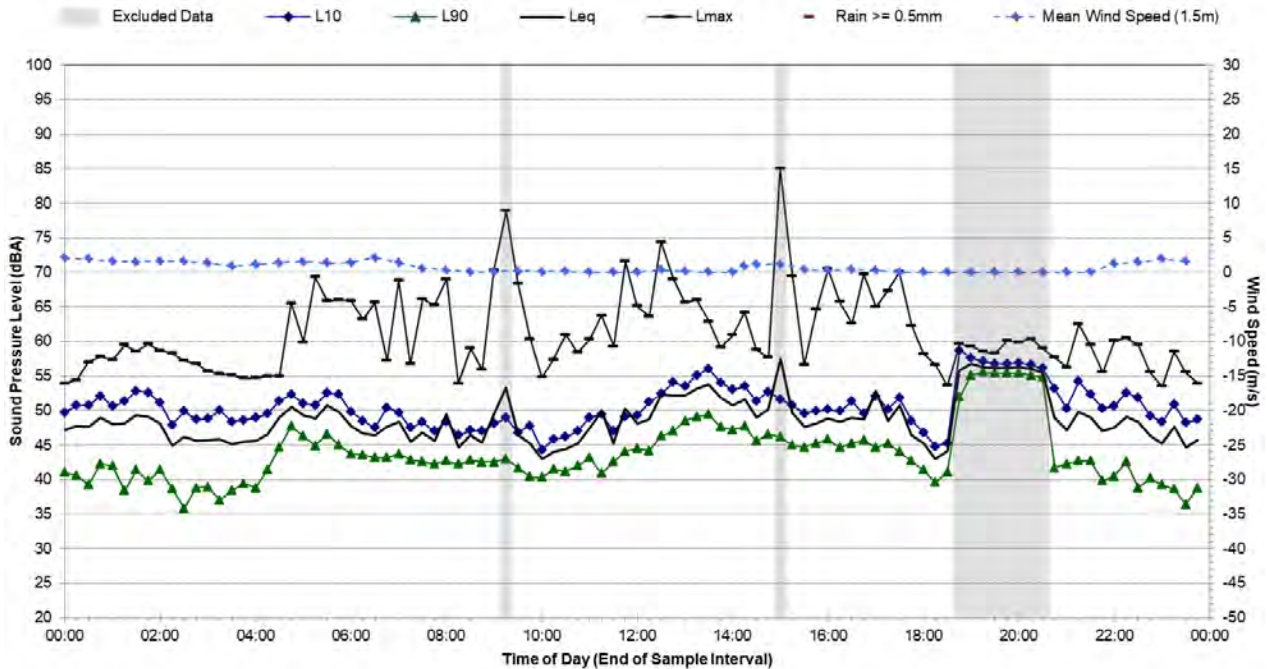
Statistical Ambient Noise Levels

L04 - 64 Haydens Wharf Road, Cooperabung - Thursday, 25 October 2018



Statistical Ambient Noise Levels

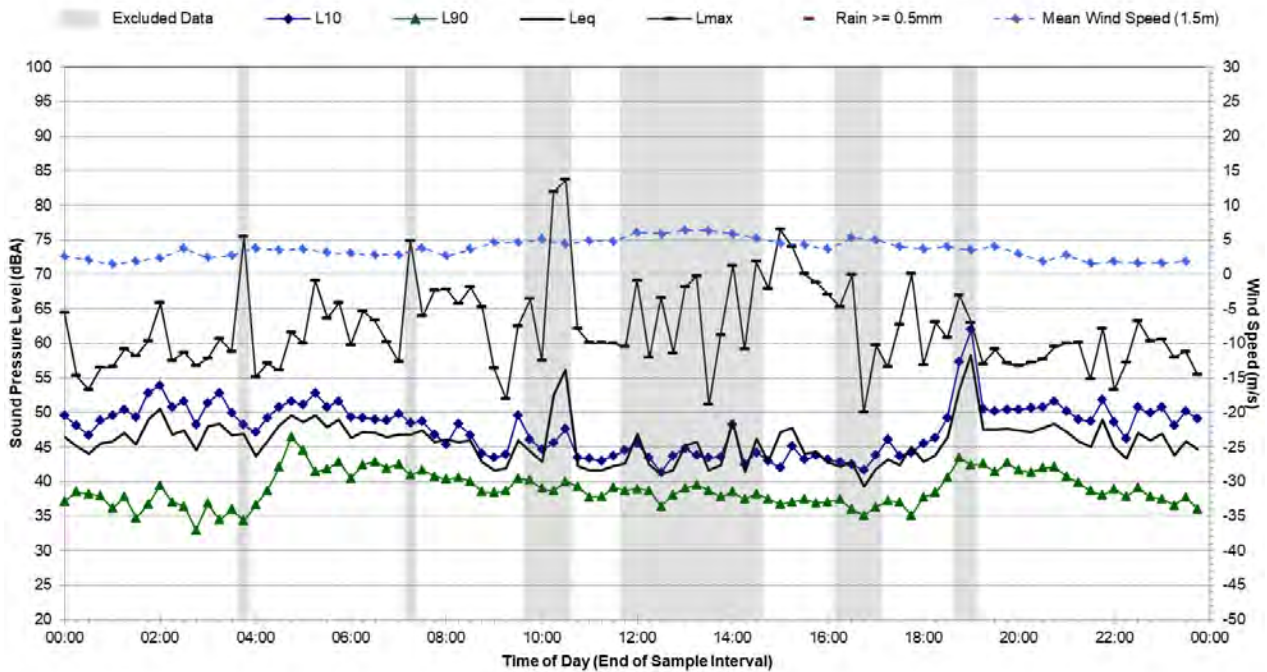
L04 - 64 Haydens Wharf Road, Cooperabung - Friday, 26 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

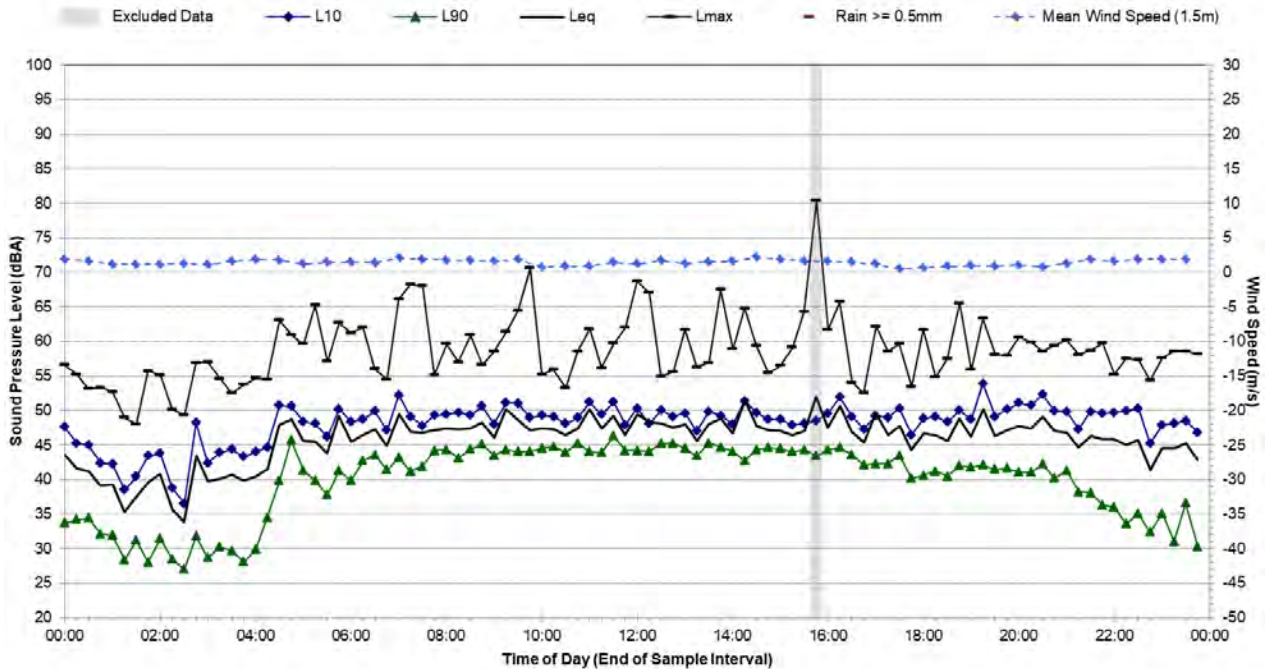
Statistical Ambient Noise Levels

L04 - 64 Haydens Wharf Road, Cooperabung - Saturday, 27 October 2018



Statistical Ambient Noise Levels

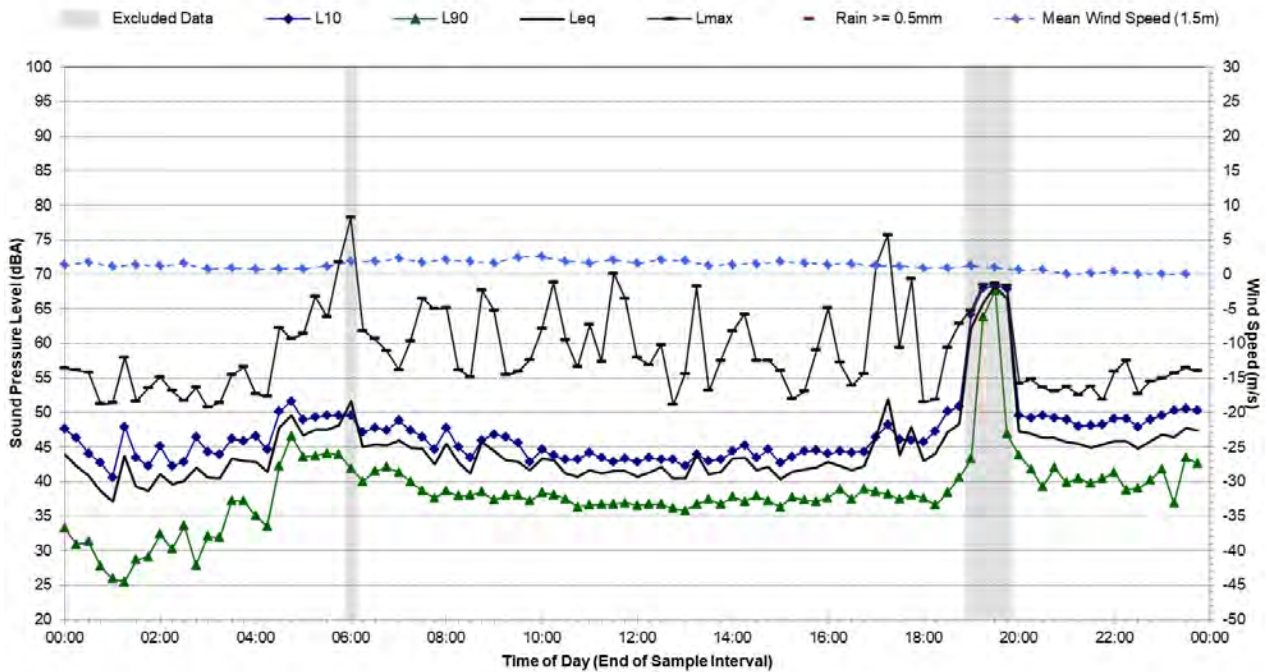
L04 - 64 Haydens Wharf Road, Cooperabung - Sunday, 28 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

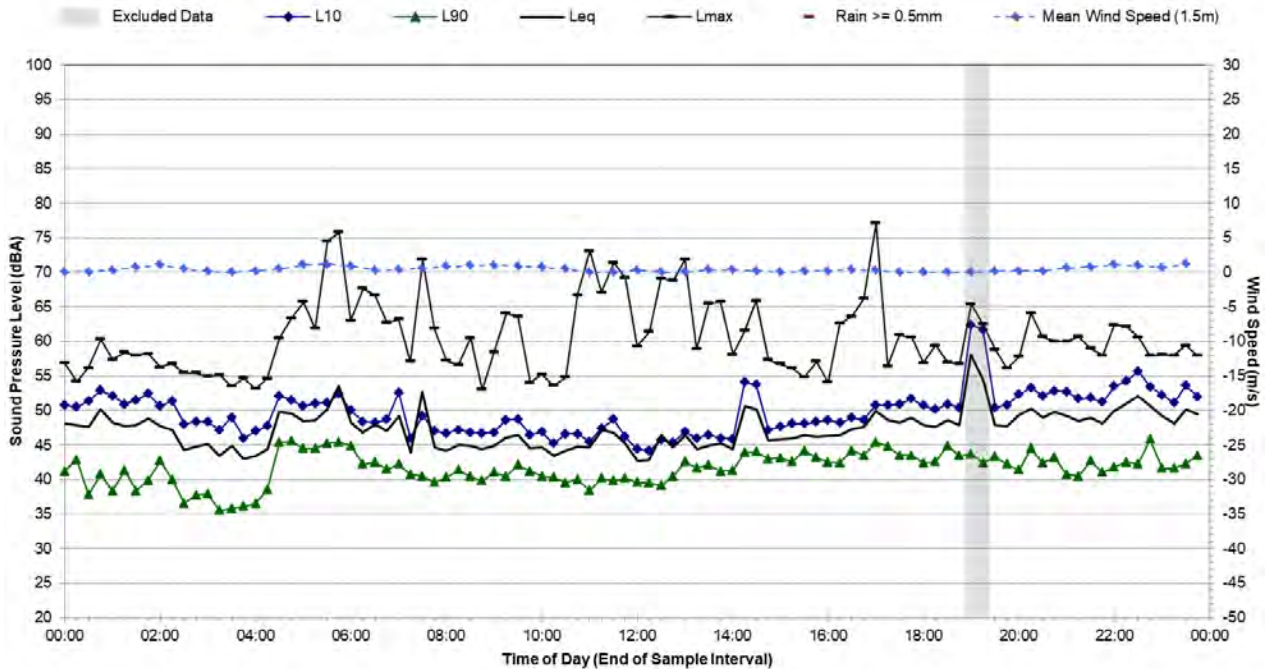
Statistical Ambient Noise Levels

L04 - 64 Haydens Wharf Road, Cooperabung - Monday, 29 October 2018



Statistical Ambient Noise Levels

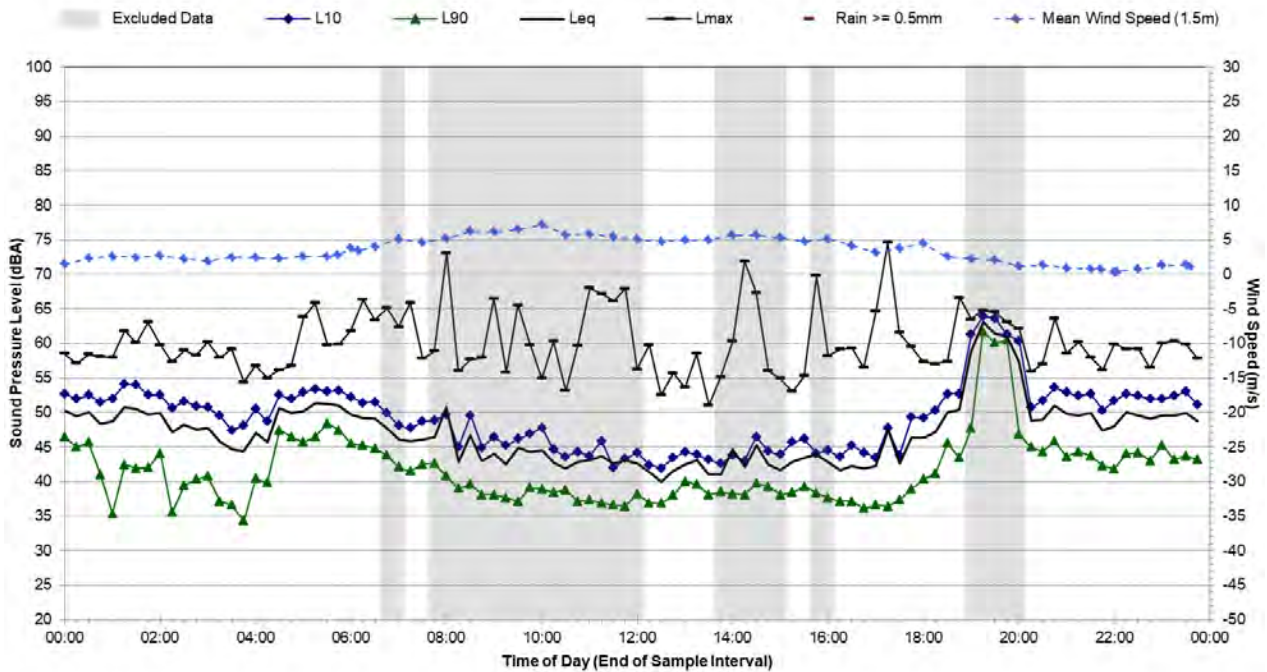
L04 - 64 Haydens Wharf Road, Cooperabung - Tuesday, 30 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

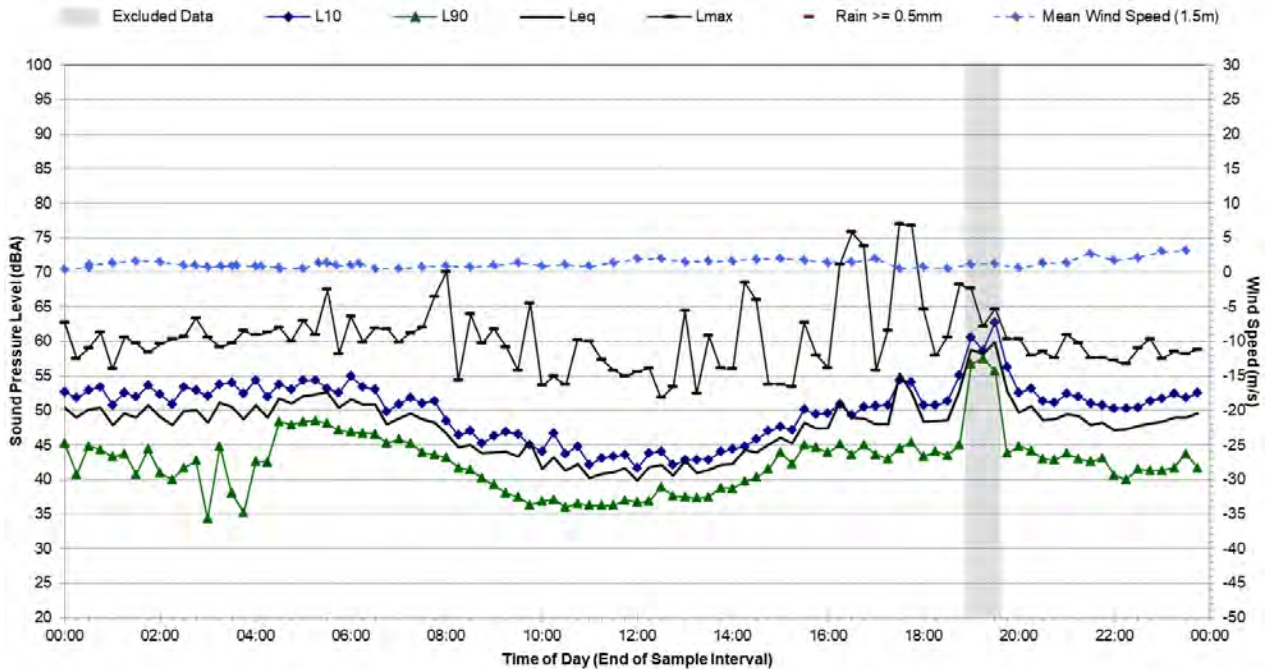
Statistical Ambient Noise Levels

L04 - 64 Haydens Wharf Road, Cooperabung - Wednesday, 31 October 2018



Statistical Ambient Noise Levels

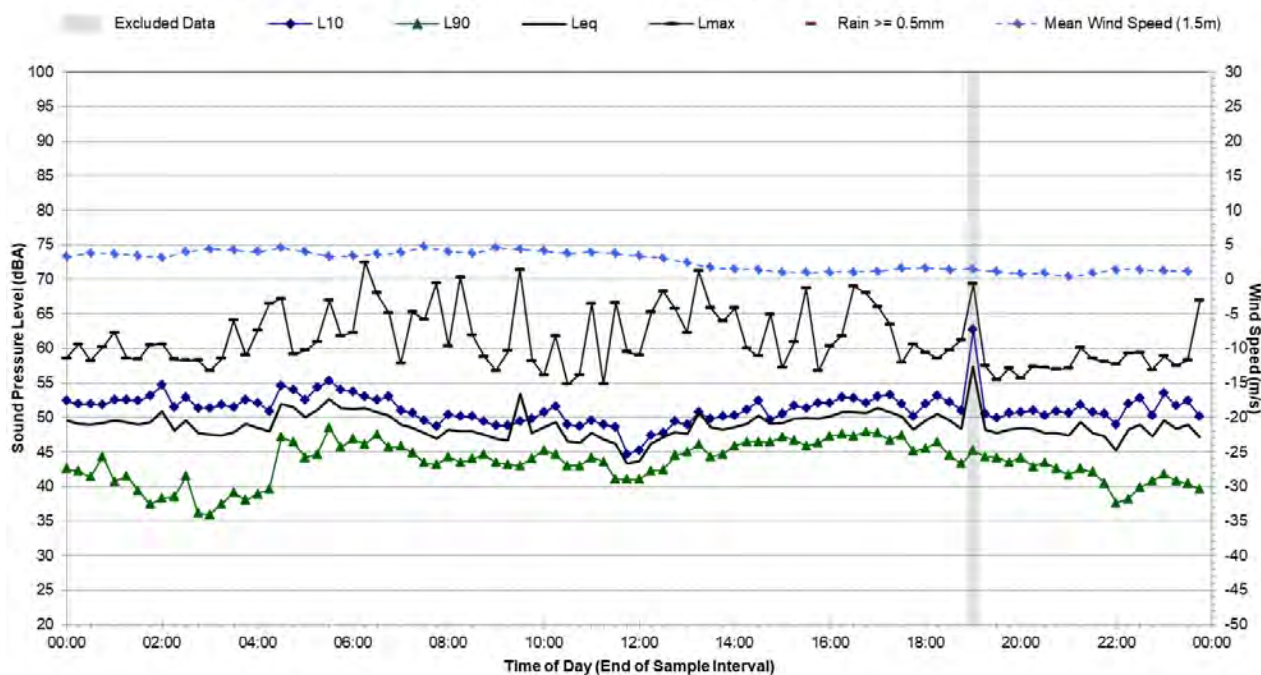
L04 - 64 Haydens Wharf Road, Cooperabung - Thursday, 1 November 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

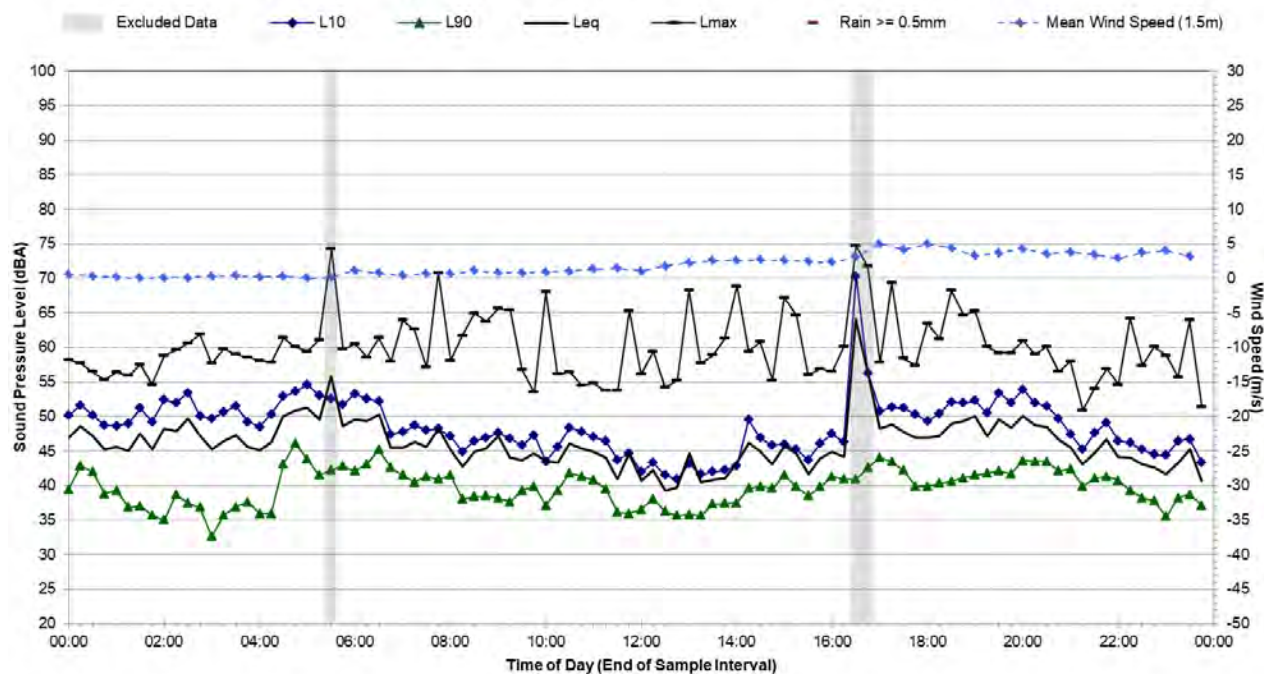
Statistical Ambient Noise Levels

L04 - 64 Haydens Wharf Road, Cooperabung - Friday, 2 November 2018



Statistical Ambient Noise Levels

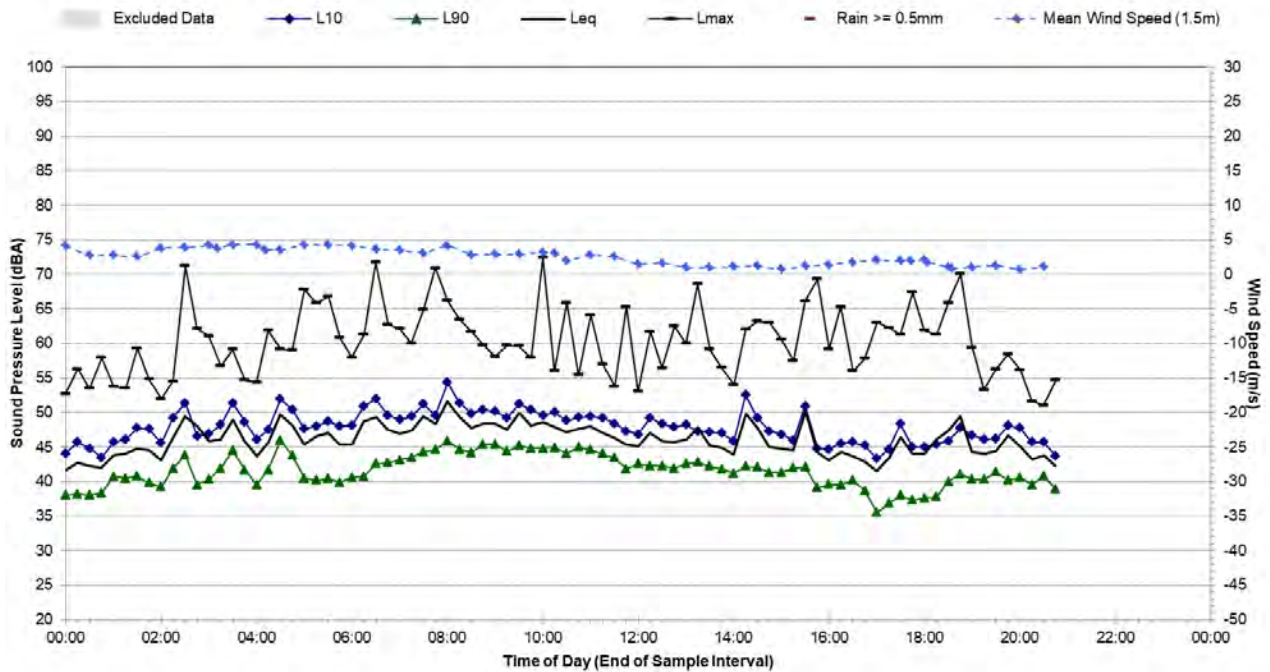
L04 - 64 Haydens Wharf Road, Cooperabung - Saturday, 3 November 2018





Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

Statistical Ambient Noise Levels

L04 - 64 Haydens Wharf Road, Cooperabung - Sunday, 4 November 2018

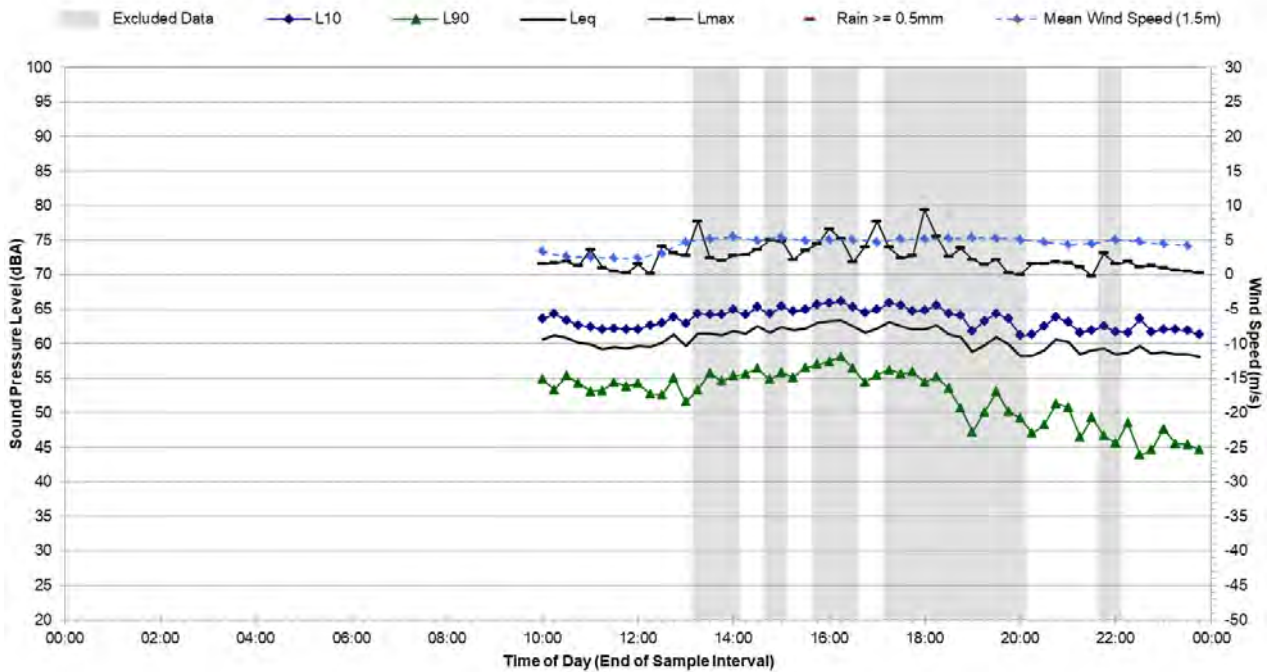


Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

Noise Monitoring Location		L.05				Map of Noise Monitoring Location	
Noise Monitoring Address		Address: 8 Haydens Wharf Road, Cooperabung					
Logger Device Type: ARL NGARA, Logger Serial: 87809E Sound Level Meter Device Type: Brüel and Kjær 2270, Sound Level Meter Serial No: 2487418							
Recorded Noise Levels (LAmax): 23/10/2018: Constant vehicle traffic: 59-60 dBA, Truck passbys: 63-70 dBA, Birds: 54-56 dBA. 06/11/2018: Light vehicle traffic: 63 dBA, Truck passbys: 63-69 dBA.							
Ambient Noise Logging Results – NPfI Defined Time Periods						Photo of Noise Monitoring Location	
Monitoring Period		Noise Level (dBA)					
		RBL	LAeq	L10	L1		
Daytime		50	60	62	66		
Evening		45	59	62	67		
Night-time		39	57	61	67		
Ambient Noise Logging Results – RNP Defined Time Periods							
Monitoring Period		Noise Level (dBA)					
		LAeq(period)		LAeq(1hour)			
Daytime (7am-10pm)		59		62			
Night-time (10pm-7am)		57		60			
Attended Noise Measurement Results							
Date	Start Time	Measured Noise Level (dBA)					
		LA90	LAeq	LAmax			
23/10/2018	09:20	54	60	70			
06/11/2018	01:32	43	58	75			

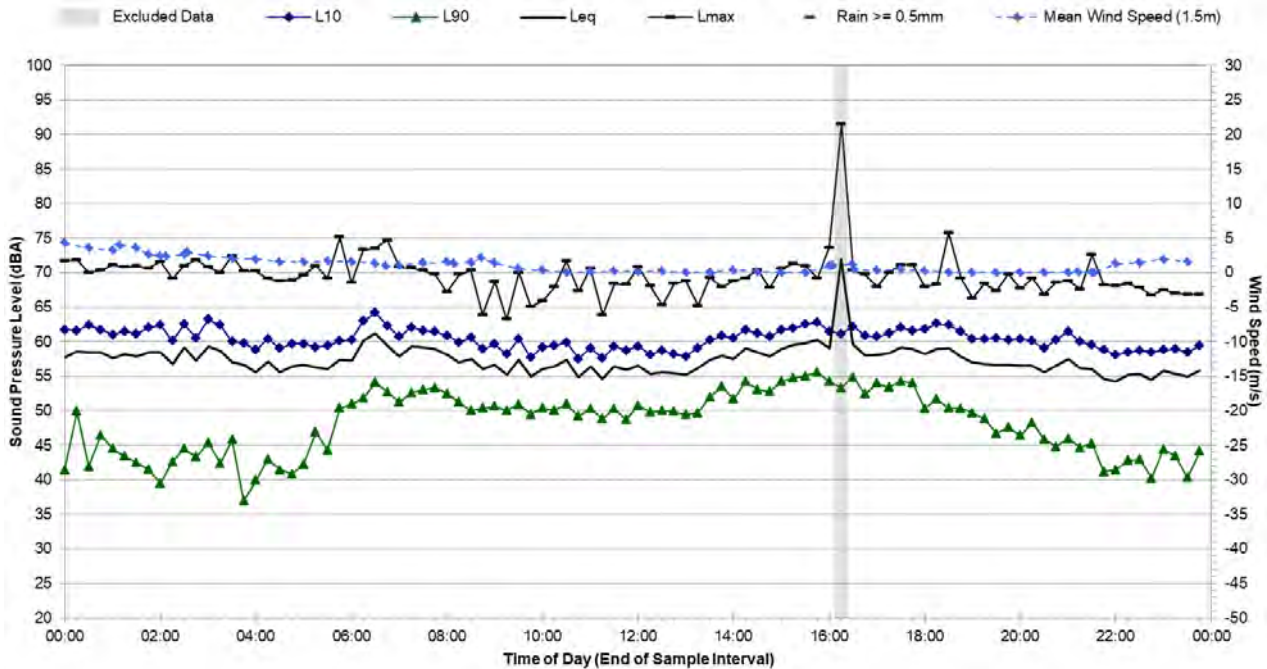
Statistical Ambient Noise Levels

Location L5 - 8 Haydens Wharf Road, Cooperabung - Tuesday, 23 October 2018



Statistical Ambient Noise Levels

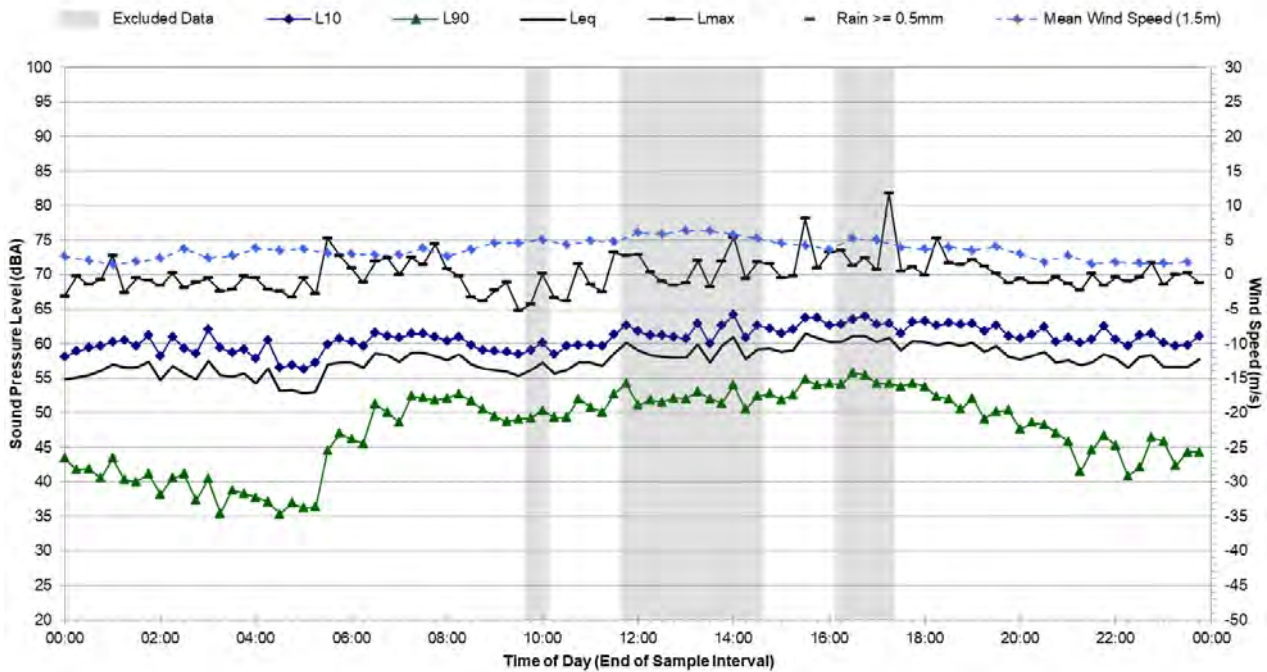
Location L5 - 8 Haydens Wharf Road, Cooperabung - Wednesday, 24 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

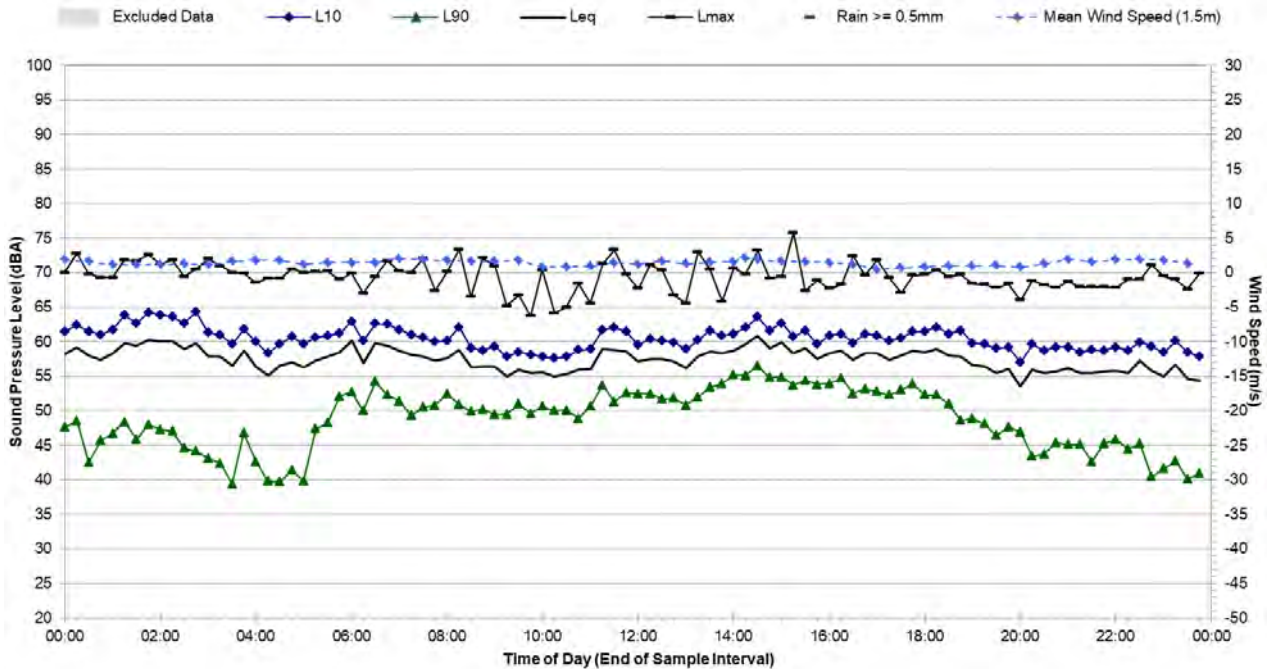
Statistical Ambient Noise Levels

Location L5 - 8 Haydens Wharf Road, Cooperabung - Thursday, 25 October 2018



Statistical Ambient Noise Levels

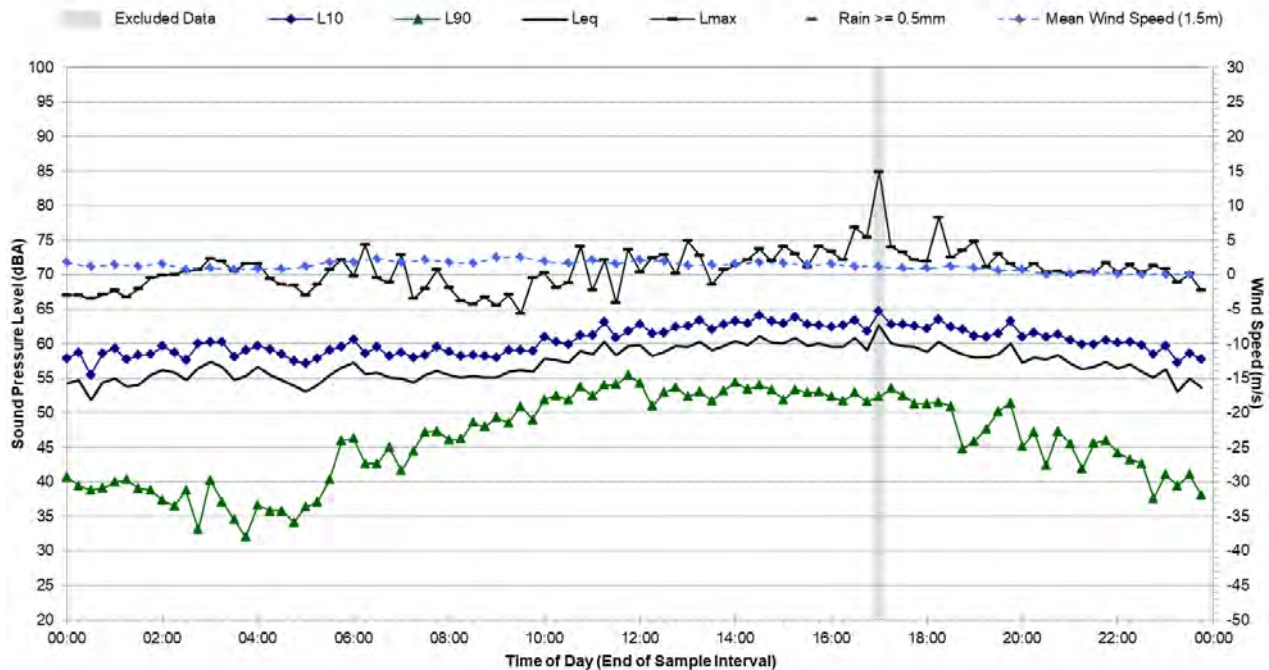
Location L5 - 8 Haydens Wharf Road, Cooperabung - Friday, 26 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

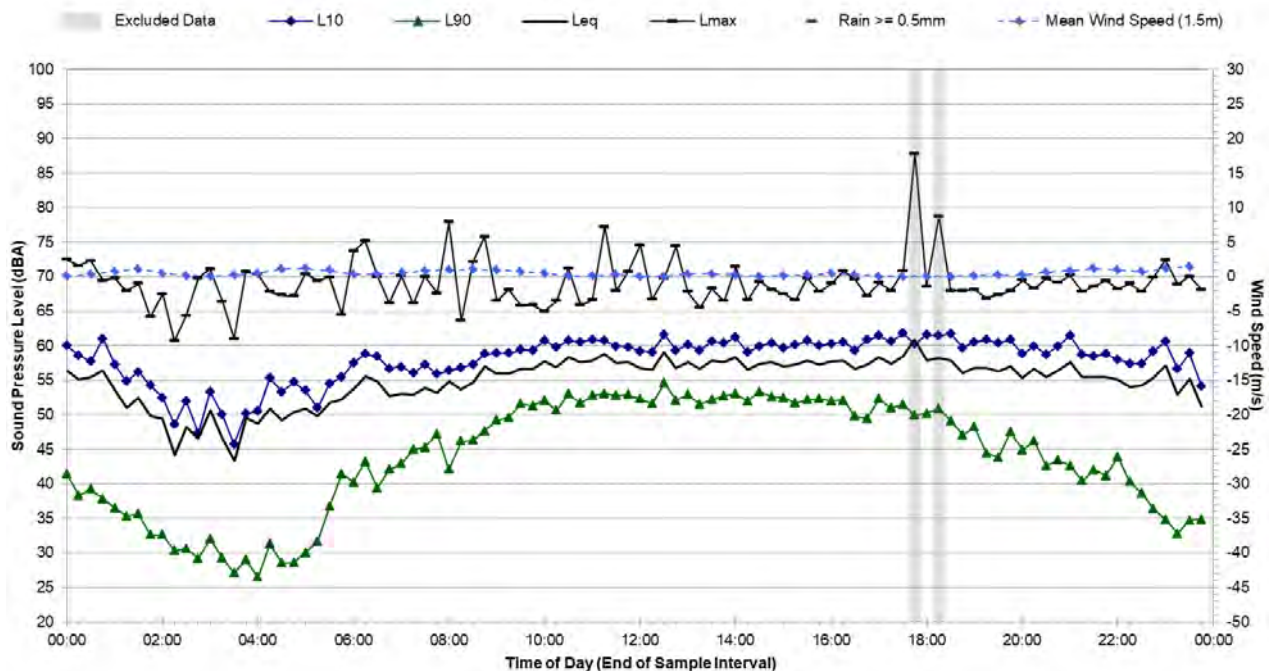
Statistical Ambient Noise Levels

Location L5 - 8 Haydens Wharf Road, Cooperabung - Saturday, 27 October 2018



Statistical Ambient Noise Levels

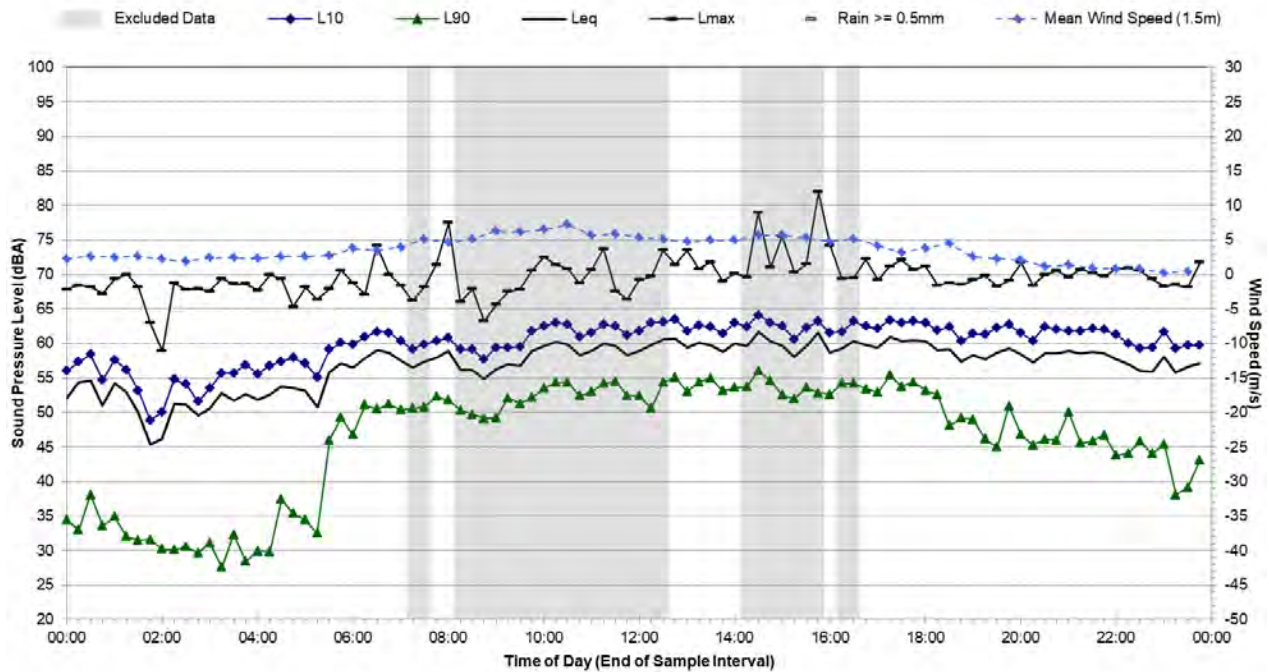
Location L5 - 8 Haydens Wharf Road, Cooperabung - Sunday, 28 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

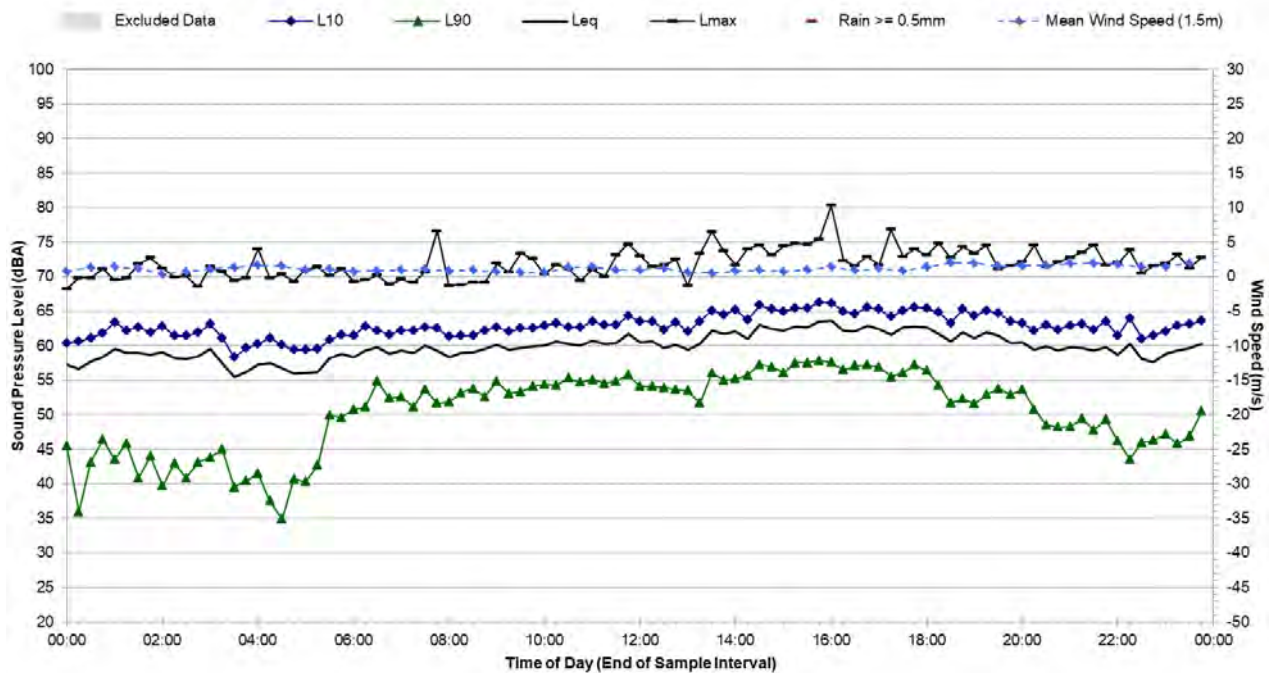
Statistical Ambient Noise Levels

Location L5 - 8 Haydens Wharf Road, Cooperabung - Monday, 29 October 2018



Statistical Ambient Noise Levels

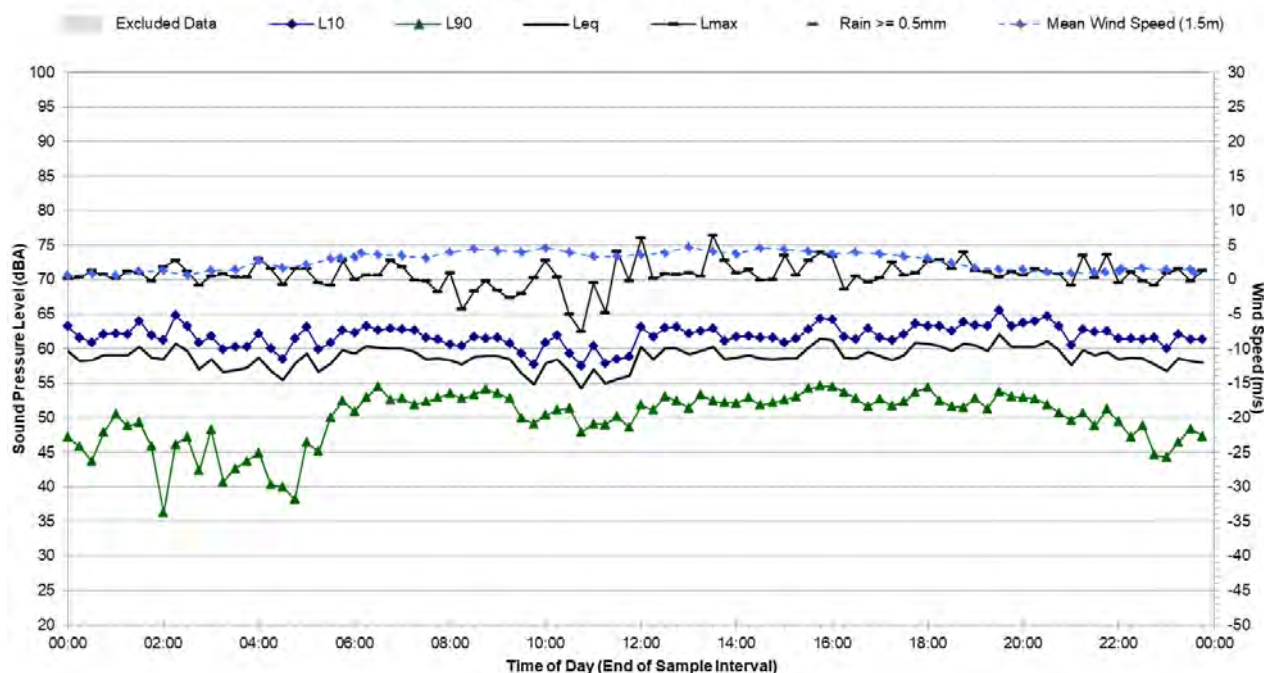
Location L5 - 8 Haydens Wharf Road, Cooperabung - Tuesday, 30 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

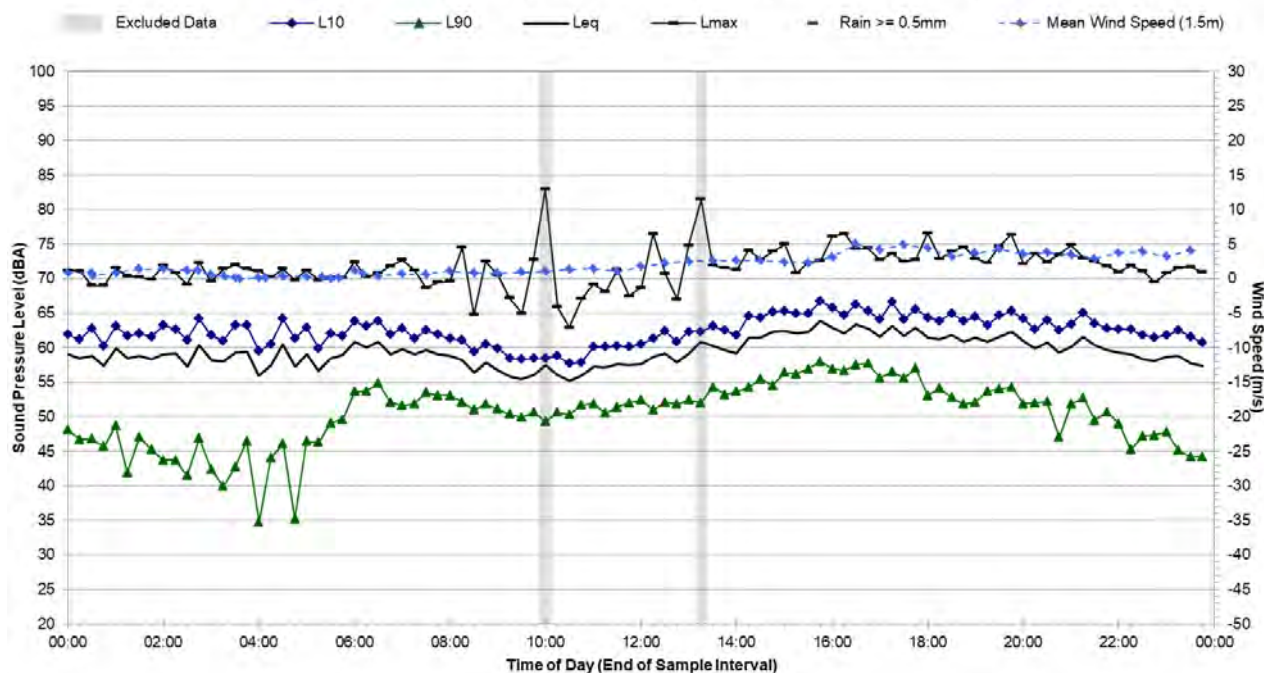
Statistical Ambient Noise Levels

Location L5 - 8 Haydens Wharf Road, Cooperabung - Wednesday, 31 October 2018



Statistical Ambient Noise Levels

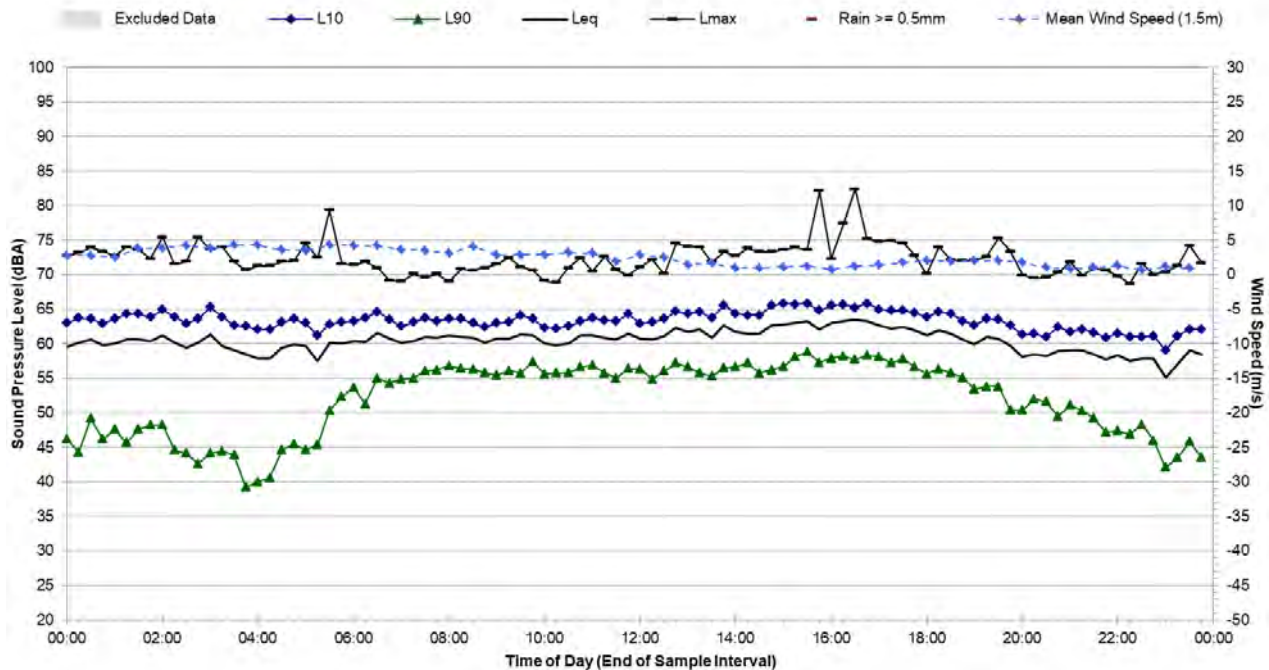
Location L5 - 8 Haydens Wharf Road, Cooperabung - Thursday, 1 November 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

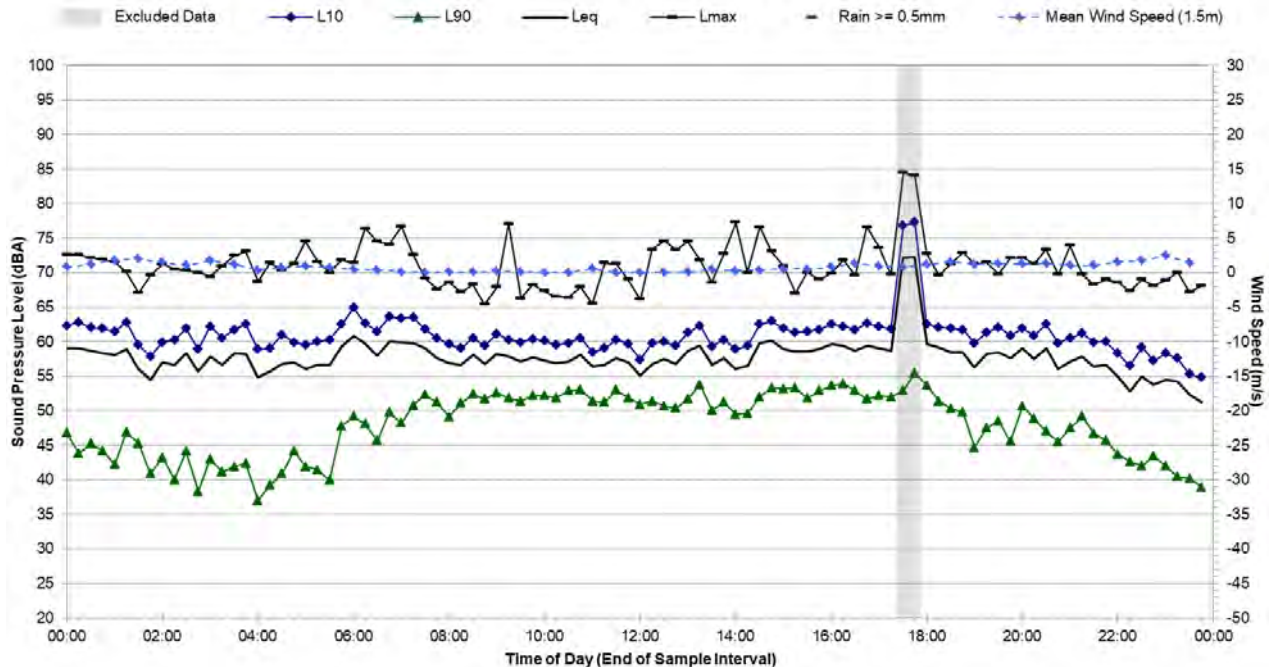
Statistical Ambient Noise Levels

Location L5 - 8 Haydens Wharf Road, Cooperabung - Friday, 2 November 2018



Statistical Ambient Noise Levels

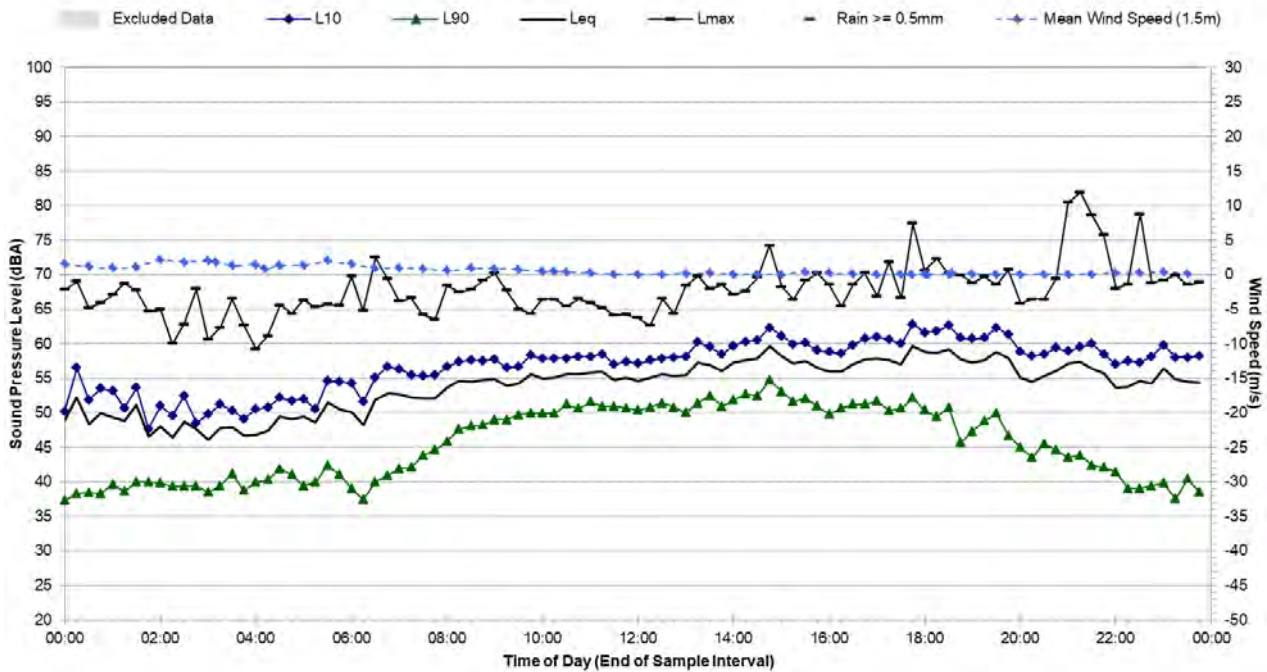
Location L5 - 8 Haydens Wharf Road, Cooperabung - Saturday, 3 November 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

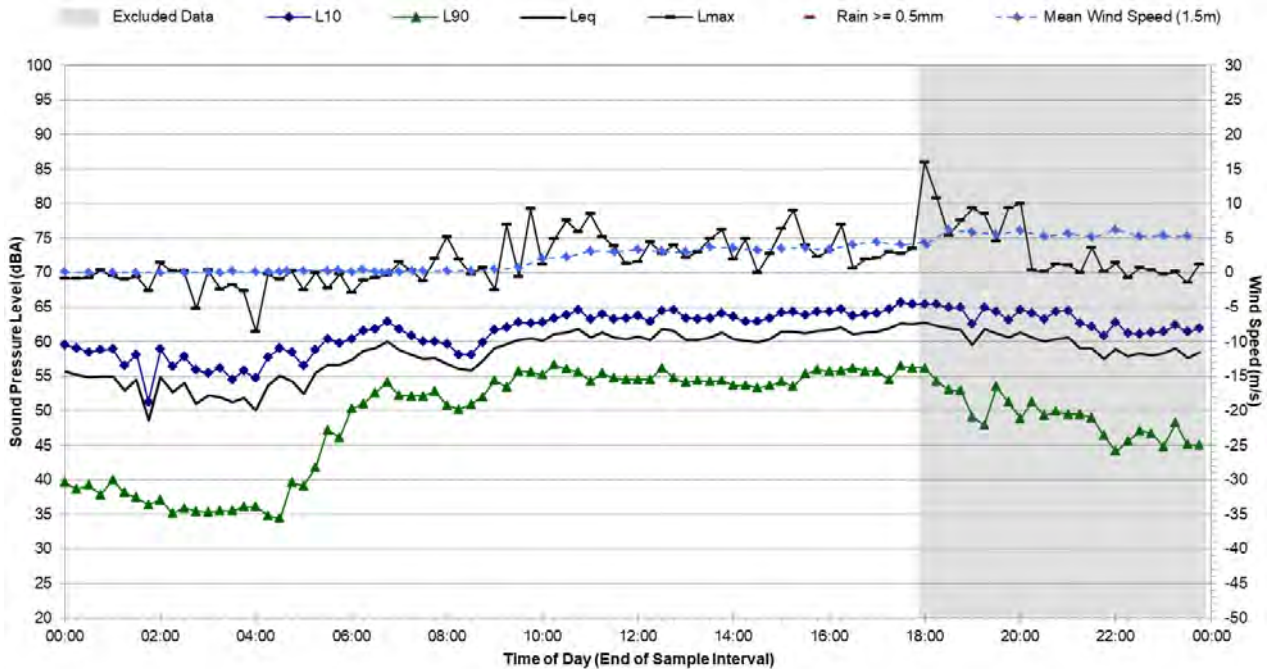
Statistical Ambient Noise Levels

Location L5 - 8 Haydens Wharf Road, Cooperabung - Sunday, 4 November 2018



Statistical Ambient Noise Levels

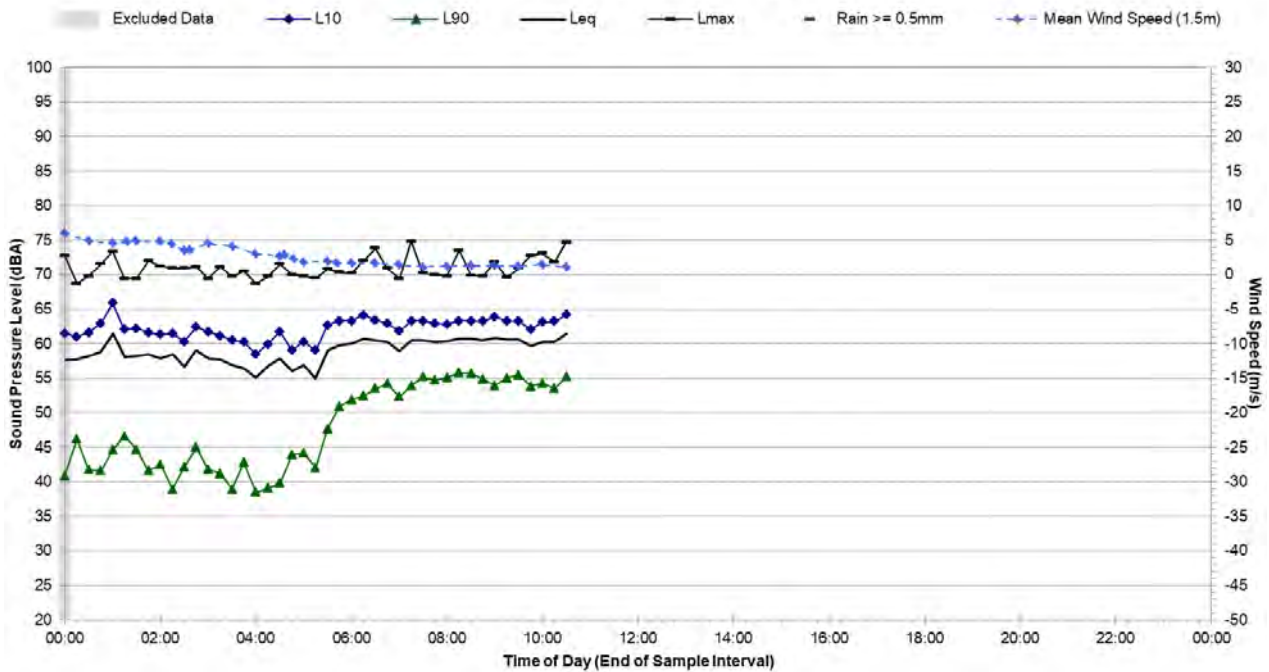
Location L5 - 8 Haydens Wharf Road, Cooperabung - Monday, 5 November 2018



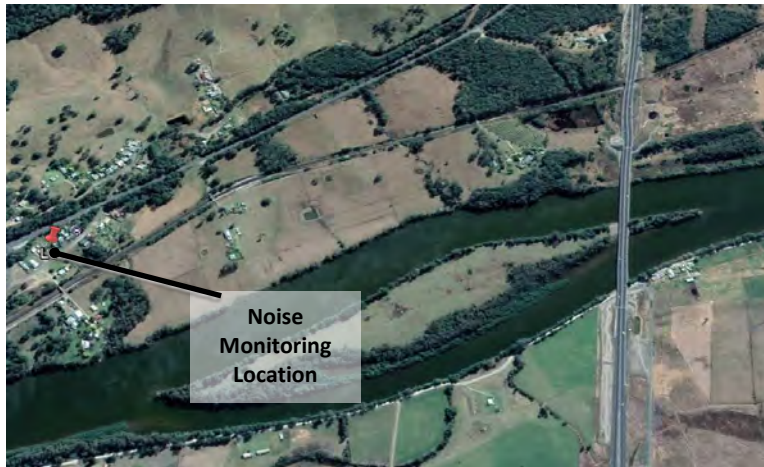

Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

Statistical Ambient Noise Levels

Location L5 - 8 Haydens Wharf Road, Cooperabung - Tuesday, 6 November 2018

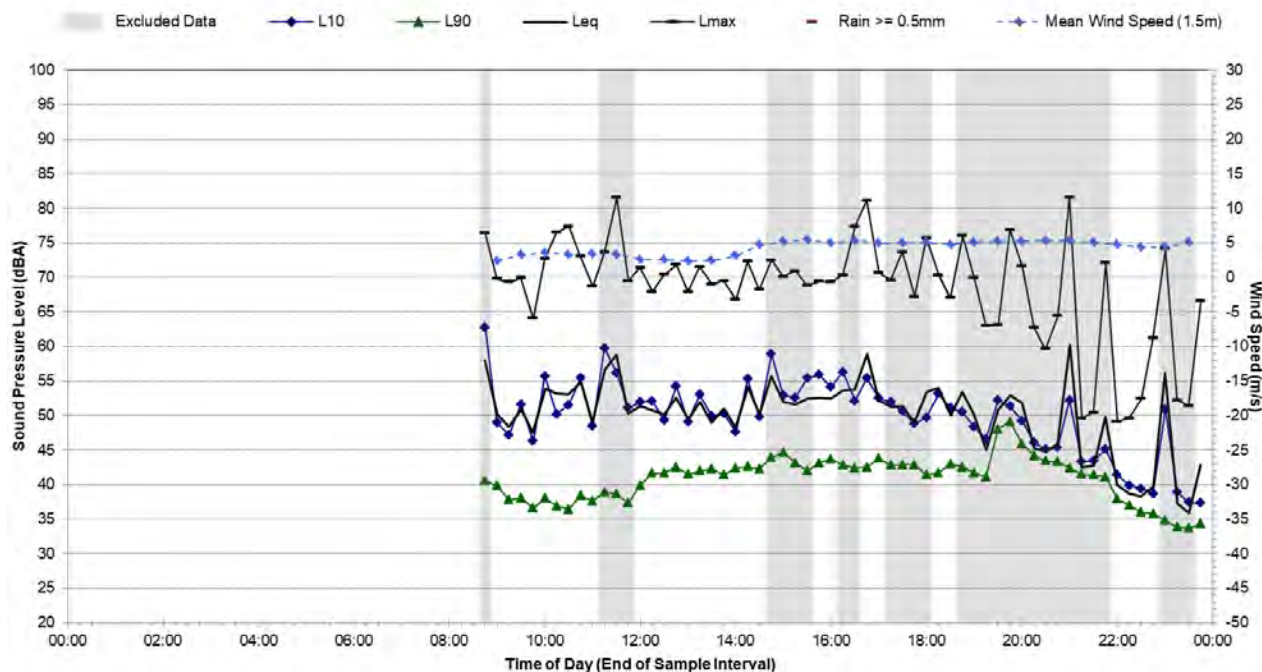


Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

Noise Monitoring Location	L.06				Map of Noise Monitoring Location
Noise Monitoring Address	Address: 13 Cooperabung Drive, Telegraph Point				
Logger Device Type: ARL NGARA, Logger Serial: 878005F Sound Level Meter Device Type: Brüel and Kjær 2270, Sound Level Meter Serial No: 2414604 and 2487418					
Recorded Noise Levels (LAmax): 23/10/2018: Local traffic: 50-54 dBA, Freeway Trucks : 45-51 dBA, Birds: 43-52 dBA, Motorbike 78 dBA. 06/11/2018: Freeway traffic: 45-47 dBA, Nearby car leaving: 51-62 dBA, Birds: 43-56 dBA, Dog barking: 62-69 dBA, Background: 40-41 dBA.					
Ambient Noise Logging Results – NPfI Defined Time Periods					Photo of Noise Monitoring Location
Monitoring Period	Noise Level (dBA)				
	RBL	LAeq	L10	L1	
Daytime	38	52	51	63	
Evening	38	49	48	55	
Night-time	31	45	41	47	
Ambient Noise Logging Results – RNP Defined Time Periods					
Monitoring Period	Noise Level (dBA)				
	LAeq(period)		LAeq(1hour)		
Daytime (7am-10pm)	51		54		
Night-time (10pm-7am)	45		52		
Attended Noise Measurement Results					
Date	Start Time	Measured Noise Level (dBA)			
		LA90	LAeq	LAmax	
23/10/2018	08:10	39	54	78	
06/11/2018	05:43	41	50	72	

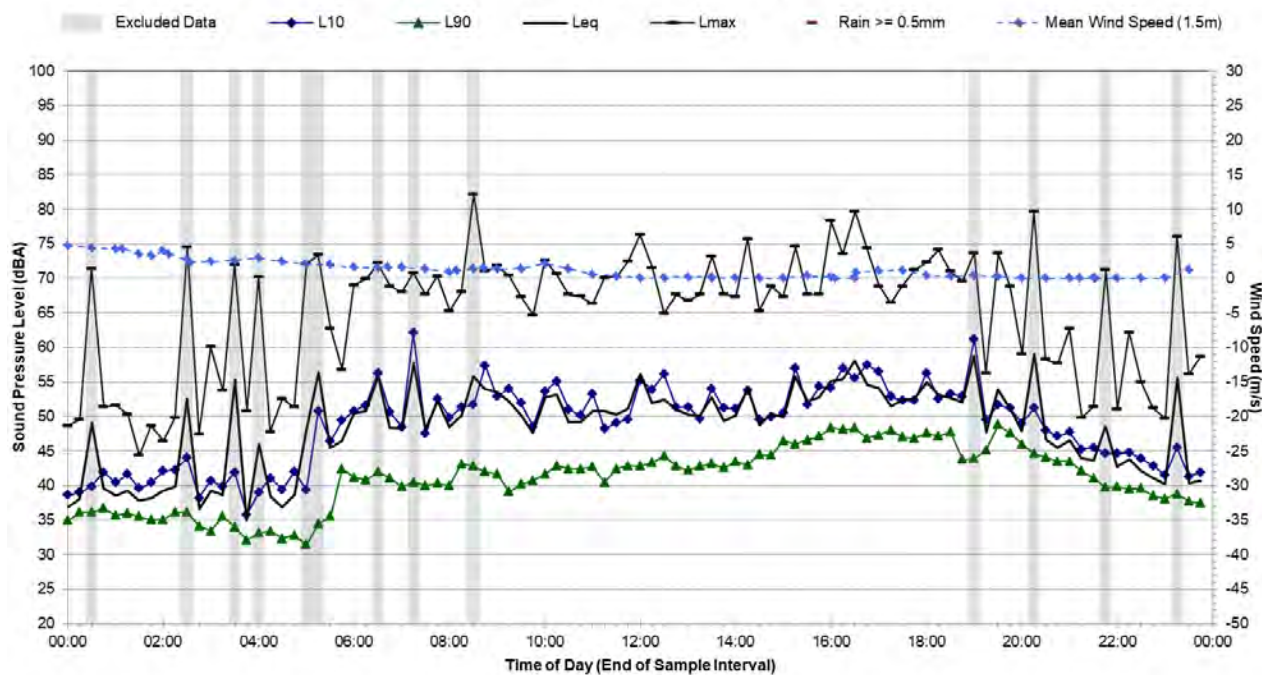
Statistical Ambient Noise Levels

L06 - 13 Cooperabung Drive, Telegraph Point - Tuesday, 23 October 2018



Statistical Ambient Noise Levels

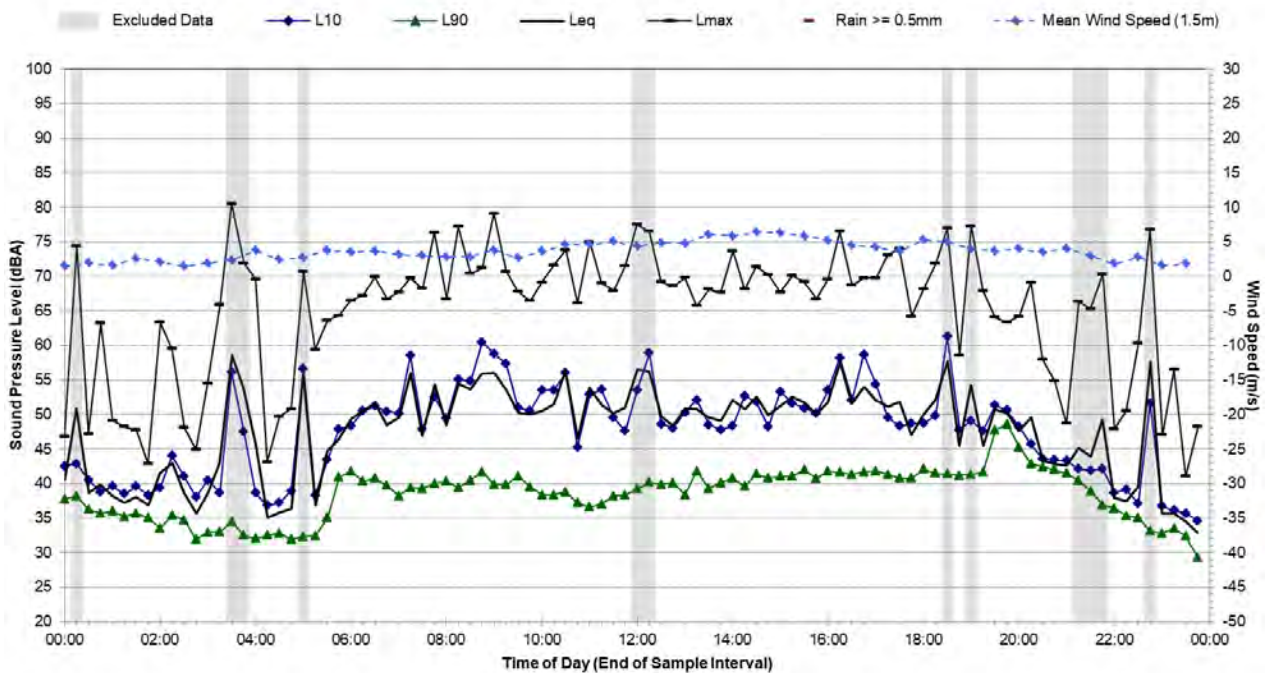
L06 - 13 Cooperabung Drive, Telegraph Point - Wednesday, 24 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

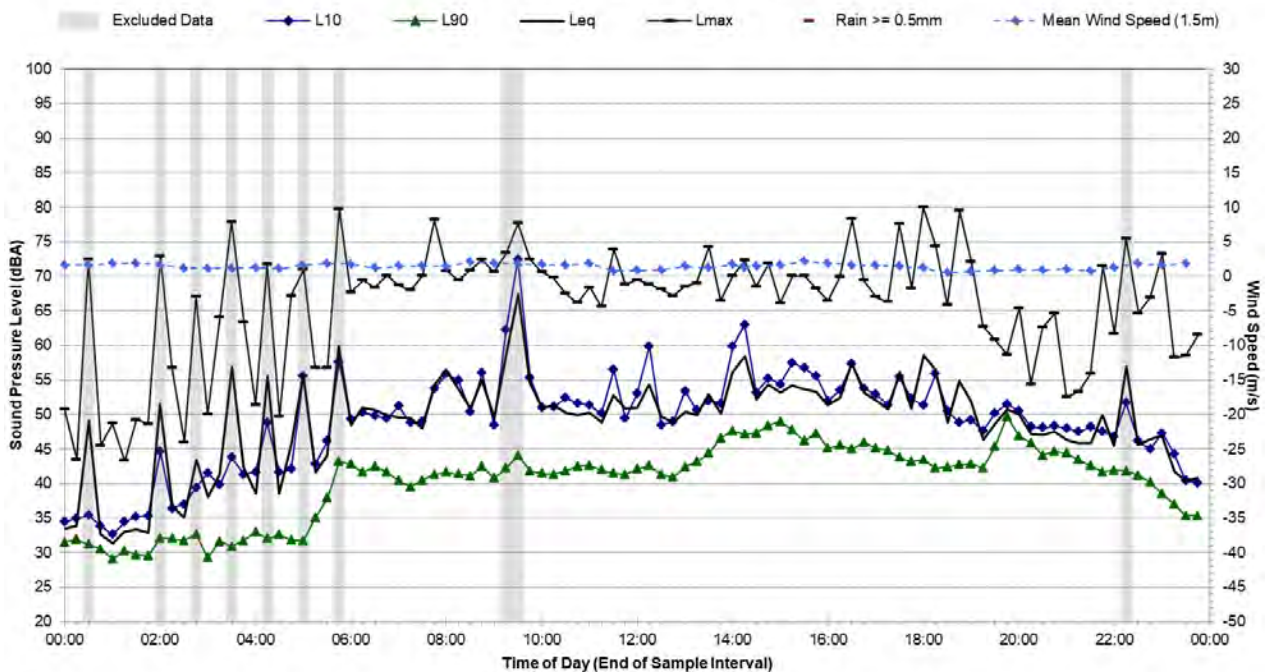
Statistical Ambient Noise Levels

L06 - 13 Cooperabung Drive, Telegraph Point - Thursday, 25 October 2018



Statistical Ambient Noise Levels

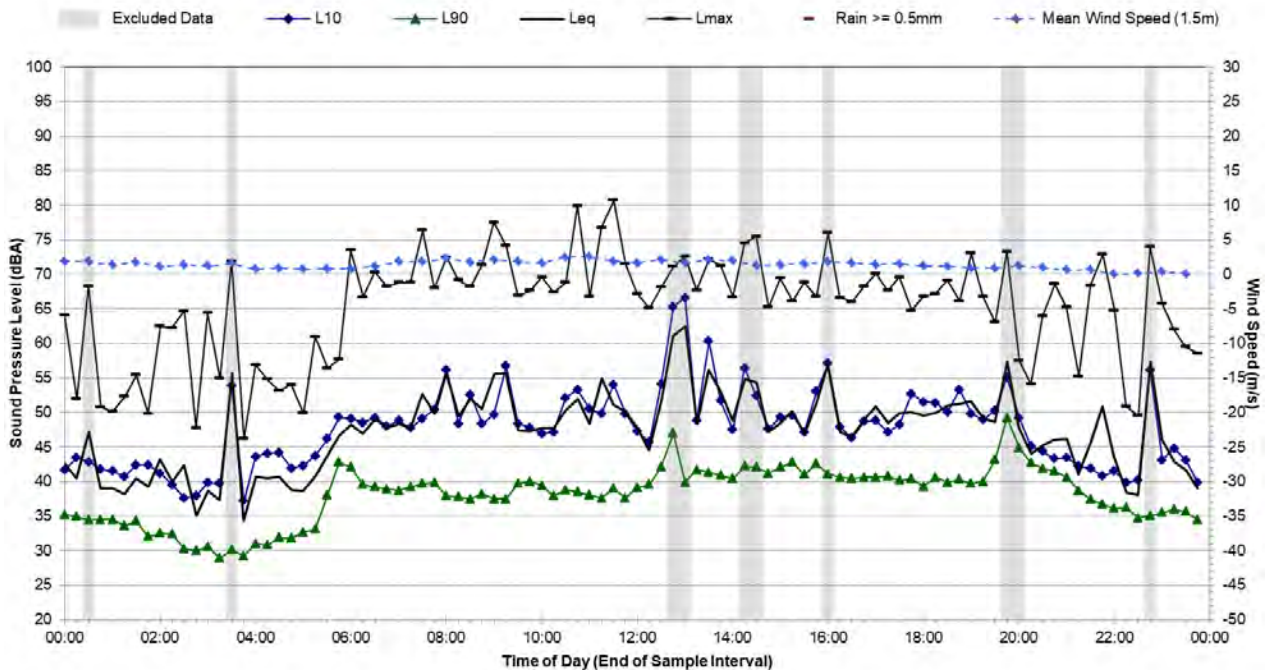
L06 - 13 Cooperabung Drive, Telegraph Point - Friday, 26 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

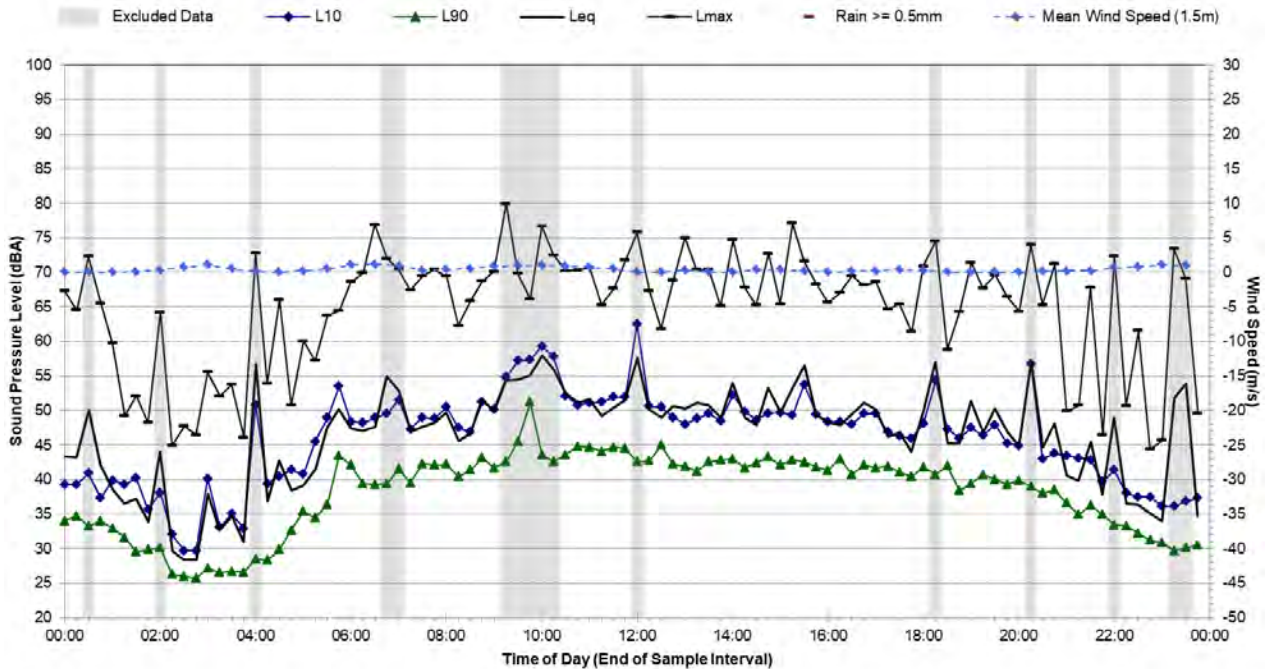
Statistical Ambient Noise Levels

L06 - 13 Cooperabung Drive, Telegraph Point - Saturday, 27 October 2018



Statistical Ambient Noise Levels

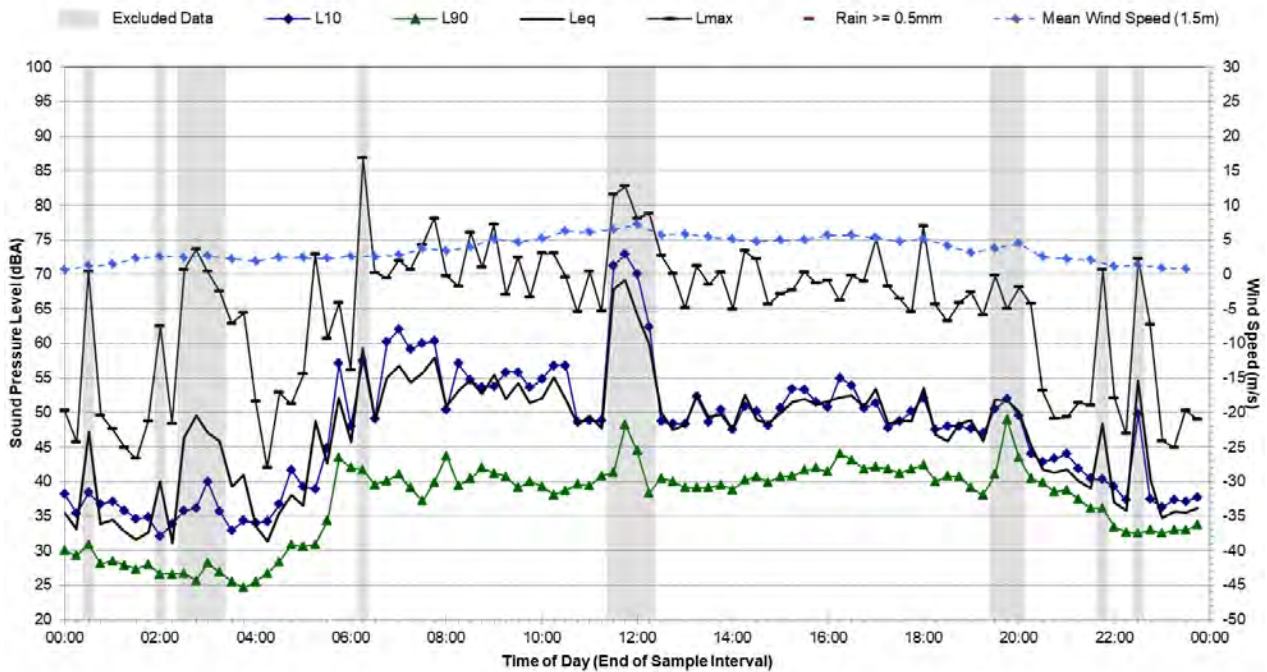
L06 - 13 Cooperabung Drive, Telegraph Point - Sunday, 28 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

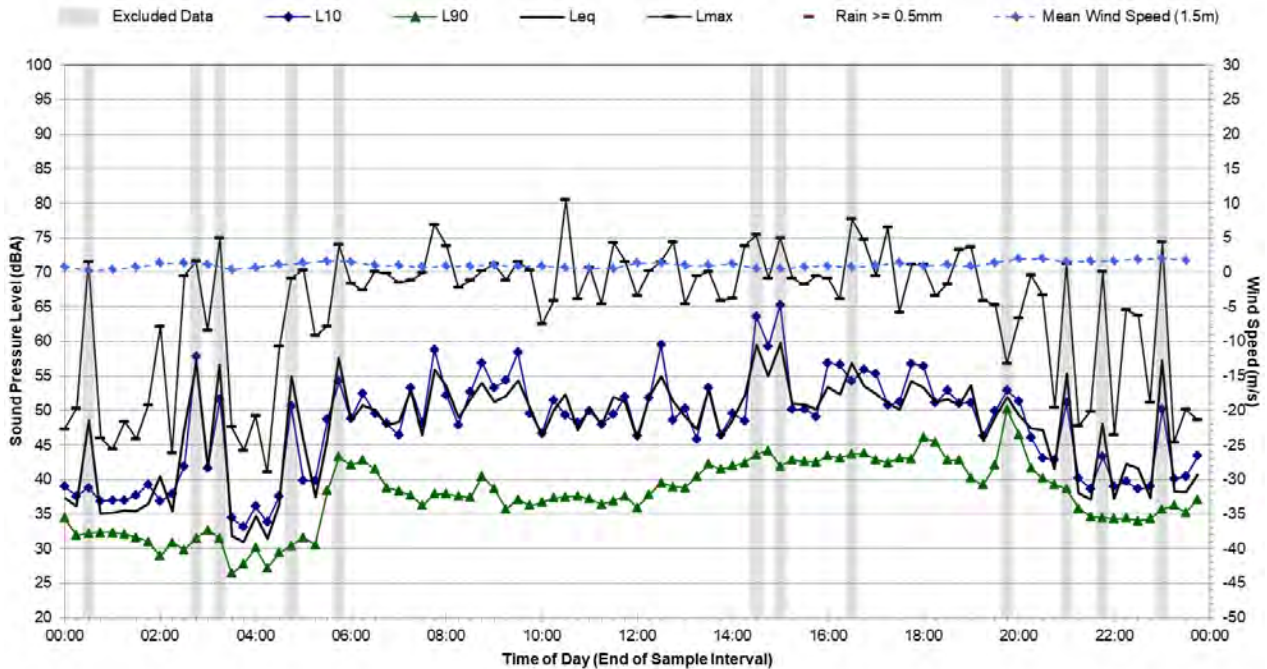
Statistical Ambient Noise Levels

L06 - 13 Cooperabung Drive, Telegraph Point - Monday, 29 October 2018



Statistical Ambient Noise Levels

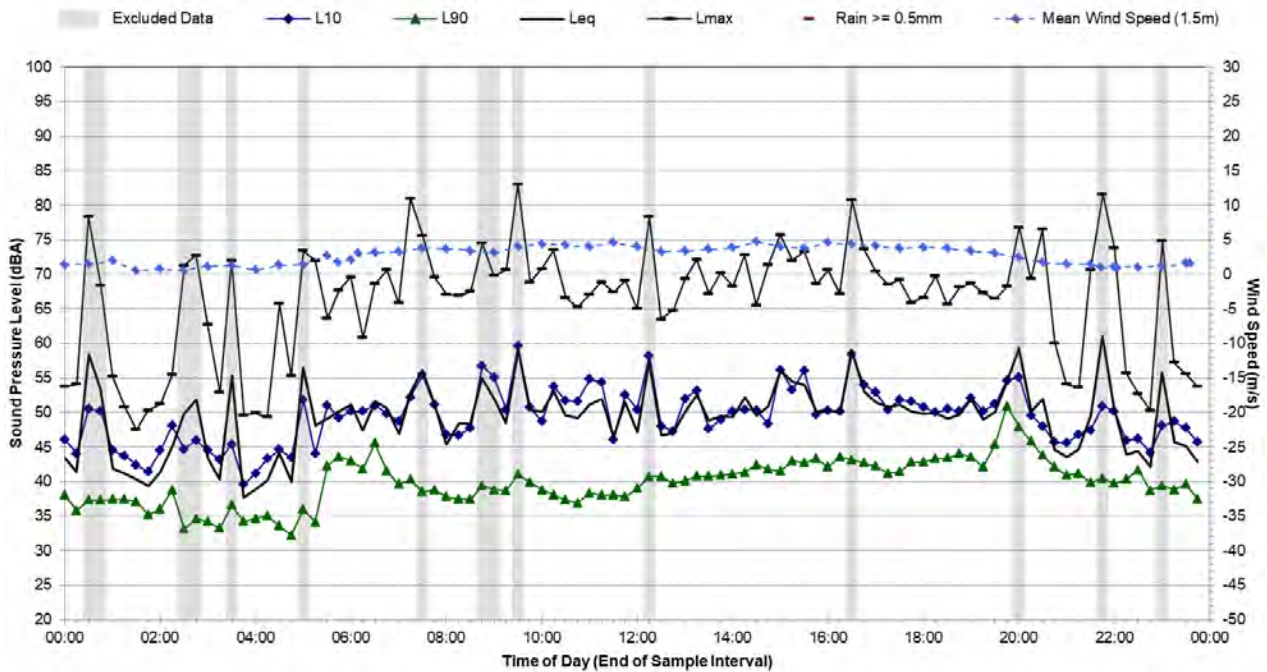
L06 - 13 Cooperabung Drive, Telegraph Point - Tuesday, 30 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

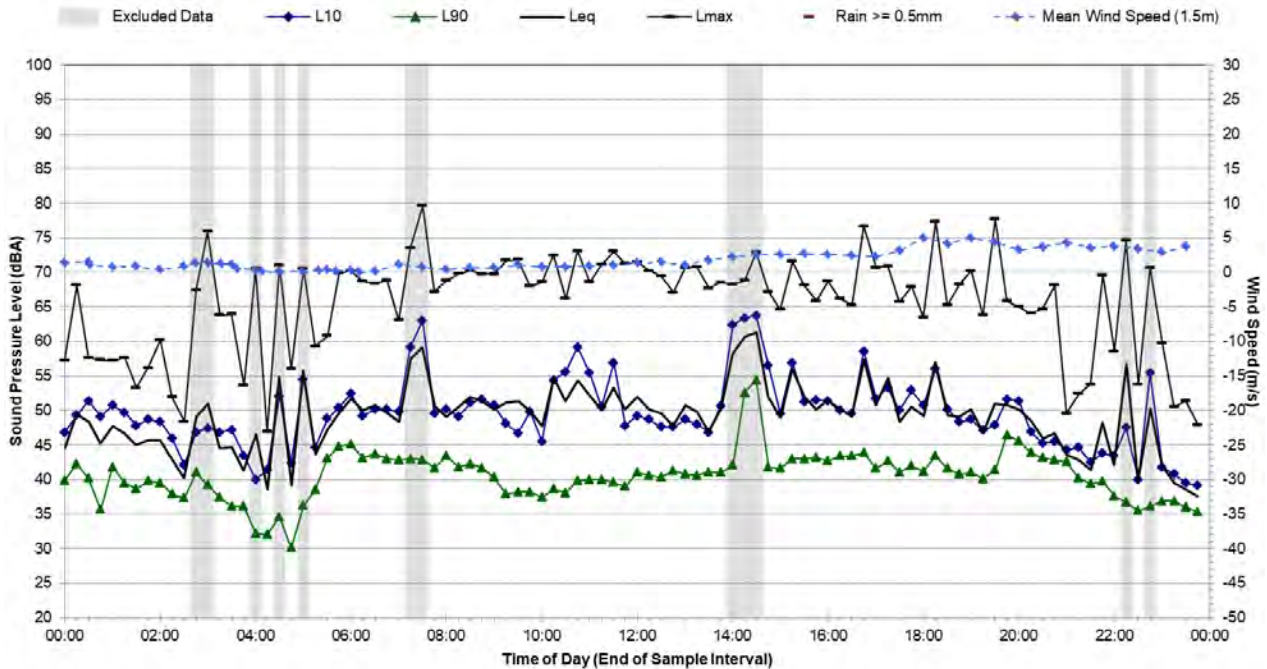
Statistical Ambient Noise Levels

L06 - 13 Cooperabung Drive, Telegraph Point - Wednesday, 31 October 2018



Statistical Ambient Noise Levels

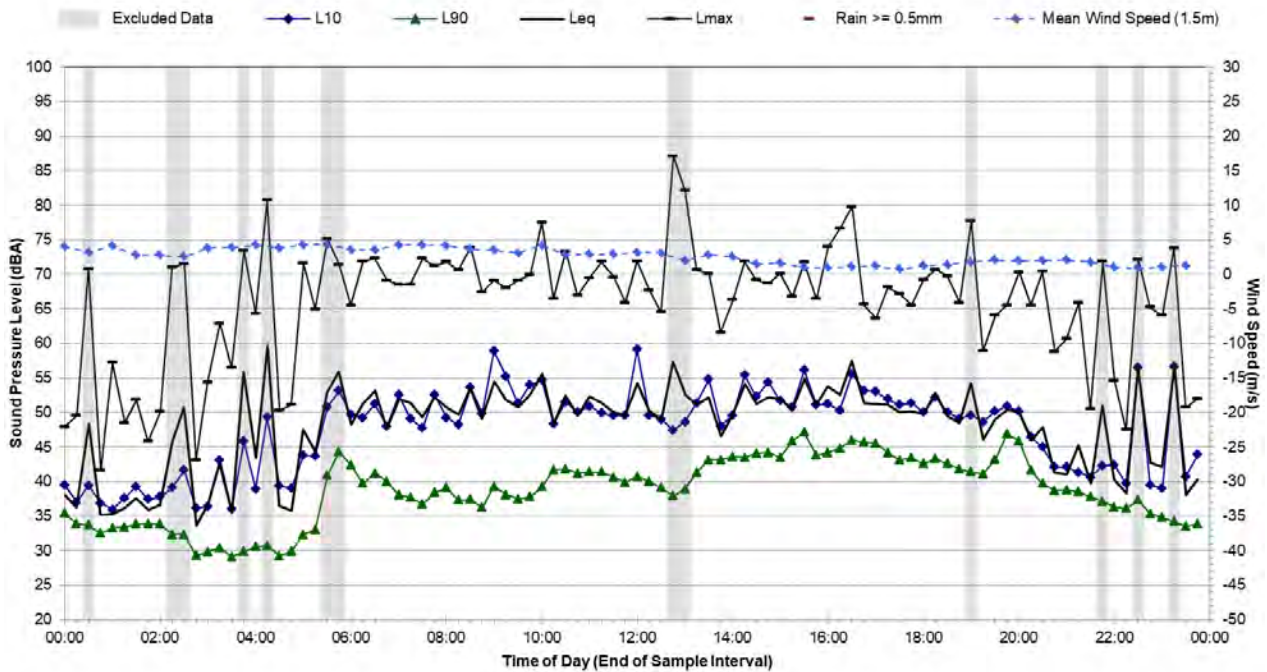
L06 - 13 Cooperabung Drive, Telegraph Point - Thursday, 1 November 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

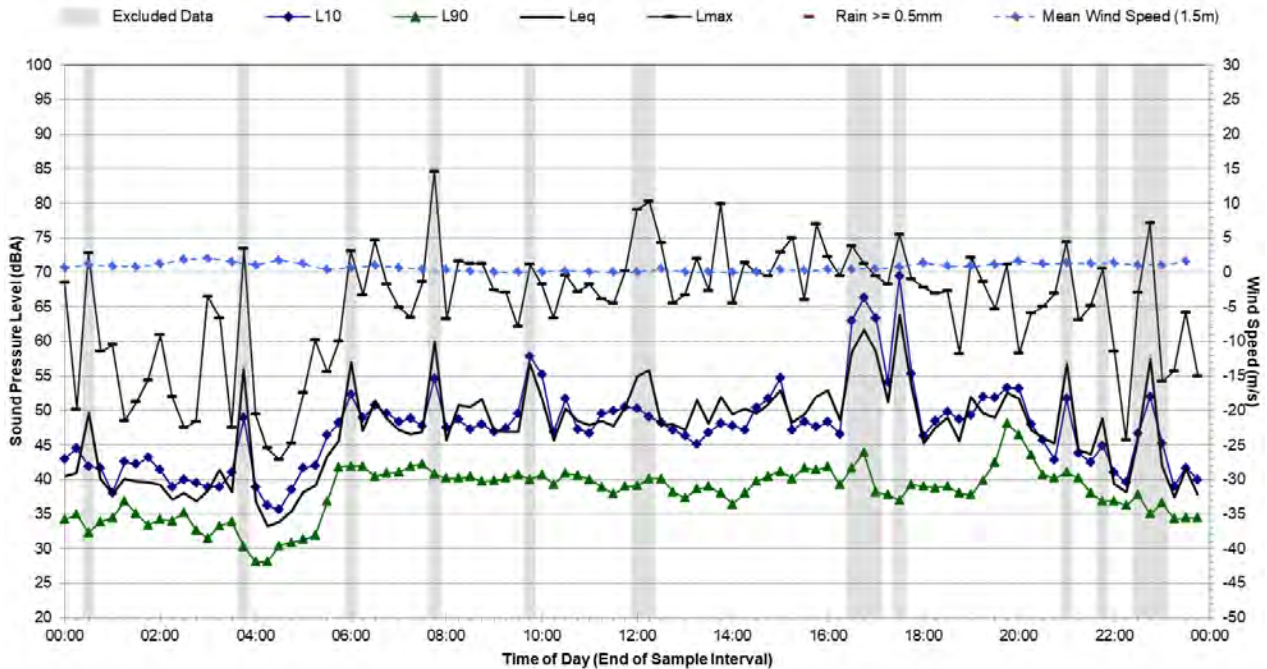
Statistical Ambient Noise Levels

L06 - 13 Cooperabung Drive, Telegraph Point - Friday, 2 November 2018



Statistical Ambient Noise Levels

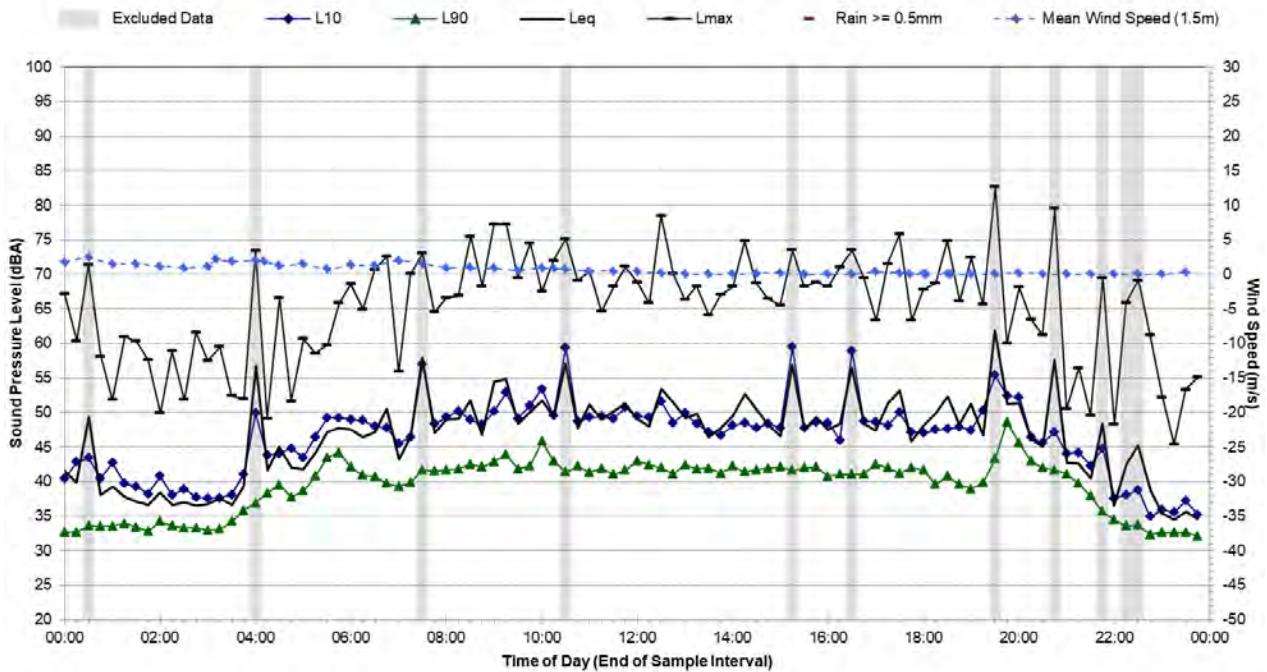
L06 - 13 Cooperabung Drive, Telegraph Point - Saturday, 3 November 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

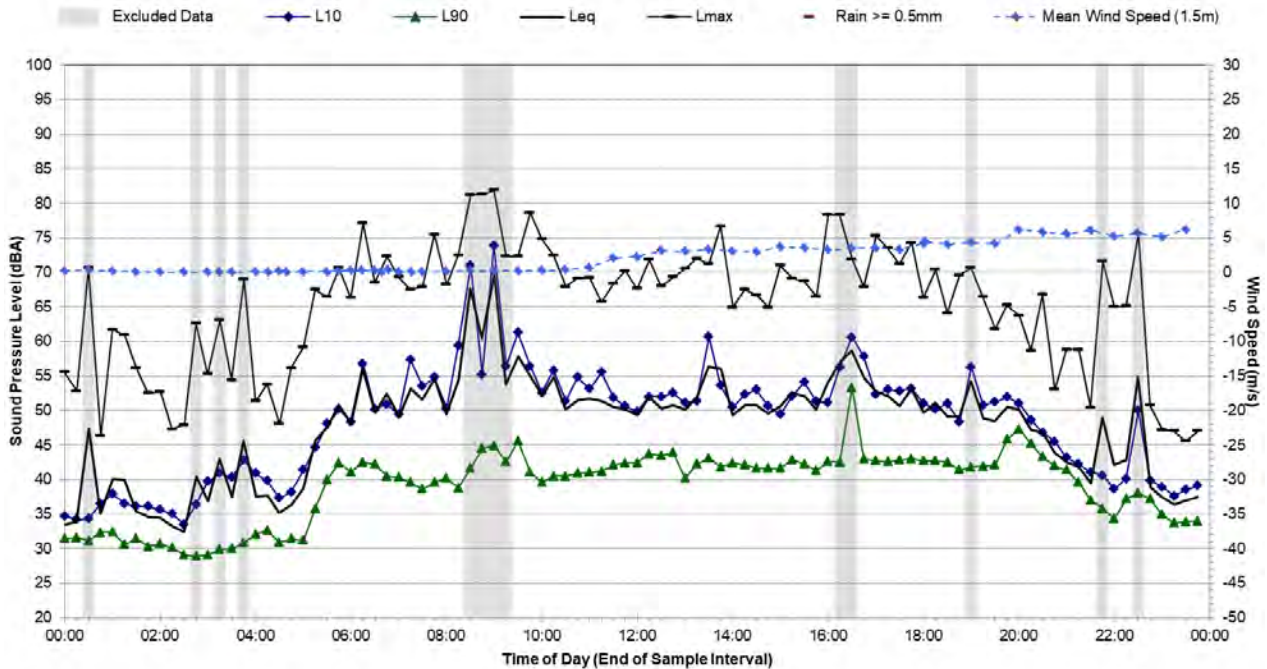
Statistical Ambient Noise Levels

L06 - 13 Cooperabung Drive, Telegraph Point - Sunday, 4 November 2018



Statistical Ambient Noise Levels

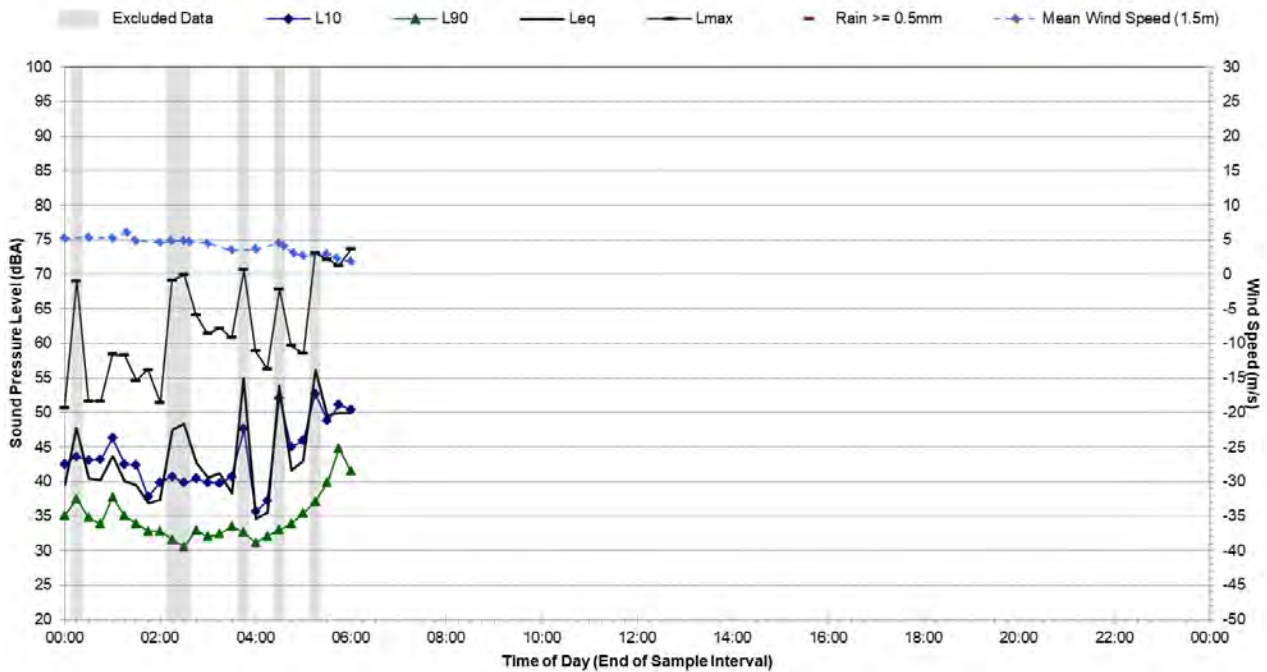
L06 - 13 Cooperabung Drive, Telegraph Point - Monday, 5 November 2018







Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

Statistical Ambient Noise Levels

L06 - 13 Cooperabung Drive, Telegraph Point - Tuesday, 6 November 2018

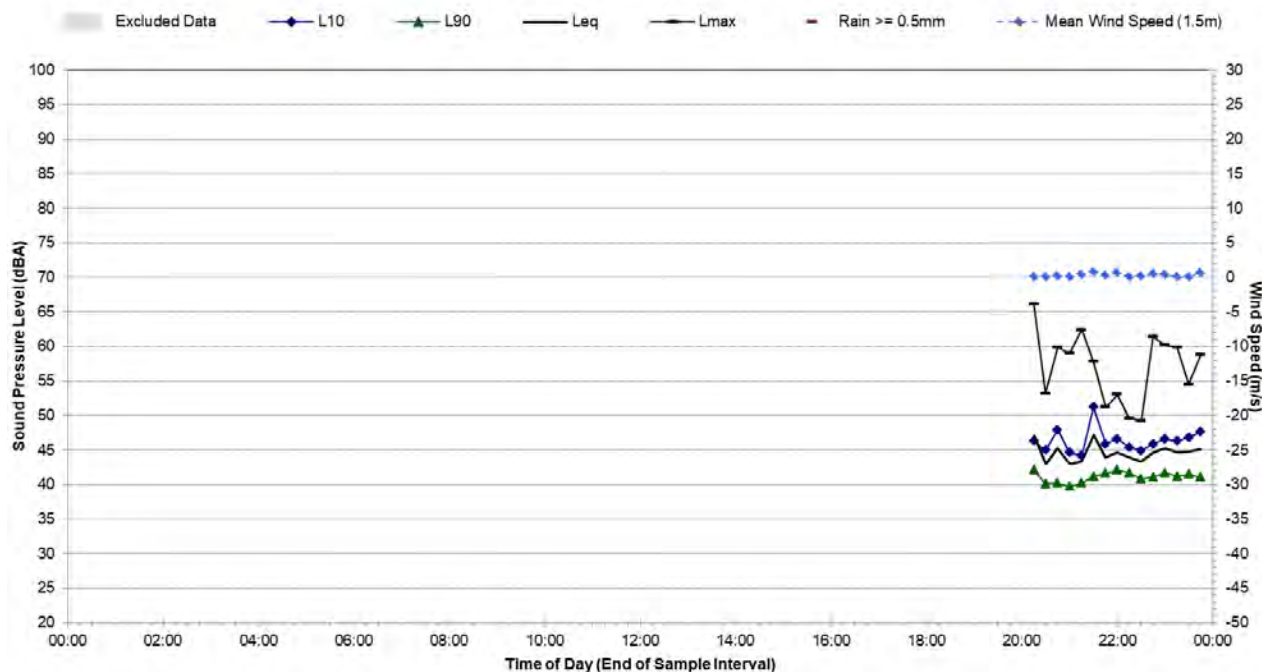


Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

Noise Monitoring Location		L.07				Map of Noise Monitoring Location	
Noise Monitoring Address		Hacks Ferry Road (Stoney Park), Telegraph Point					
Logger Device Type: ARL NGARA, Logger Serial: 878049 Sound Level Meter Device Type: Brüel and Kjær 2270, Sound Level Meter Serial No: 2414604							
Recorded Noise Levels (LAmax): 23/10/2018: Quiet/distant traffic: 40 dBA, Truck passbys: 44-47 dBA, Birds: 43-72 dBA, Dog barking: 51-54 dBA, Car pulling up nearby: 52-53. 05/11/2018: Quiet/distant traffic: 40-41 dBA, Truck passbys: 43-46 dBA, Birds: 43-60 dBA, Bugs: 47.							
Ambient Noise Logging Results – NPfI Defined Time Periods						Photo of Noise Monitoring Location	
Monitoring Period		Noise Level (dBA)					
		RBL	LAeq	L10	L1		
Daytime		37	51	49	59		
Evening		38	45	45	50		
Night-time		33	44	45	50		
Ambient Noise Logging Results – RNP Defined Time Periods							
Monitoring Period		Noise Level (dBA)					
		LAeq(period)		LAeq(1hour)			
Daytime (7am-10pm)		49		55			
Night-time (10pm-7am)		44		49			
Attended Noise Measurement Results							
Date	Start Time	Measured Noise Level (dBA)					
		LA90	LAeq	LAmaz			
23/10/2018	08:30	39	49	73			
05/11/2018	22:45	41	48	62			

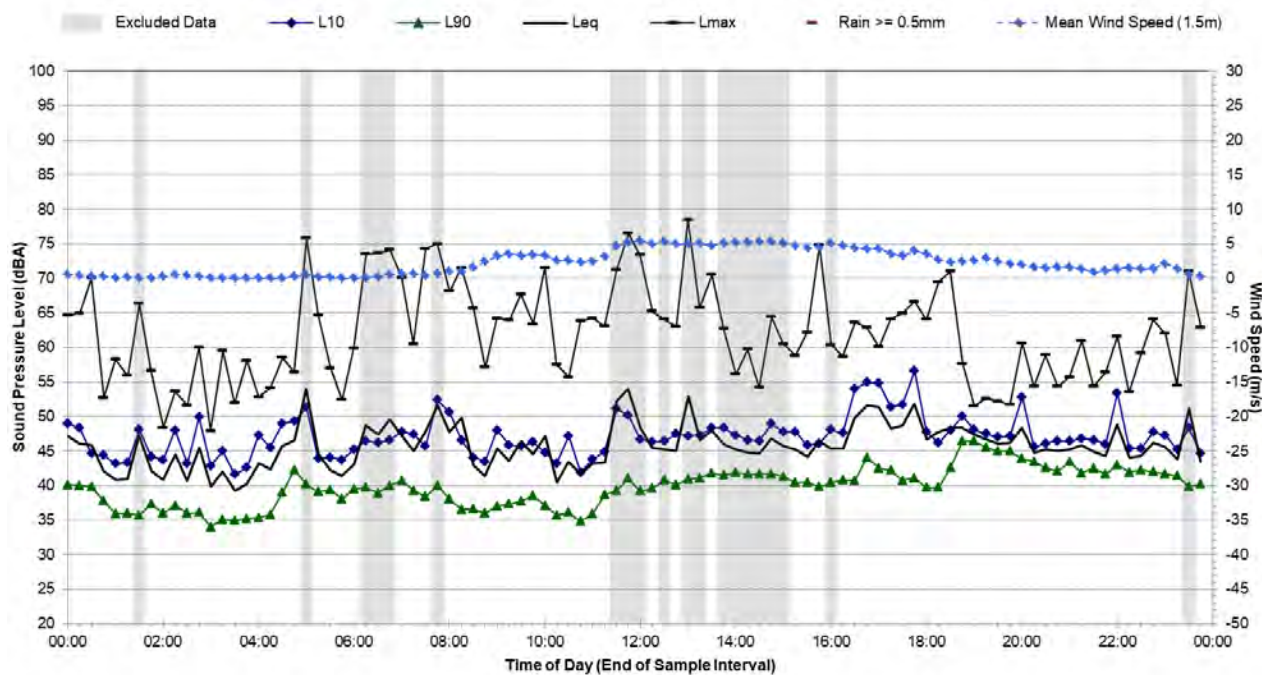
Statistical Ambient Noise Levels

L07-Hacks Ferry Road (Stoney Park) Telegraph Point - Monday, 22 October 2018



Statistical Ambient Noise Levels

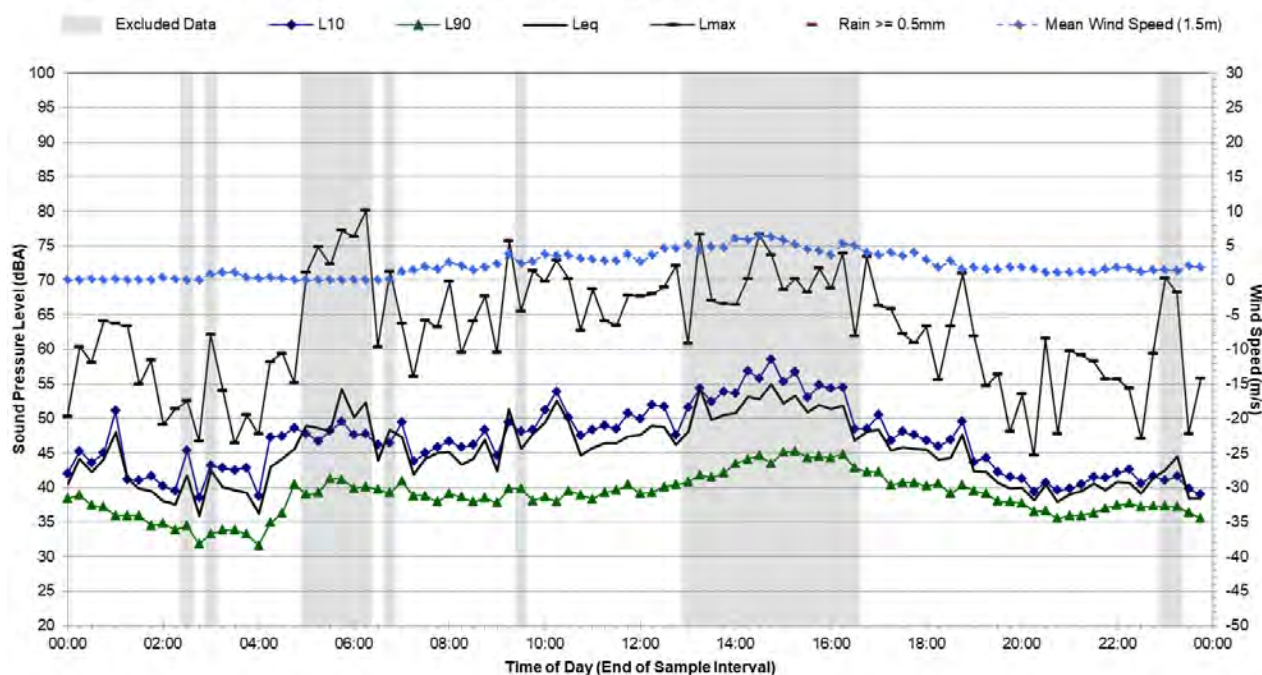
L07-Hacks Ferry Road (Stoney Park) Telegraph Point - Tuesday, 23 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

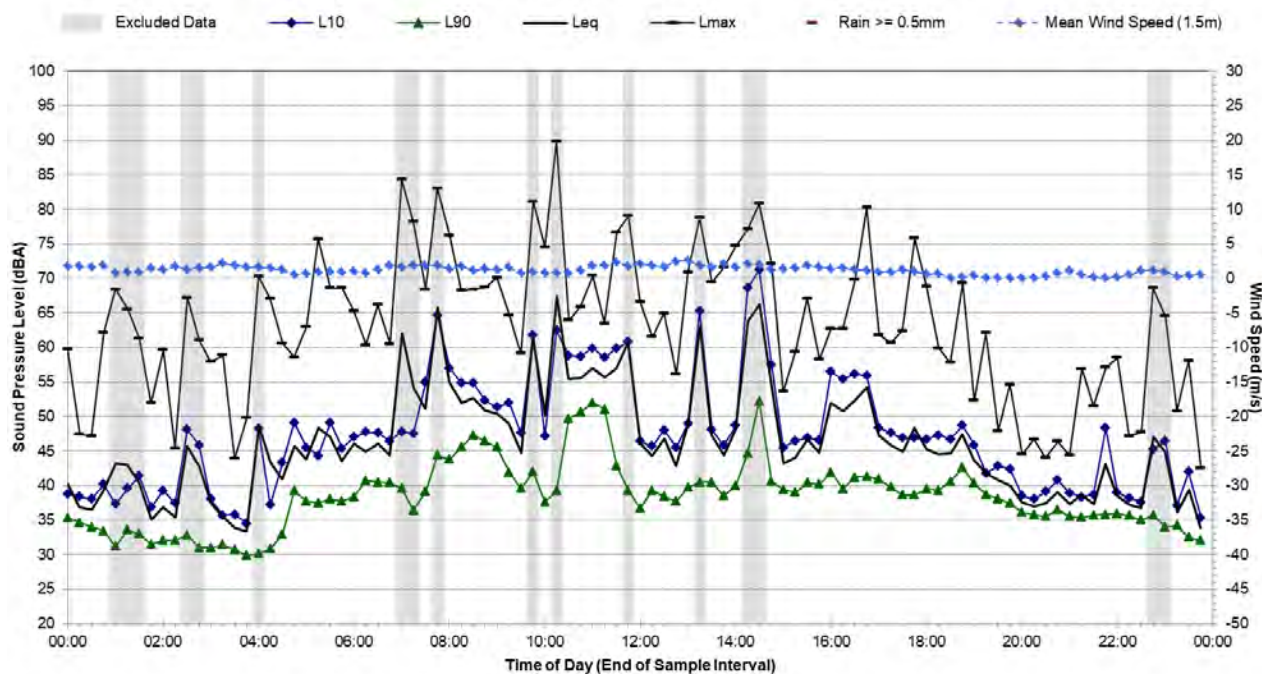
Statistical Ambient Noise Levels

L07-Hacks Ferry Road (Stoney Park) Telegraph Point - Wednesday, 24 October 2018



Statistical Ambient Noise Levels

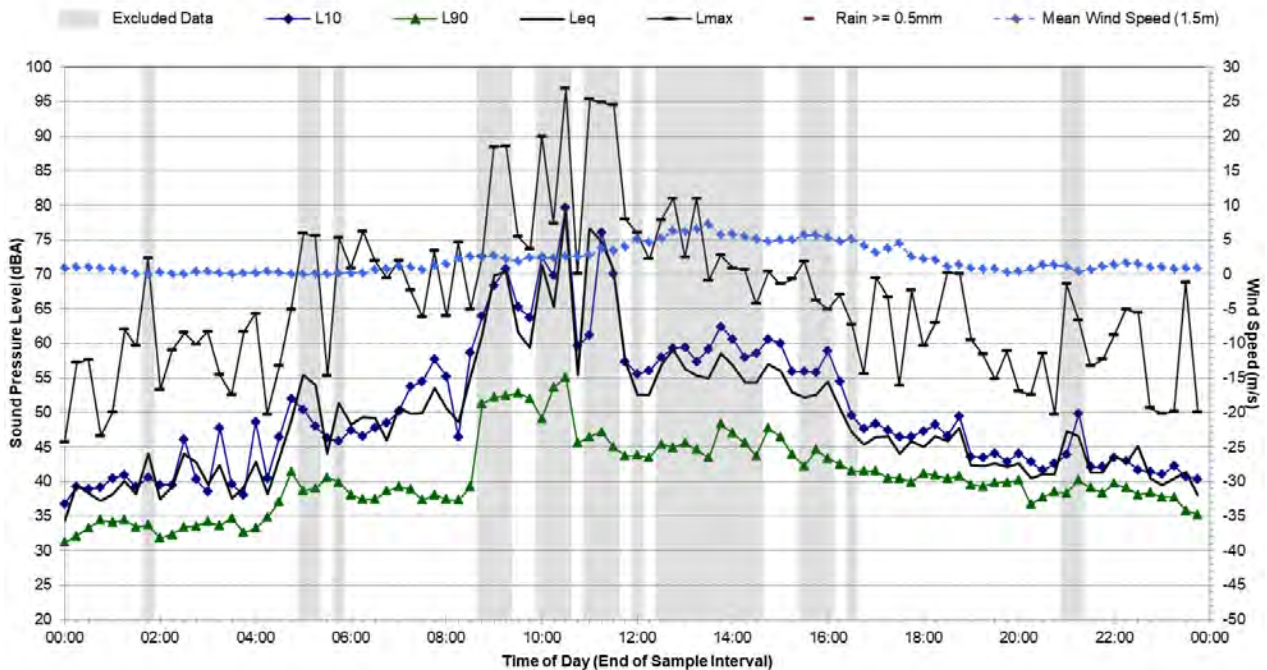
L07-Hacks Ferry Road (Stoney Park) Telegraph Point - Thursday, 25 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

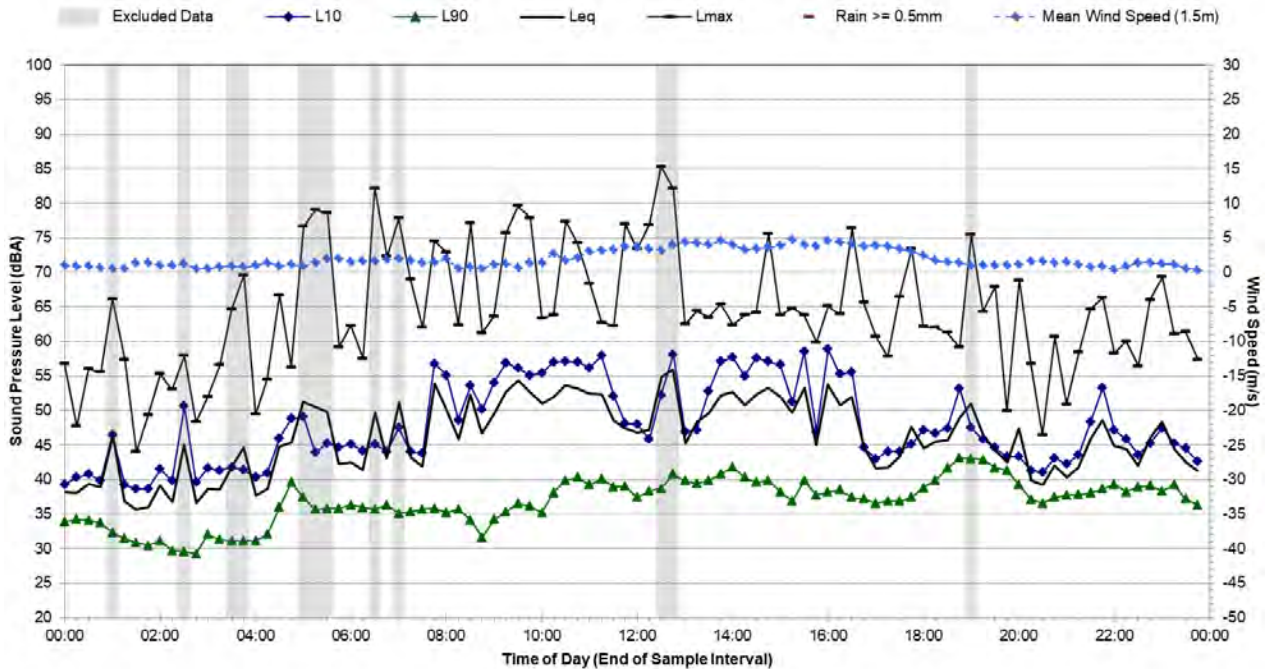
Statistical Ambient Noise Levels

L07-Hacks Ferry Road (Stoney Park) Telegraph Point - Friday, 26 October 2018



Statistical Ambient Noise Levels

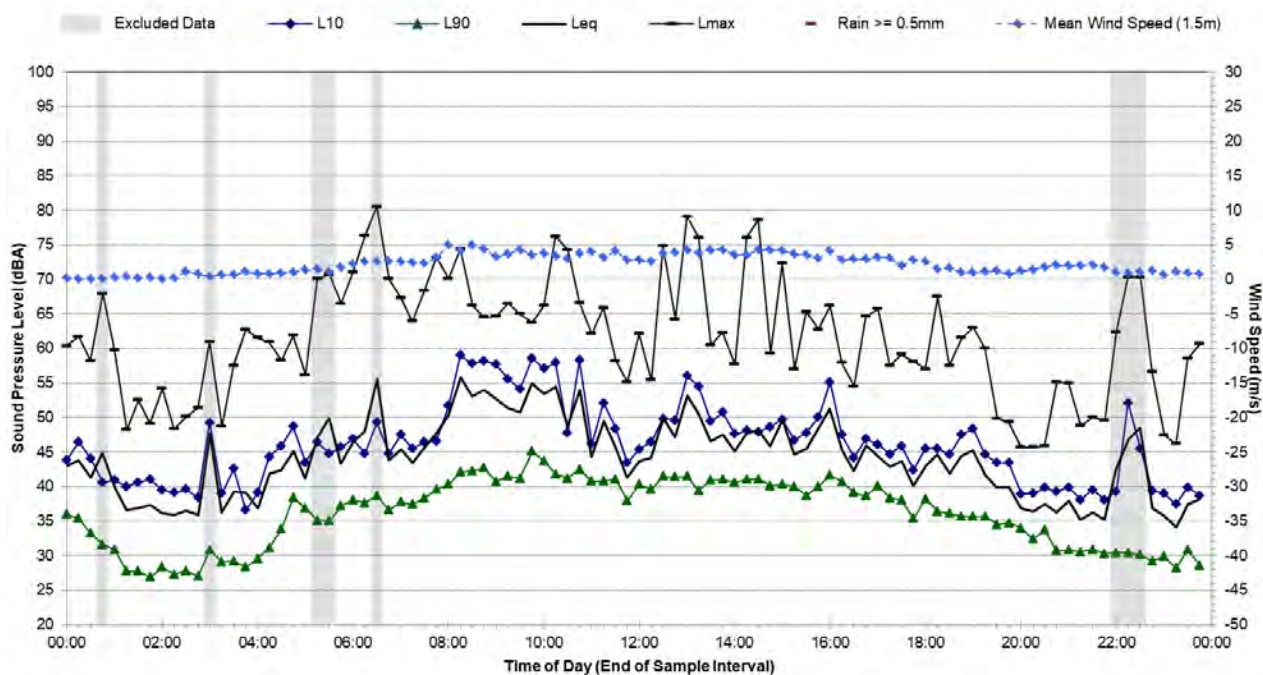
L07-Hacks Ferry Road (Stoney Park) Telegraph Point - Saturday, 27 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

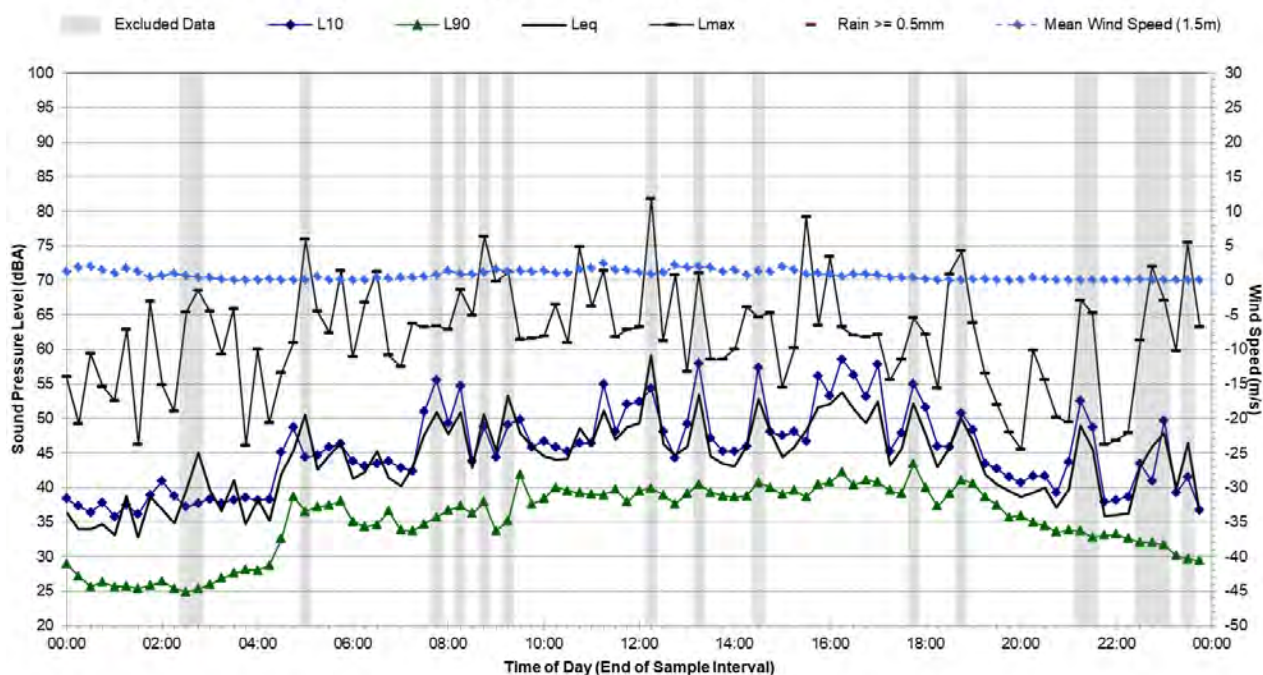
Statistical Ambient Noise Levels

L07-Hacks Ferry Road (Stoney Park) Telegraph Point - Sunday, 28 October 2018



Statistical Ambient Noise Levels

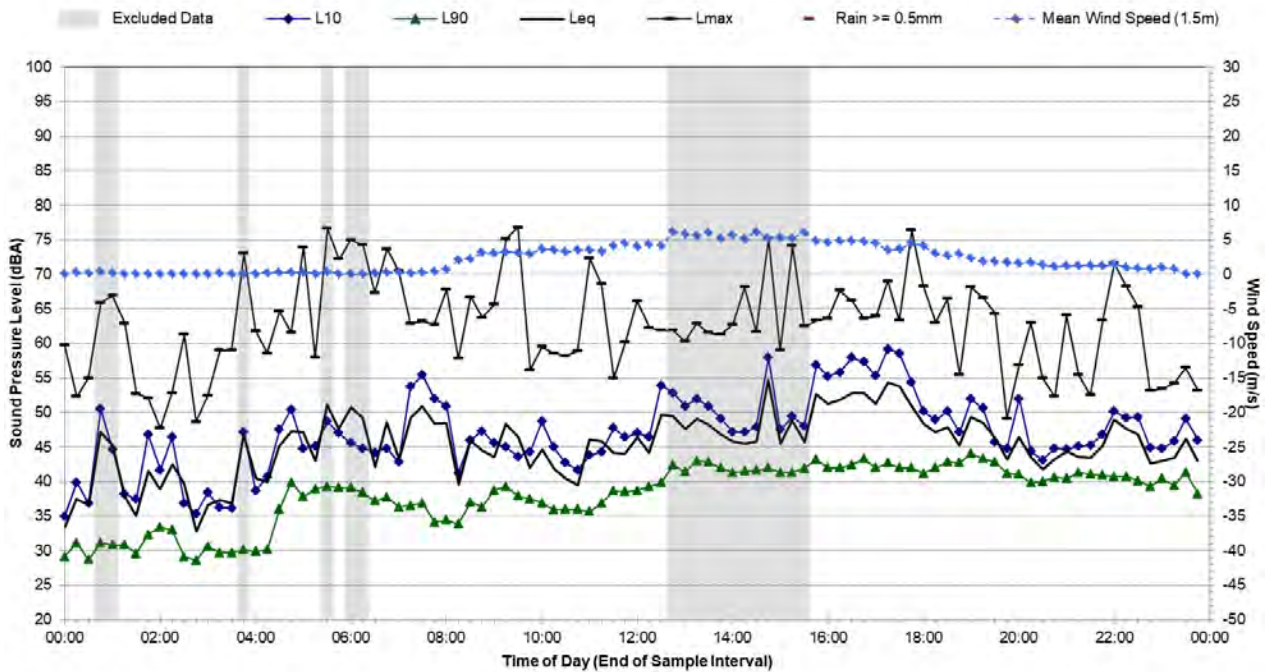
L07-Hacks Ferry Road (Stoney Park) Telegraph Point - Monday, 29 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

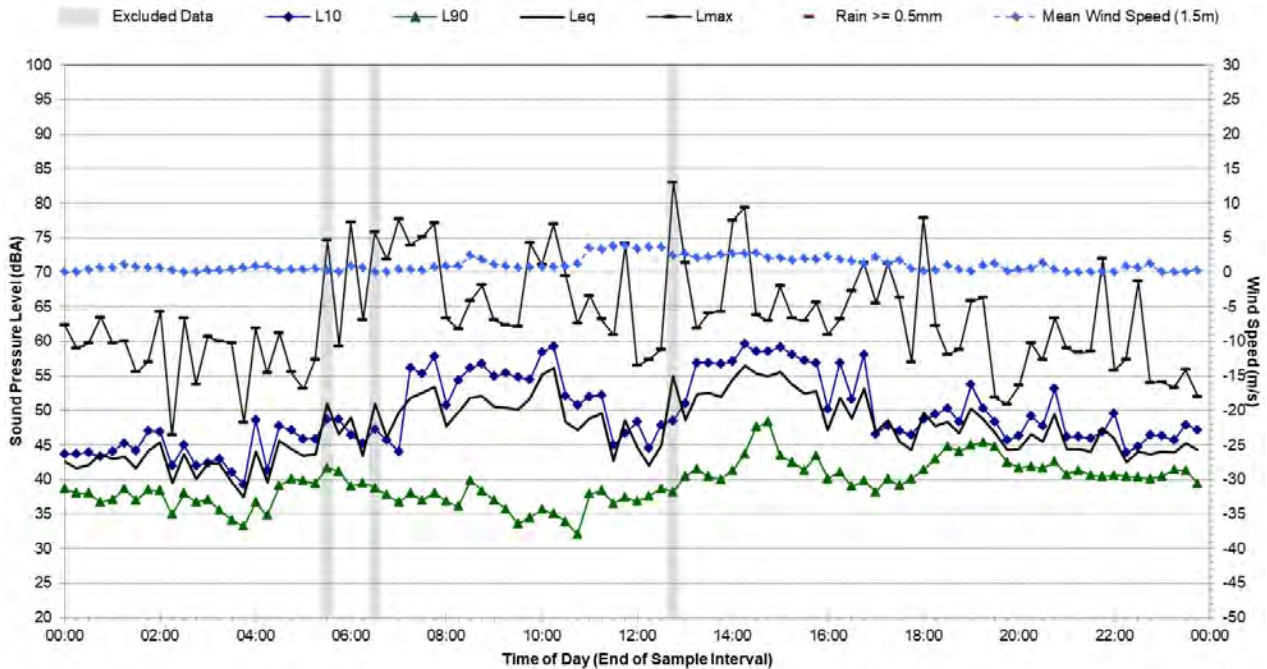
Statistical Ambient Noise Levels

L07-Hacks Ferry Road (Stoney Park) Telegraph Point - Tuesday, 30 October 2018



Statistical Ambient Noise Levels

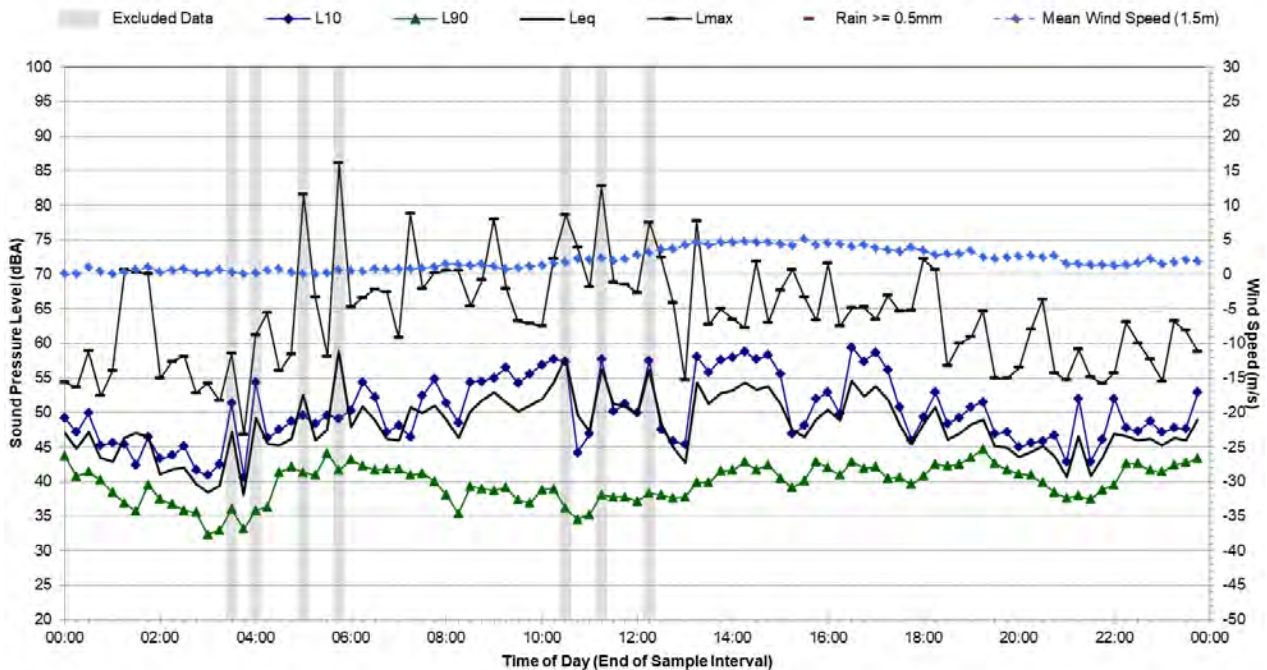
L07-Hacks Ferry Road (Stoney Park) Telegraph Point - Wednesday, 31 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

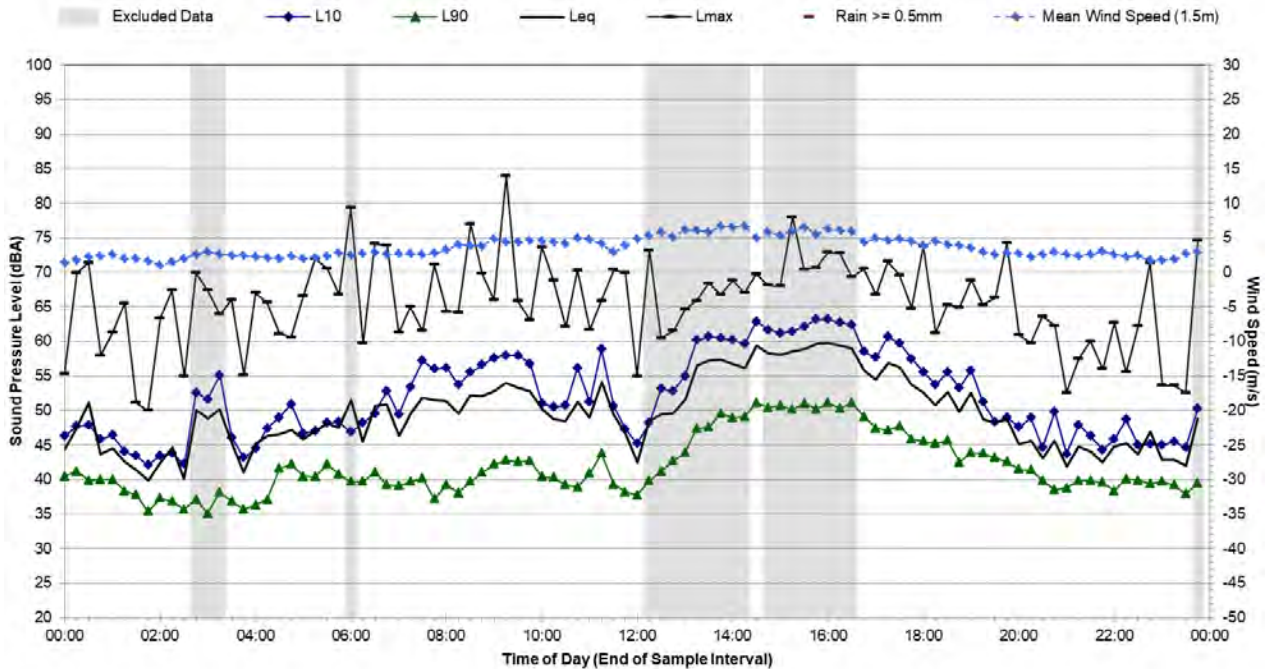
Statistical Ambient Noise Levels

L07-Hacks Ferry Road (Stoney Park) Telegraph Point - Thursday, 1 November 2018



Statistical Ambient Noise Levels

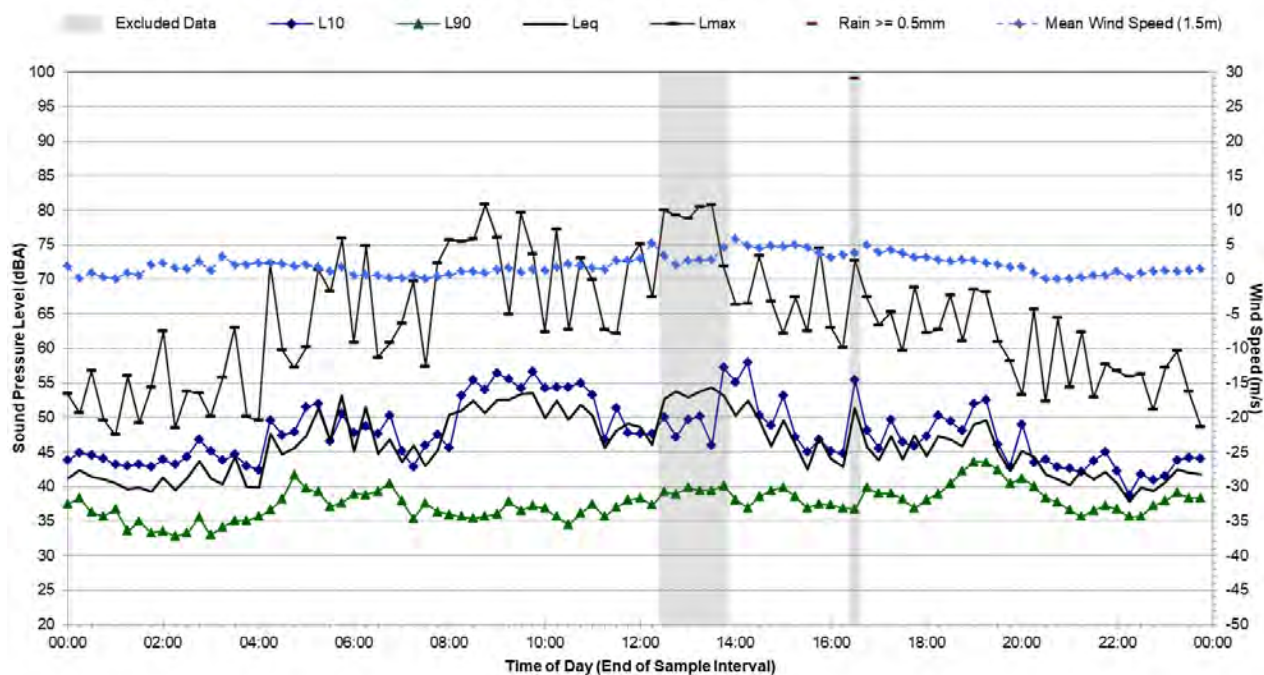
L07-Hacks Ferry Road (Stoney Park) Telegraph Point - Friday, 2 November 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

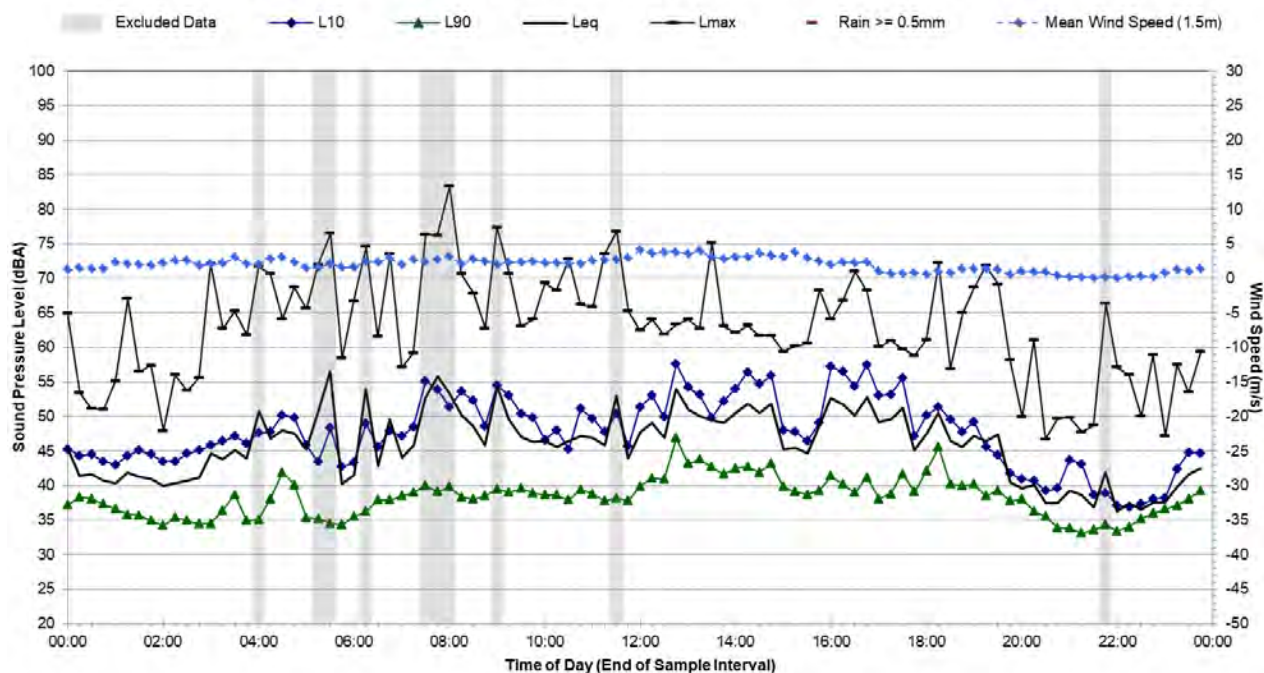
Statistical Ambient Noise Levels

L07-Hacks Ferry Road (Stoney Park) Telegraph Point - Saturday, 3 November 2018



Statistical Ambient Noise Levels

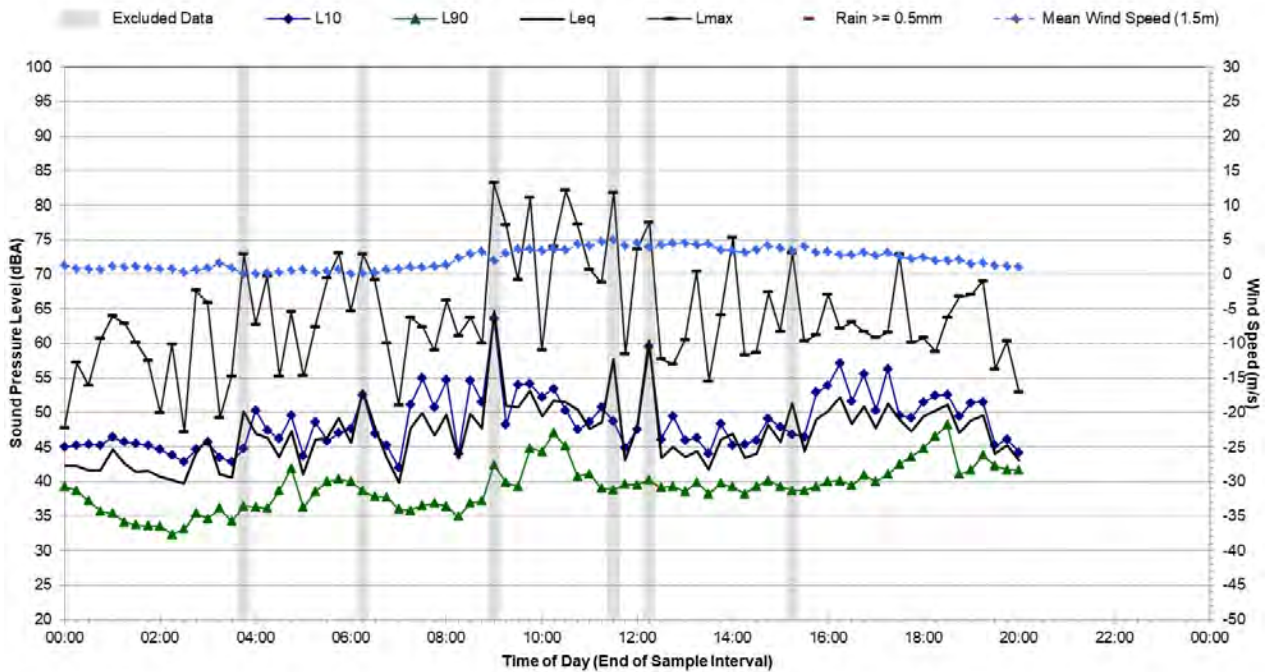
L07-Hacks Ferry Road (Stoney Park) Telegraph Point - Sunday, 4 November 2018



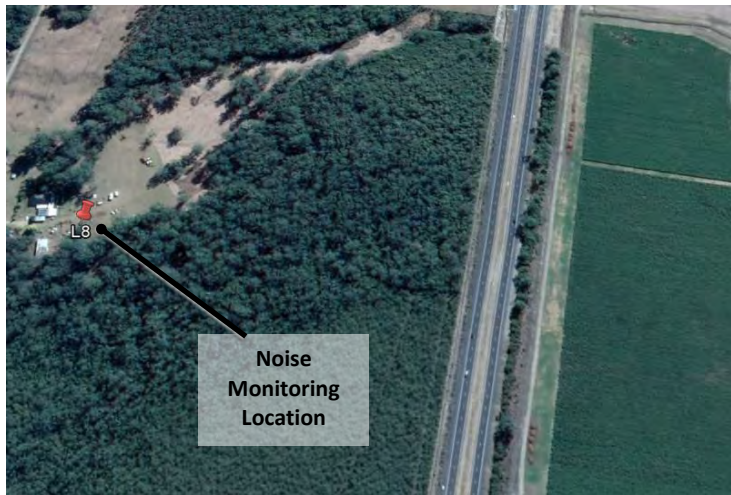

Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

Statistical Ambient Noise Levels

L07-Hacks Ferry Road (Stoney Park) Telegraph Point - Monday, 5 November 2018

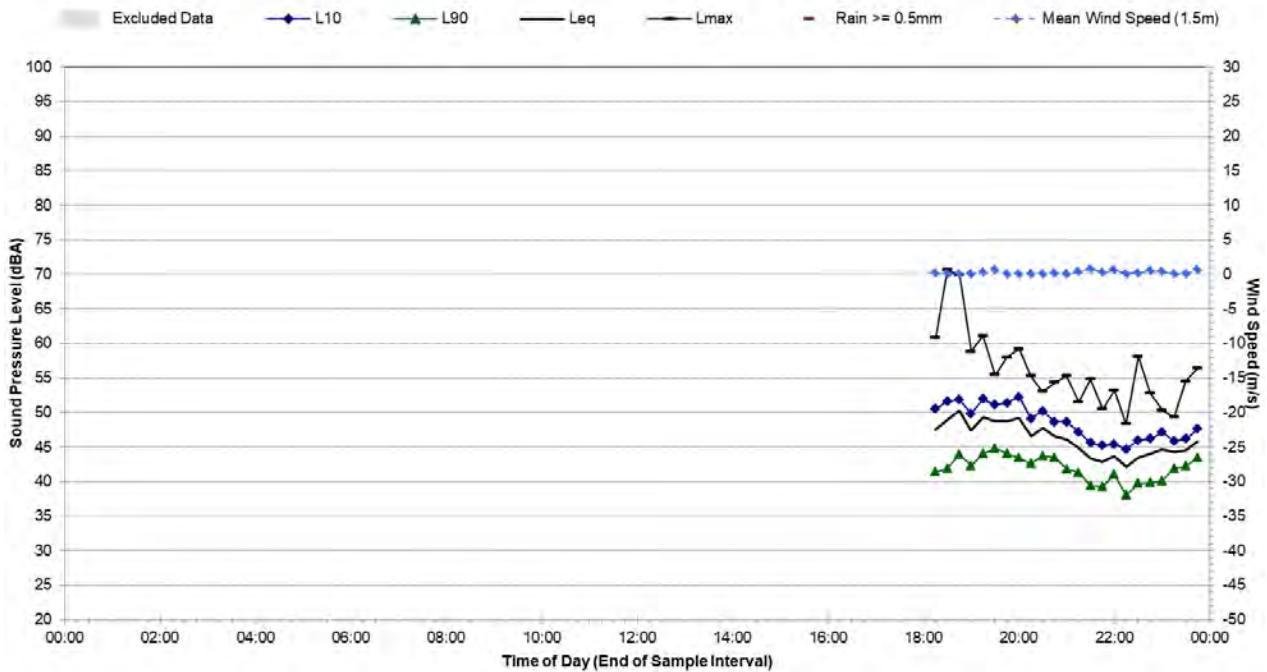


Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

Noise Monitoring Location		L.08				Map of Noise Monitoring Location		
Noise Monitoring Address		Address: 91 Moore Side Drive, Telegraph Point						
Logger Device Type: ARL NGARA, Logger Serial: 8780EA Sound Level Meter Device Type: Brüel and Kjær 2270, Sound Level Meter Serial No: 2414604								
Recorded Noise Levels (LAmax): 22/10/2018: Truck passbys: 49-56 dBA. Birds: 47-50 dBA, Lawnmower: 43 dBA. 05/11/2018: Truck passbys: 48-53 dBA, Background: 38-43 dBA.								
Ambient Noise Logging Results – NPfl Defined Time Periods						Photo of Noise Monitoring Location		
Monitoring Period		Noise Level (dBA)						
		RBL	LAeq	L10	L1			
Daytime	38	47	48	55				
Evening	39	47	48	52				
Night-time	39	47	48	51				
Ambient Noise Logging Results – RNP Defined Time Periods								
Monitoring Period		Noise Level (dBA)						
		LAeq(period)		LAeq(1hour)				
Daytime (7am-10pm)	47		50					
Night-time (10pm-7am)	47		50					
Attended Noise Measurement Results								
Date	Start Time	Measured Noise Level (dBA)						
		LA90	LAeq	LAmaz				
22/10/2018	17:00	41	46	60				
05/11/2018	22:00	40	45	58				

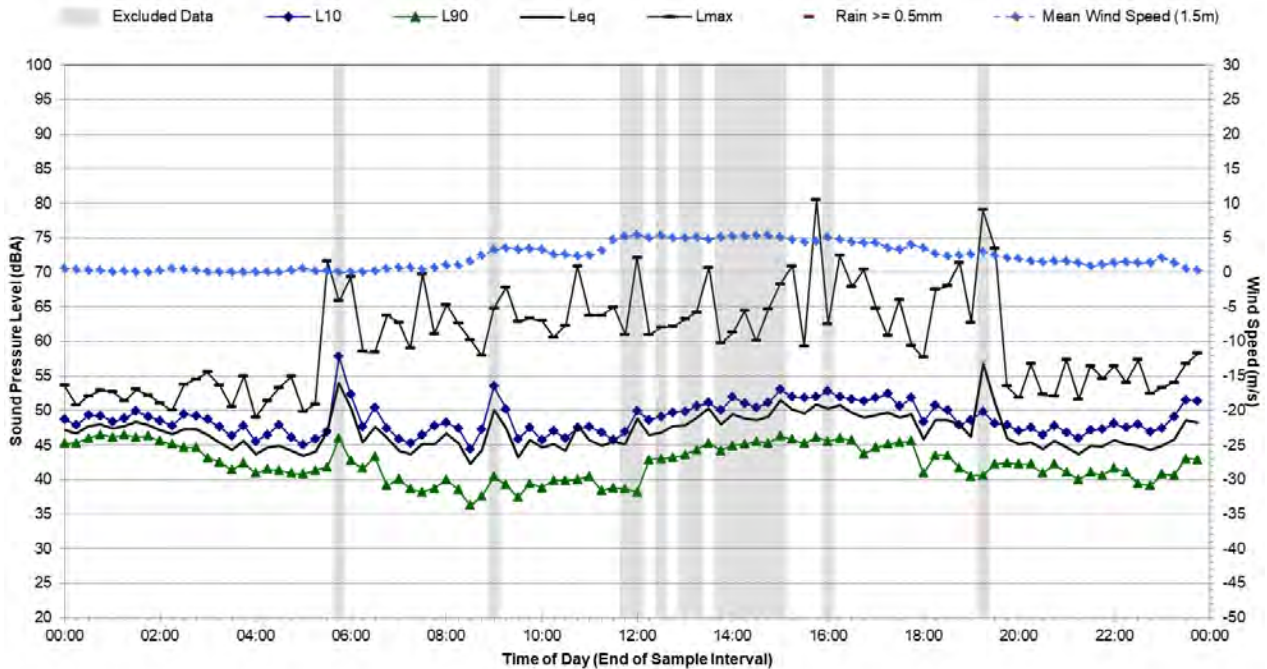
Statistical Ambient Noise Levels

L08 - 91 Moore Side Drive, Telegraph Point - Monday, 22 October 2018



Statistical Ambient Noise Levels

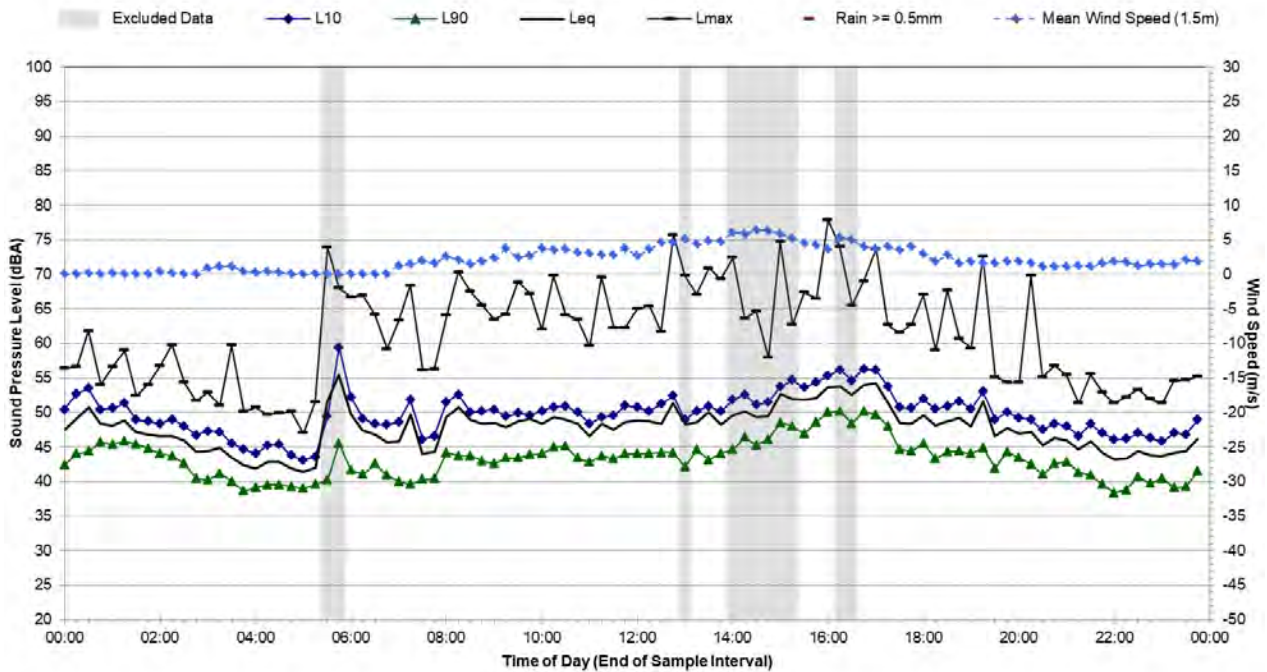
L08 - 91 Moore Side Drive, Telegraph Point - Tuesday, 23 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

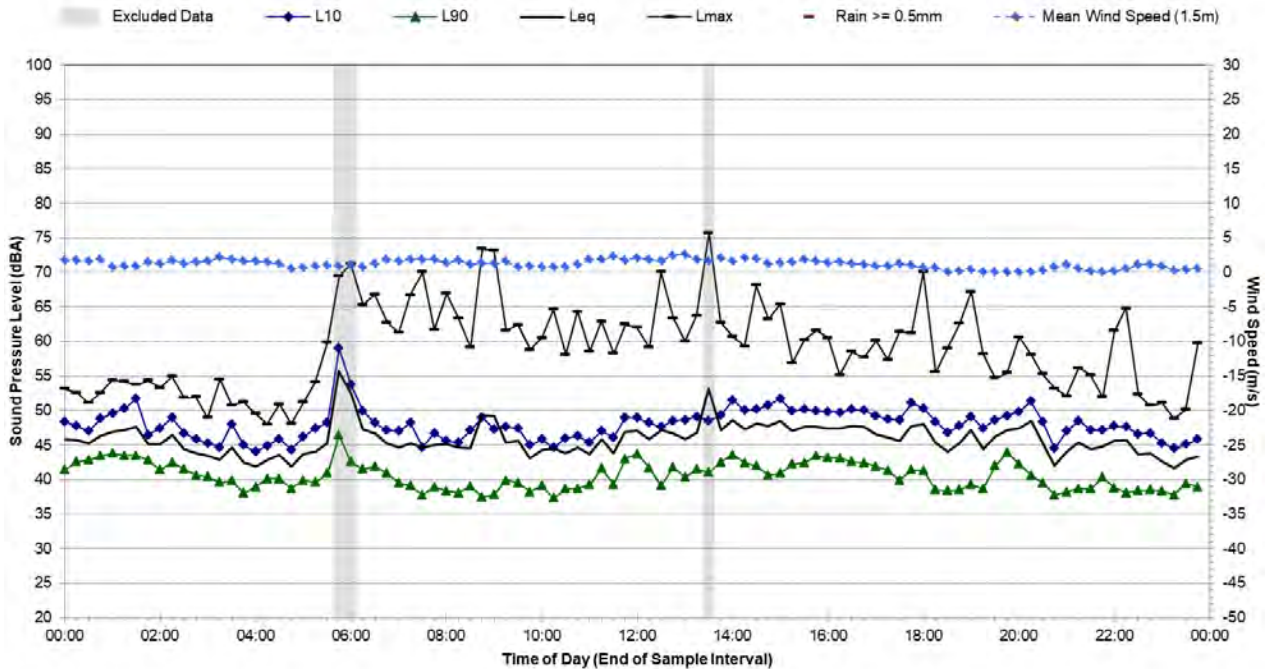
Statistical Ambient Noise Levels

L08 - 91 Moore Side Drive, Telegraph Point - Wednesday, 24 October 2018



Statistical Ambient Noise Levels

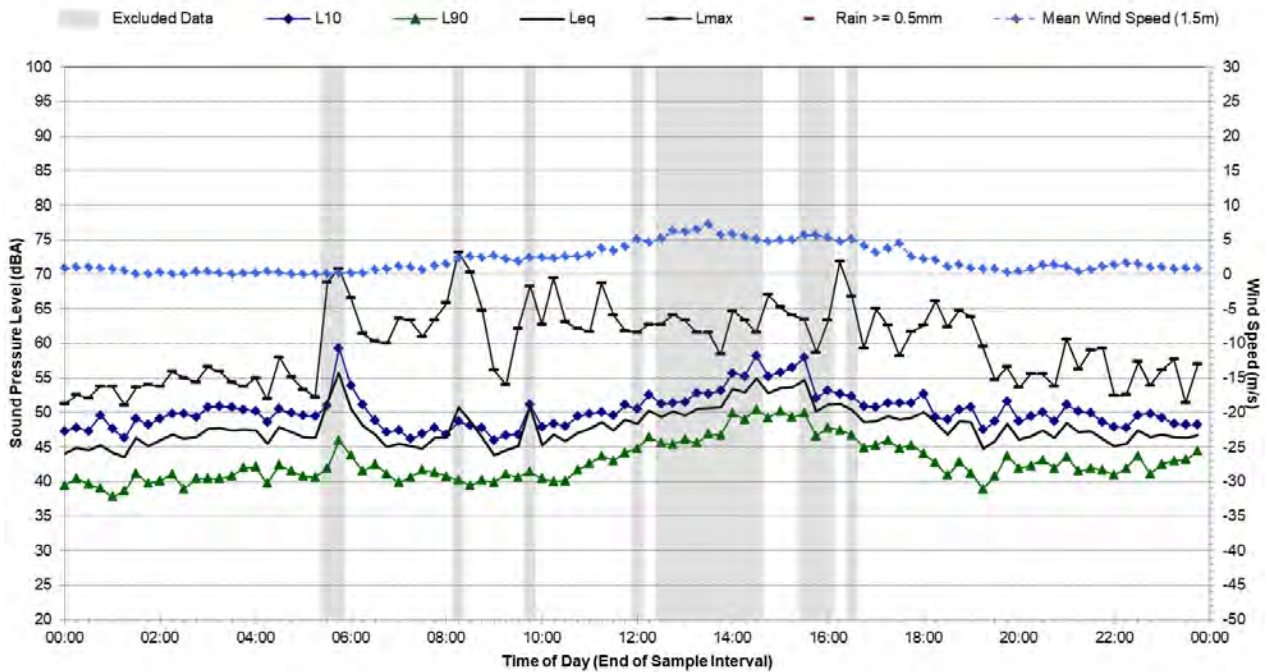
L08 - 91 Moore Side Drive, Telegraph Point - Thursday, 25 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

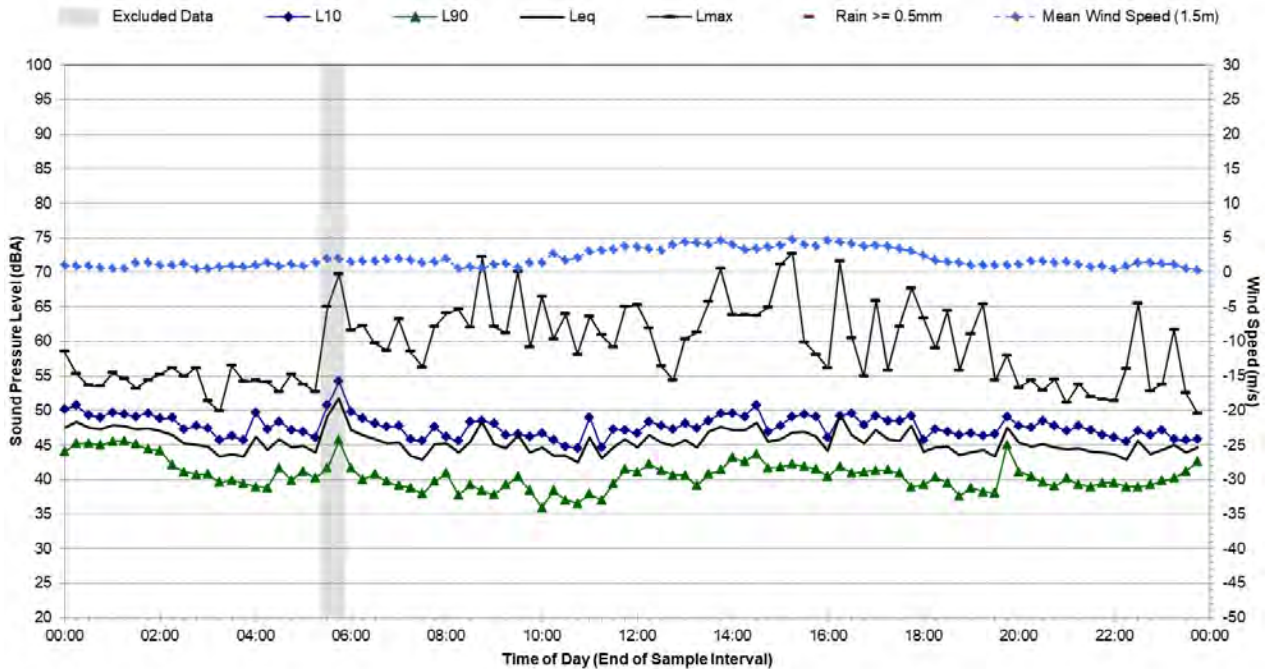
Statistical Ambient Noise Levels

L08 - 91 Moore Side Drive, Telegraph Point - Friday, 26 October 2018



Statistical Ambient Noise Levels

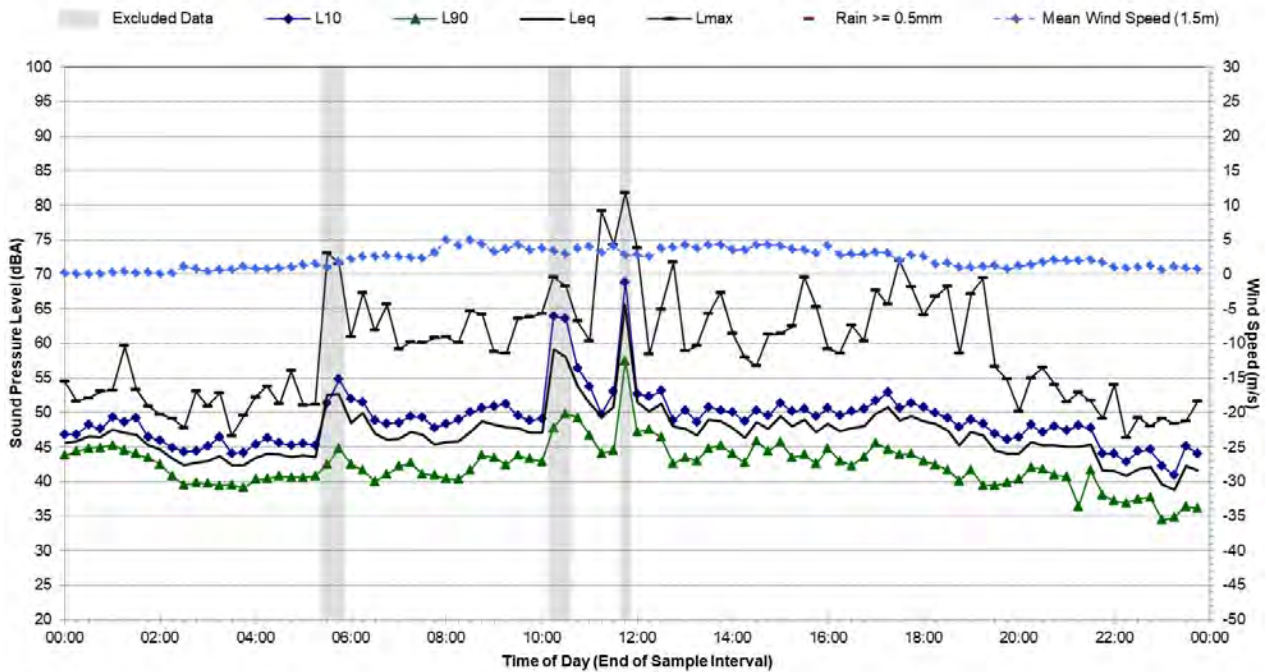
L08 - 91 Moore Side Drive, Telegraph Point - Saturday, 27 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

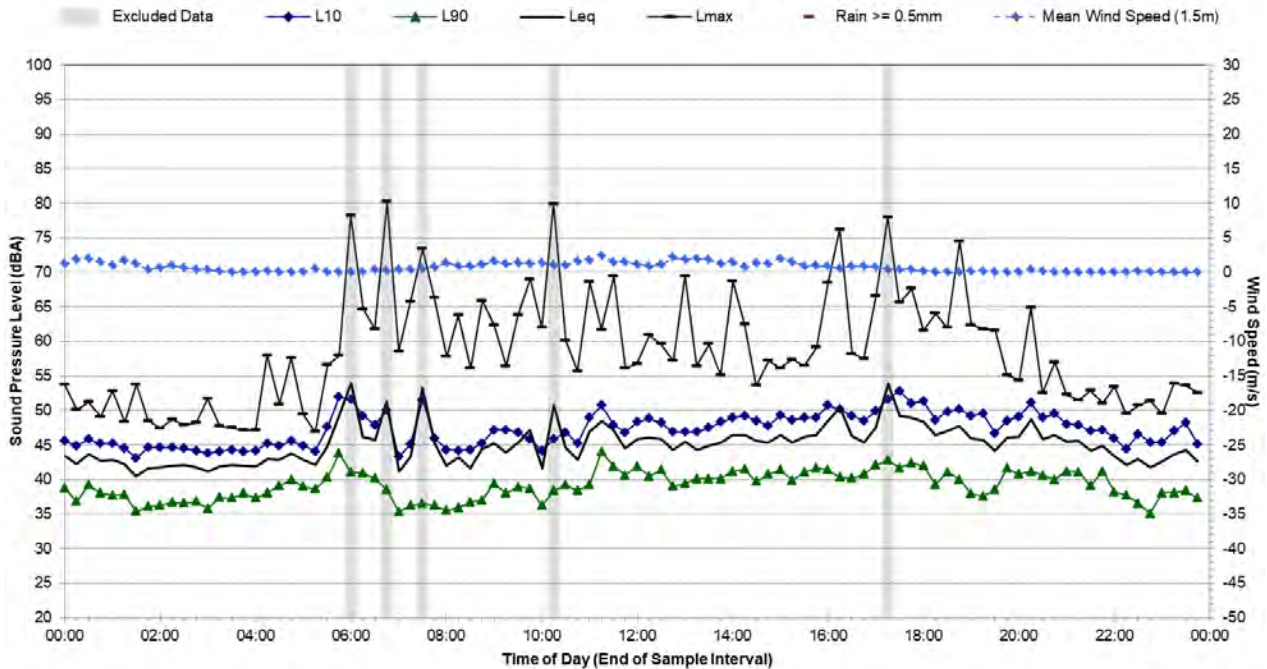
Statistical Ambient Noise Levels

L08 - 91 Moore Side Drive, Telegraph Point - Sunday, 28 October 2018



Statistical Ambient Noise Levels

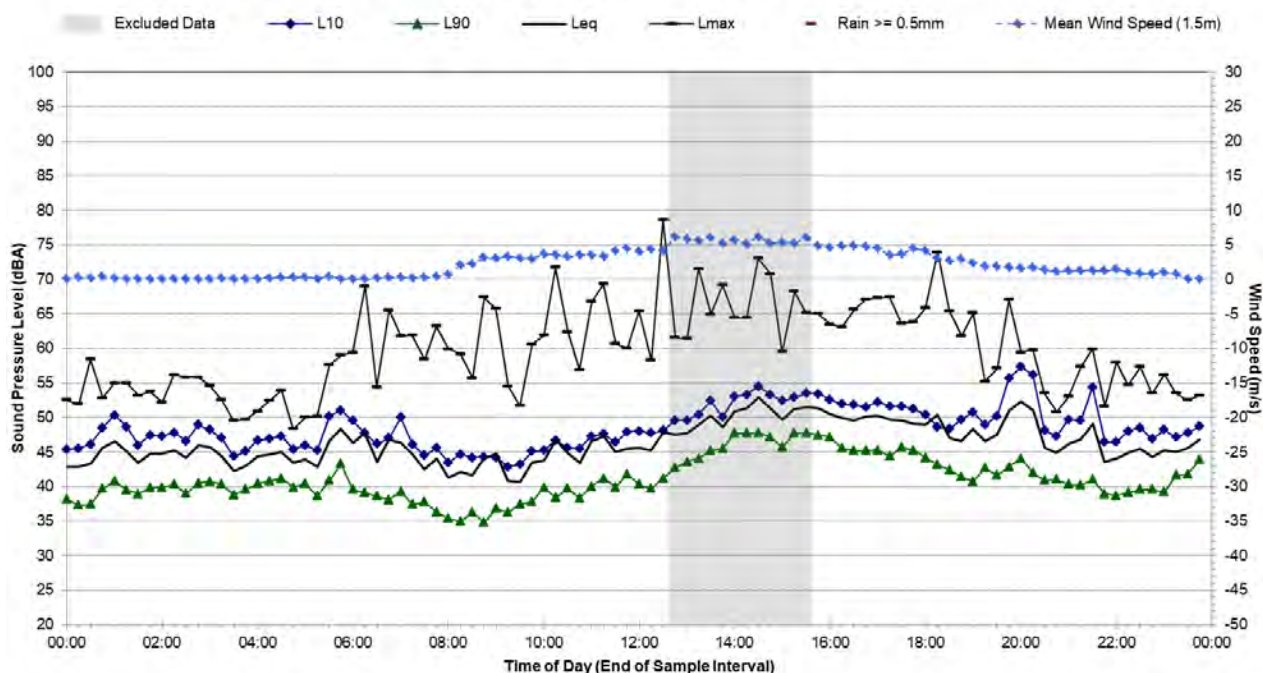
L08 - 91 Moore Side Drive, Telegraph Point - Monday, 29 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

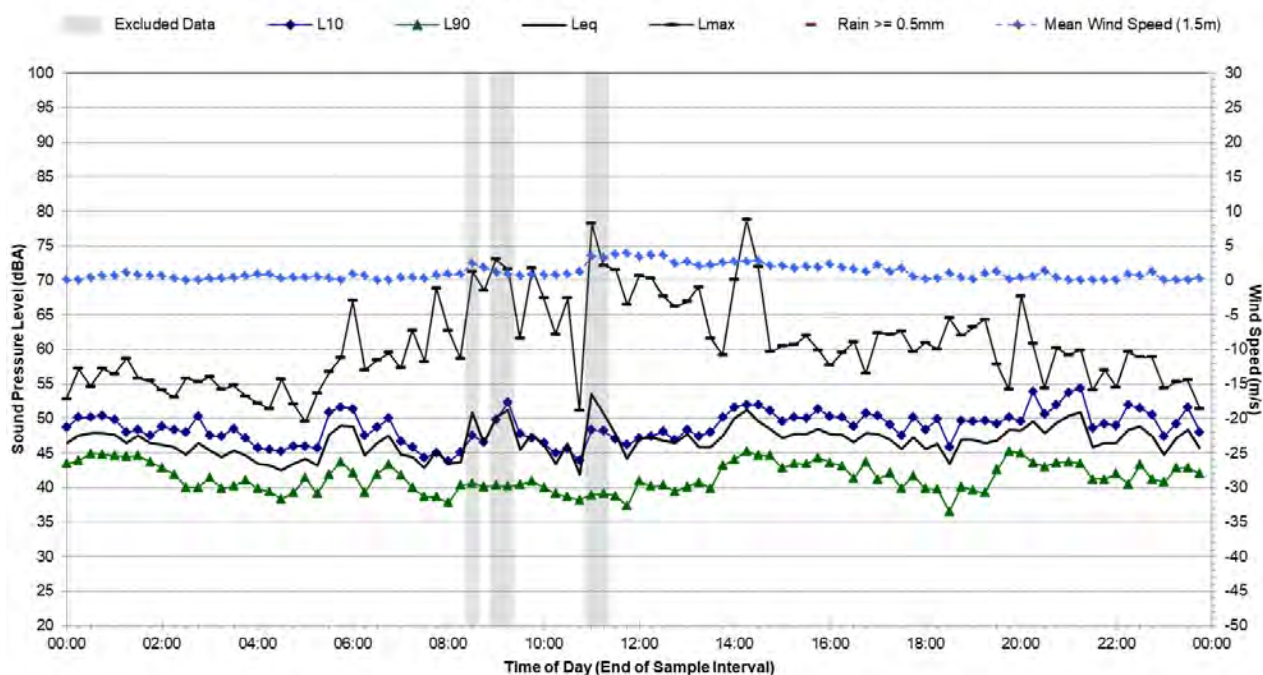
Statistical Ambient Noise Levels

L08 - 91 Moore Side Drive, Telegraph Point - Tuesday, 30 October 2018



Statistical Ambient Noise Levels

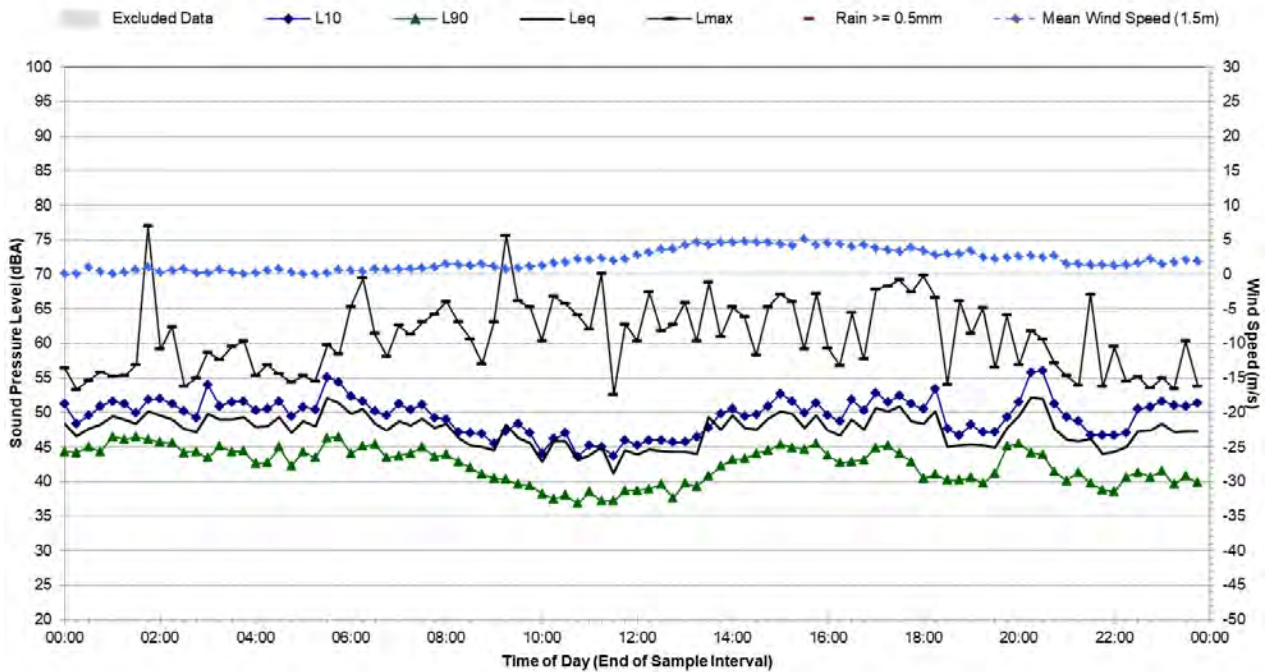
L08 - 91 Moore Side Drive, Telegraph Point - Wednesday, 31 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

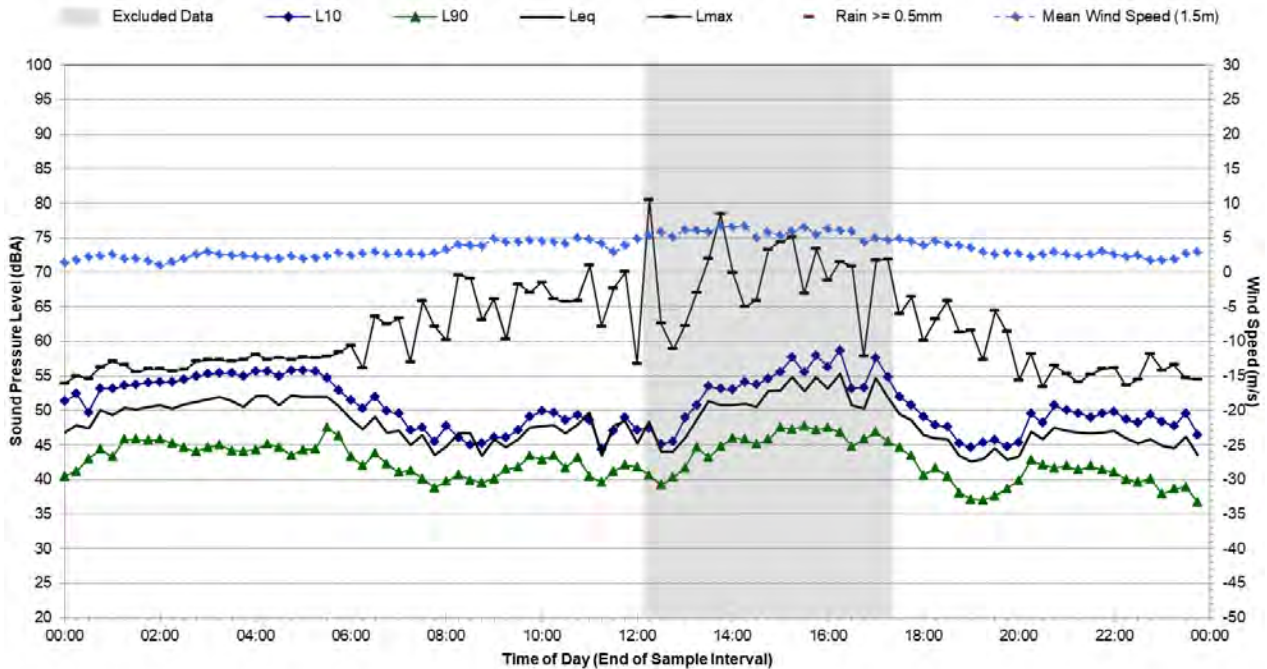
Statistical Ambient Noise Levels

L08 - 91 Moore Side Drive, Telegraph Point - Thursday, 1 November 2018



Statistical Ambient Noise Levels

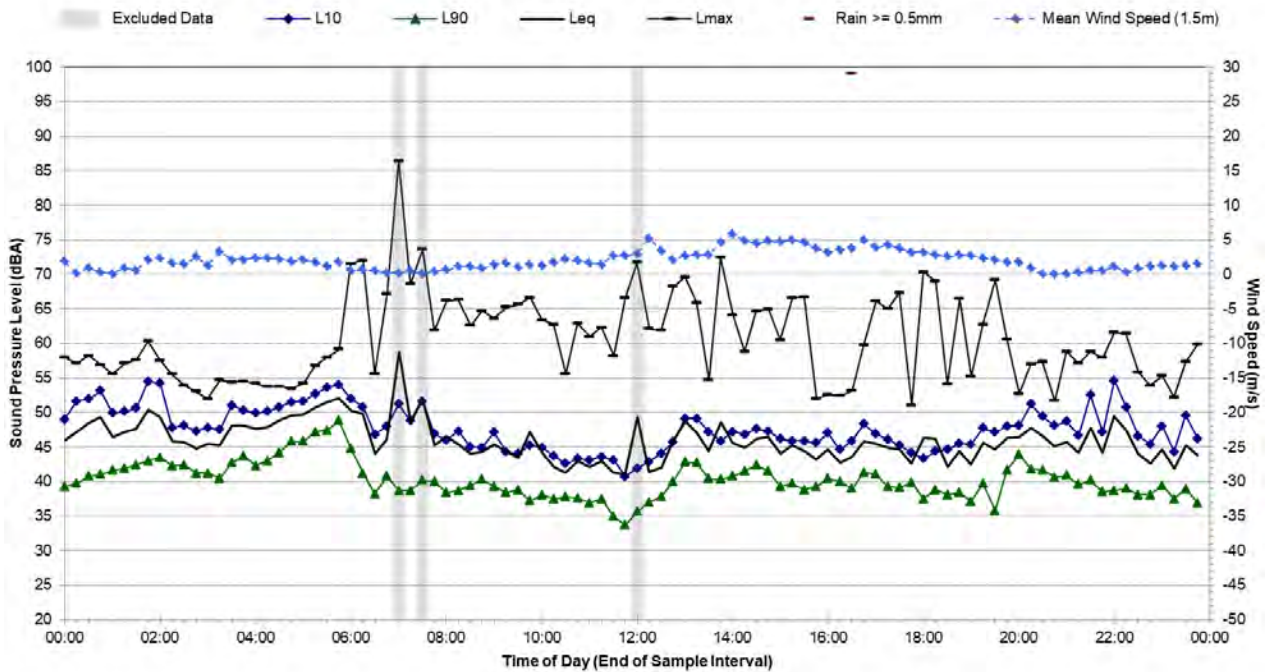
L08 - 91 Moore Side Drive, Telegraph Point - Friday, 2 November 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

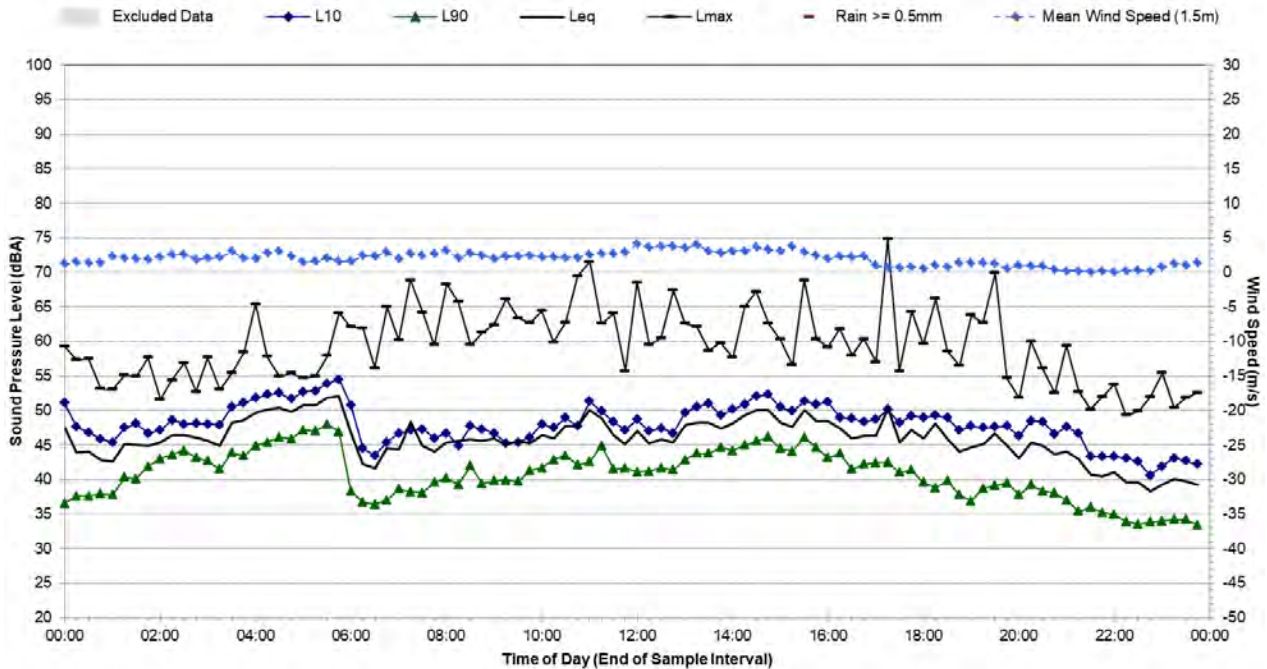
Statistical Ambient Noise Levels

L08 - 91 Moore Side Drive, Telegraph Point - Saturday, 3 November 2018



Statistical Ambient Noise Levels

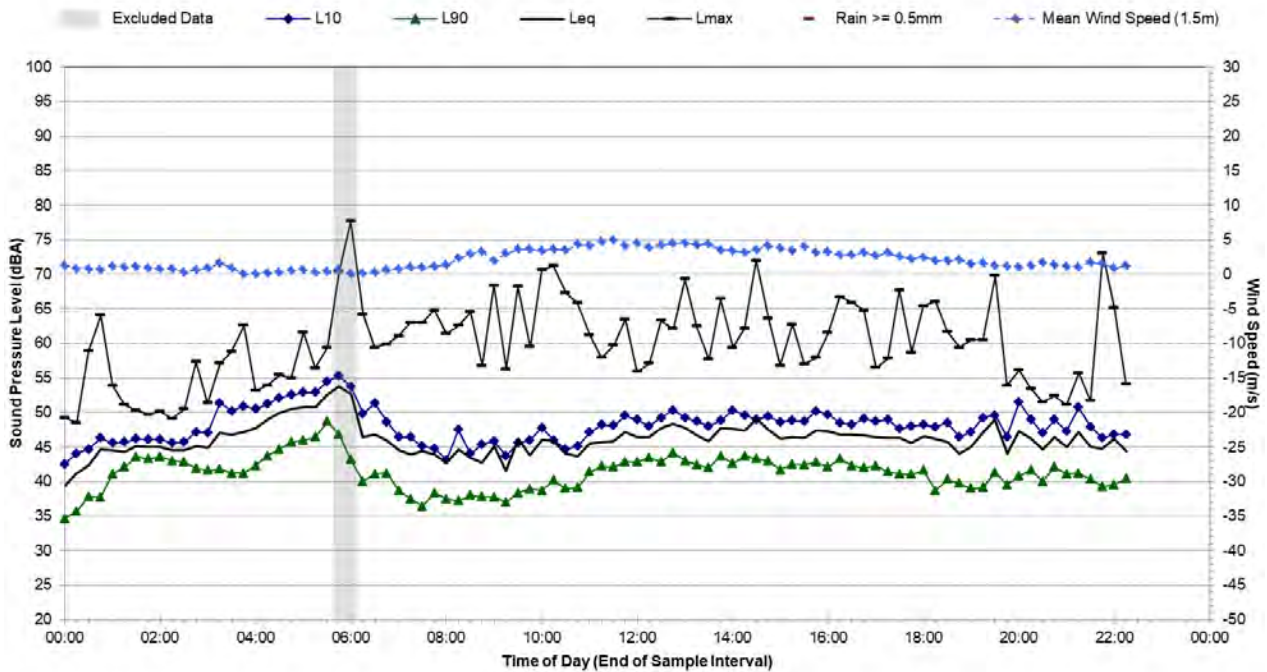
L08 - 91 Moore Side Drive, Telegraph Point - Sunday, 4 November 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

Statistical Ambient Noise Levels

L08 - 91 Moore Side Drive, Telegraph Point - Monday, 5 November 2018

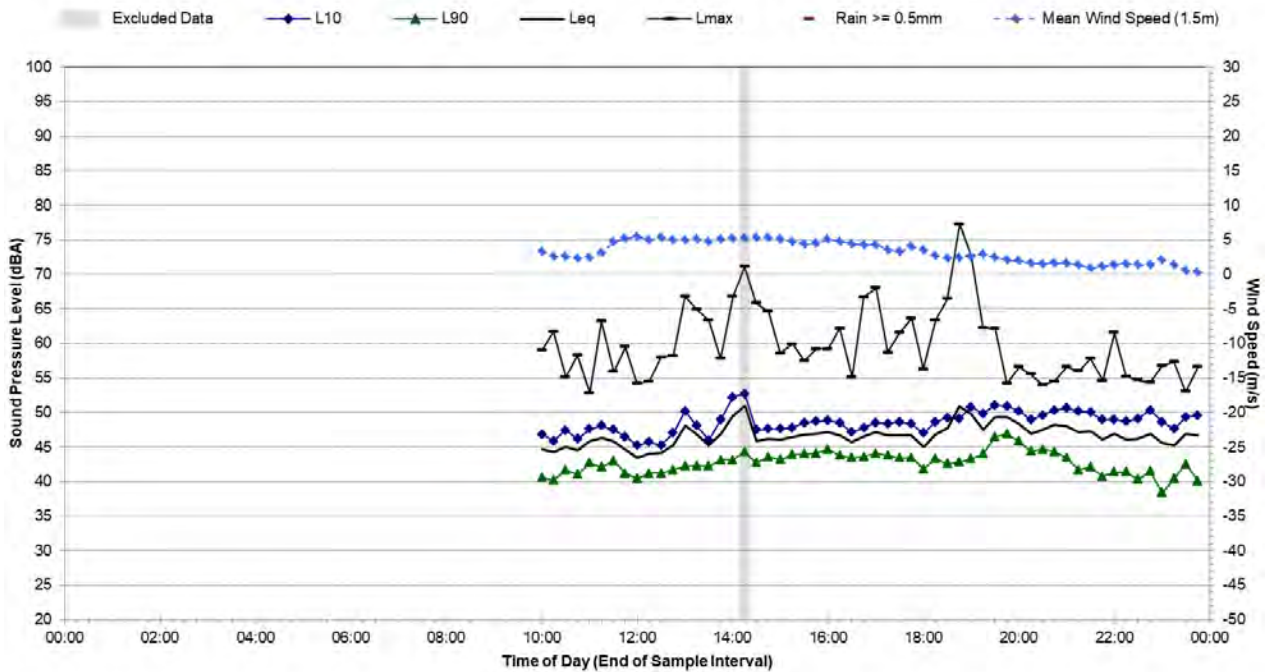


Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

Noise Monitoring Location	L.09				Map of Noise Monitoring Location
Noise Monitoring Address	Address: 61 Hosking Road, Blackman's Point				
Logger Device Type: ARL NGARA, Logger Serial: 87807D Sound Level Meter Device Type: Brüel and Kjær 2270, Sound Level Meter Serial No: 2414604					
Recorded Noise Levels (LAmax): 23/10/2018: Light vehicle traffic: 40-46 dBA, Truck passbys: 47-55, Birds: 49-62, Bugs: 44. 06/11/2018: Truck passbys: 45-51, Dogs barking: 42-43, Bugs: 42-46, Background: 39.					
Ambient Noise Logging Results – NPfI Defined Time Periods					Photo of Noise Monitoring Location
Monitoring Period	Noise Level (dBA)				
	RBL	LAeq	L10	L1	
Daytime	41	48	48	53	
Evening	41	48	50	53	
Night-time	37	48	50	52	
Ambient Noise Logging Results – RNP Defined Time Periods					
Monitoring Period	Noise Level (dBA)				
	LAeq(period)		LAeq(1hour)		
Daytime (7am-10pm)	48		51		
Night-time (10pm-7am)	48		51		
Attended Noise Measurement Results					
Date	Start Time	Measured Noise Level (dBA)			
		LA90	LAeq	LAmax	
23/10/2018	09:30	41	45	62	
06/11/2018	02:50	40	46	59	

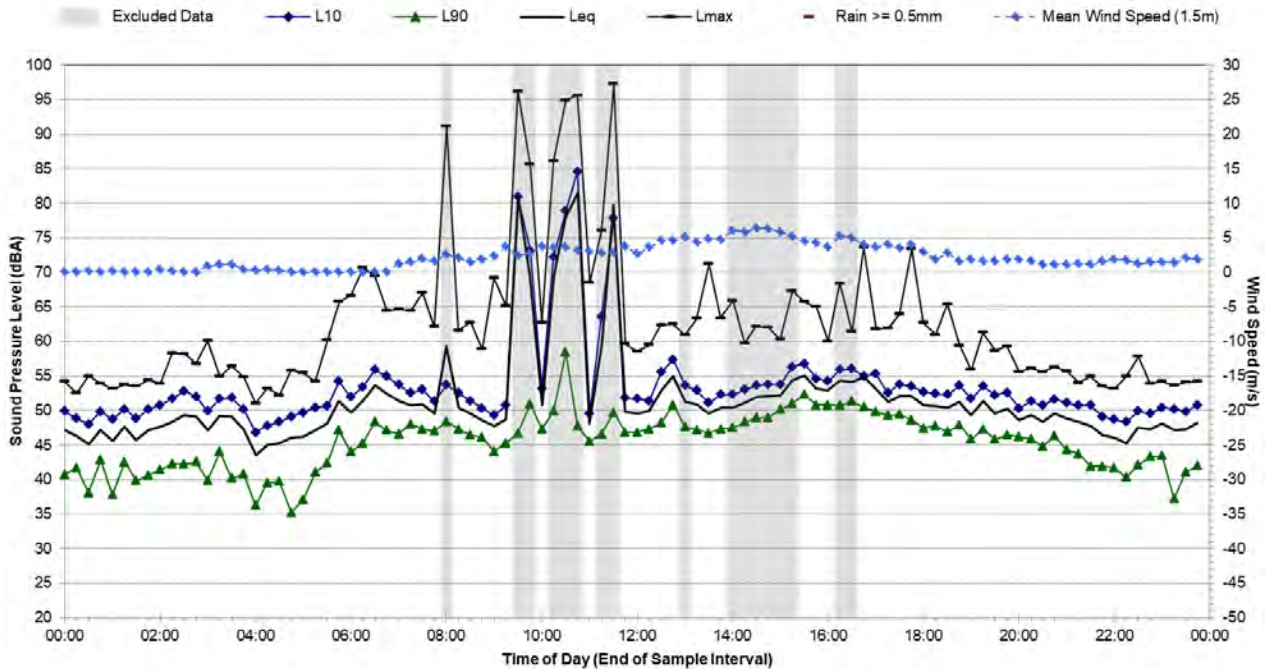
Statistical Ambient Noise Levels

L09 - 61 Hosking Road, Blackman's Point - Tuesday, 23 October 2018



Statistical Ambient Noise Levels

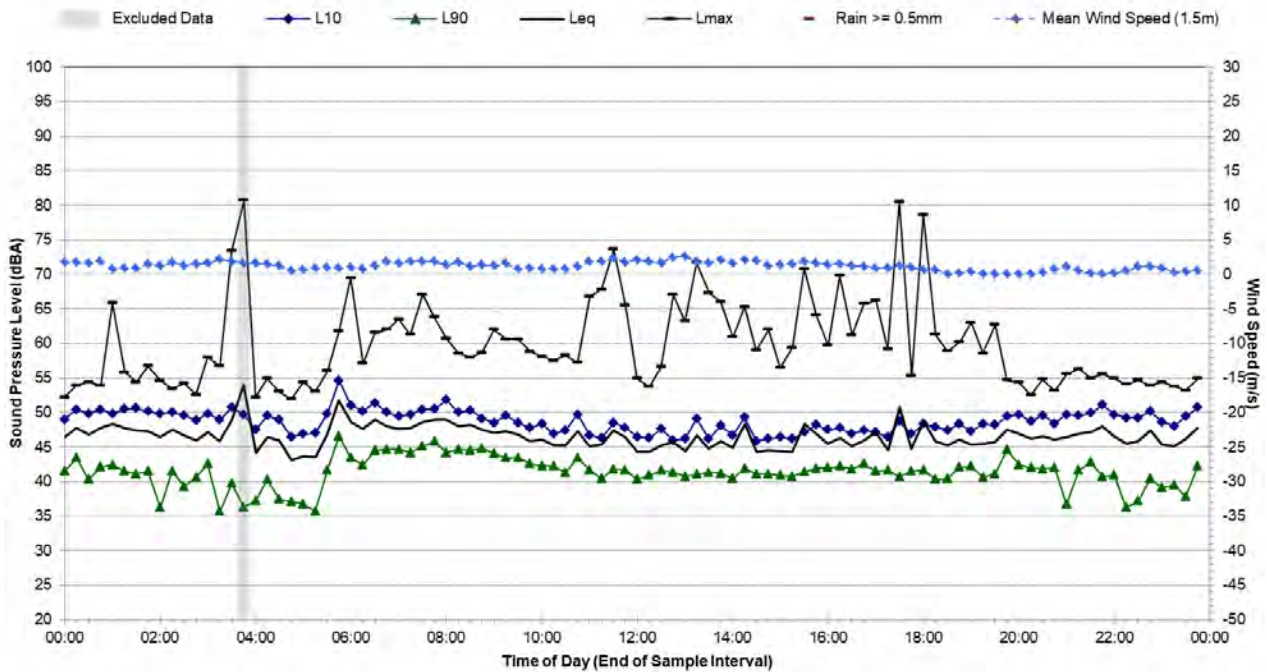
L09 - 61 Hosking Road, Blackman's Point - Wednesday, 24 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

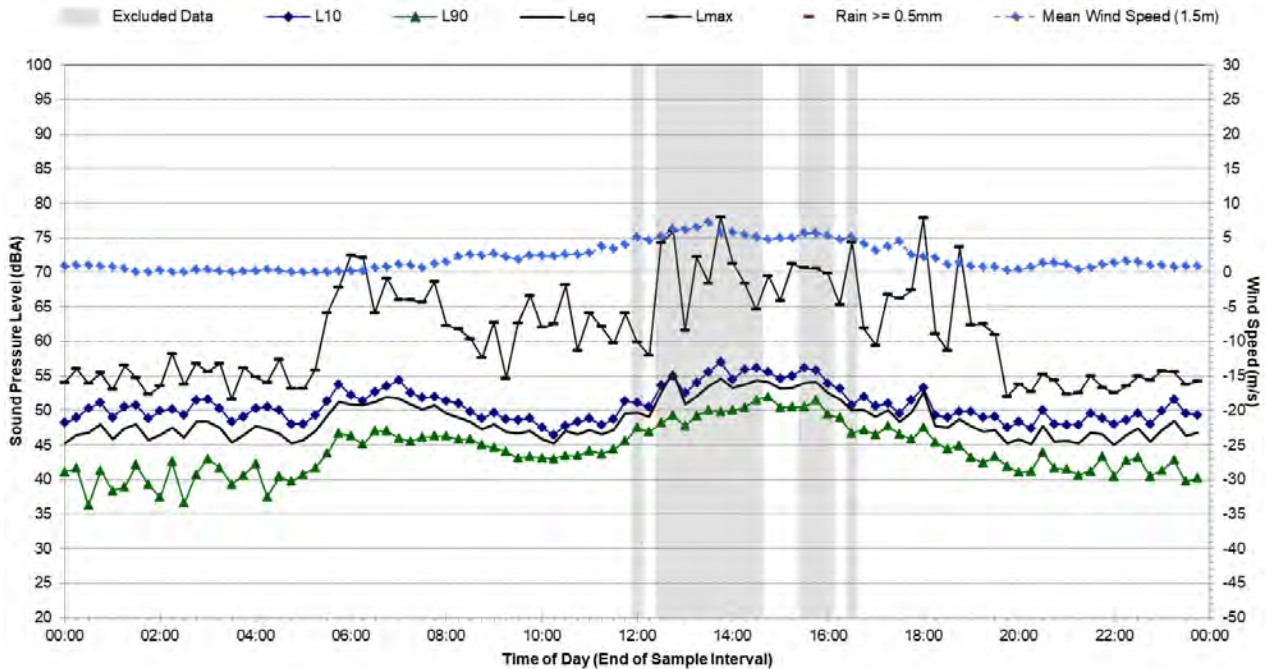
Statistical Ambient Noise Levels

L09 - 61 Hosking Road, Blackman's Point - Thursday, 25 October 2018



Statistical Ambient Noise Levels

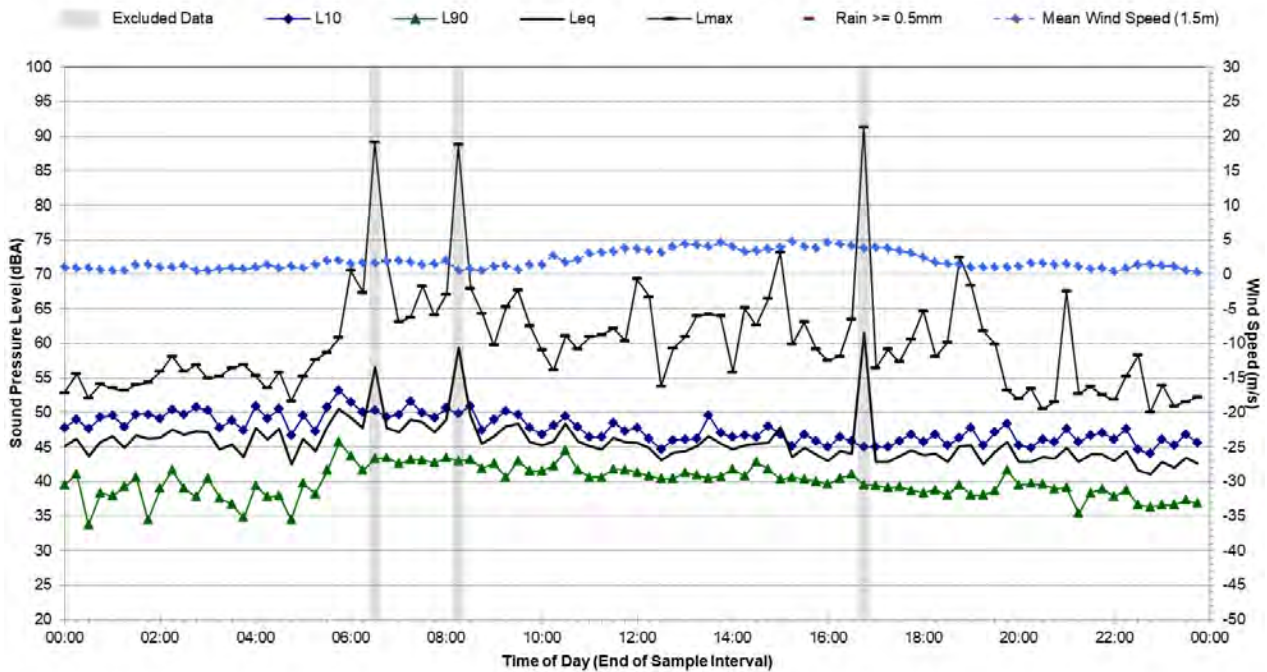
L09 - 61 Hosking Road, Blackman's Point - Friday, 26 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

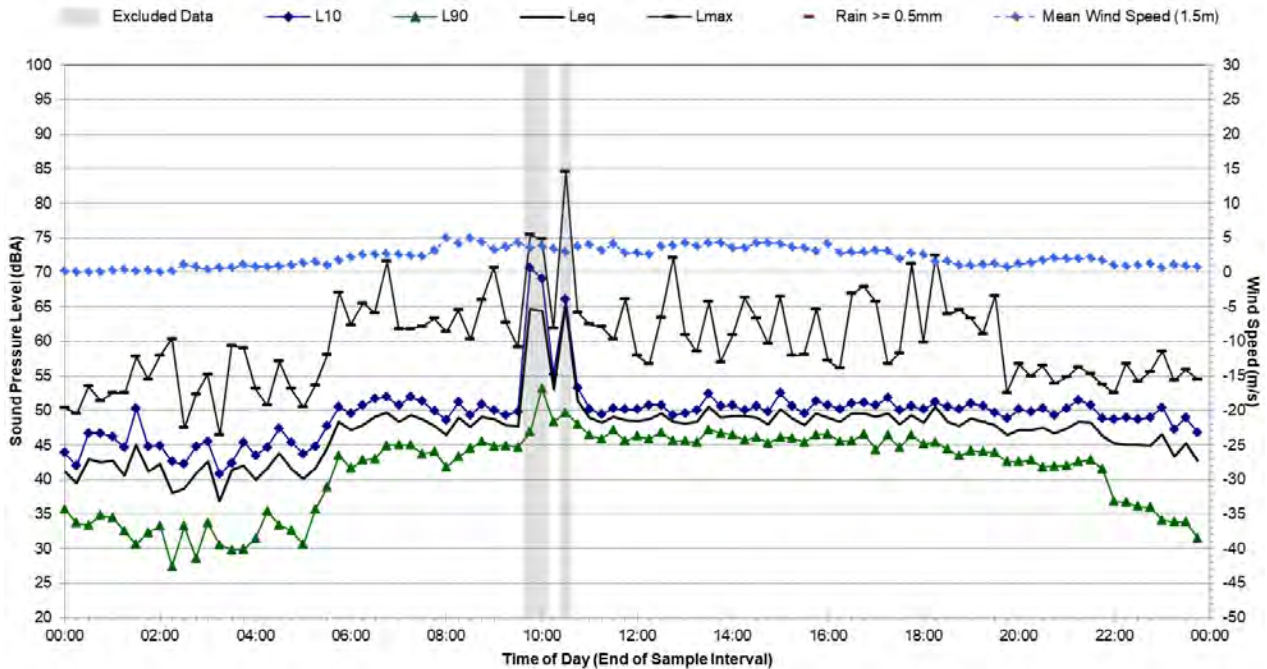
Statistical Ambient Noise Levels

L09 - 61 Hosking Road, Blackman's Point - Saturday, 27 October 2018



Statistical Ambient Noise Levels

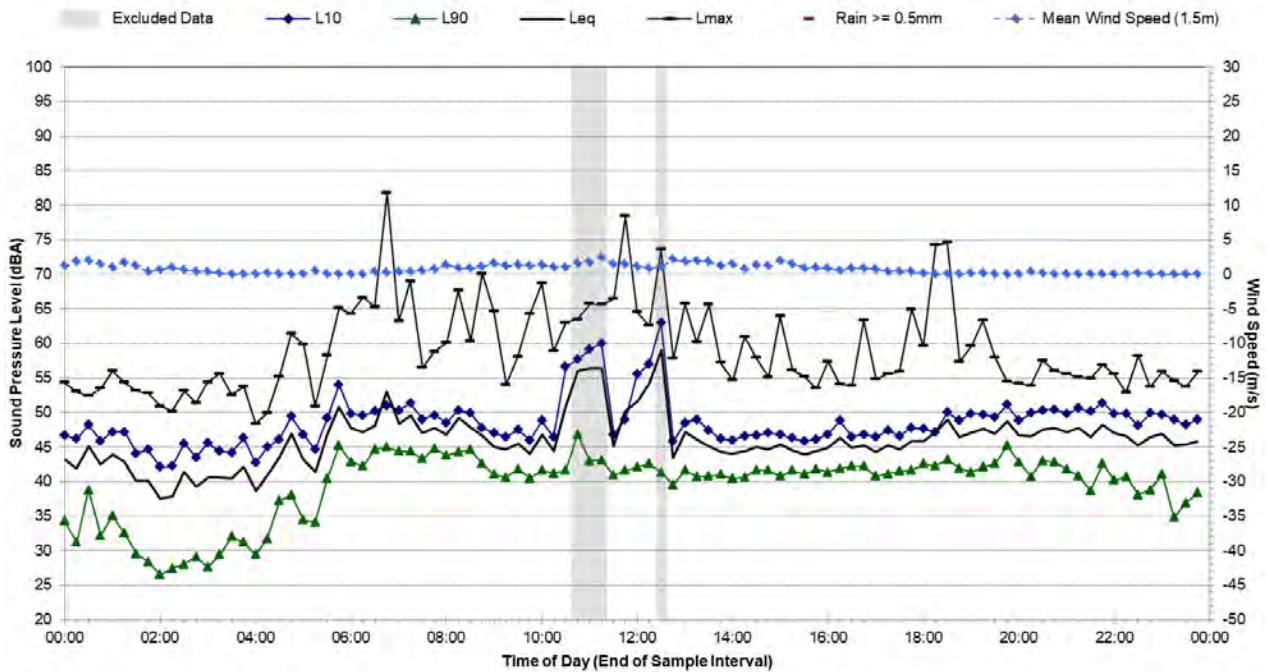
L09 - 61 Hosking Road, Blackman's Point - Sunday, 28 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

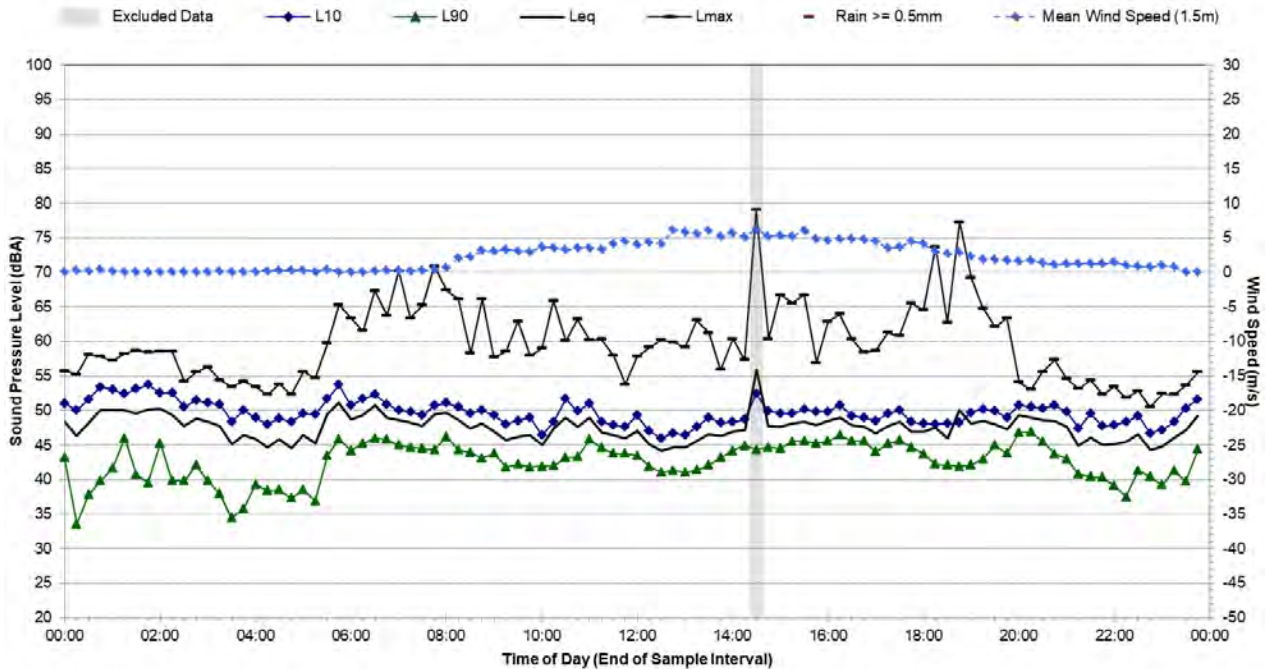
Statistical Ambient Noise Levels

L09 - 61 Hosking Road, Blackman's Point - Monday, 29 October 2018



Statistical Ambient Noise Levels

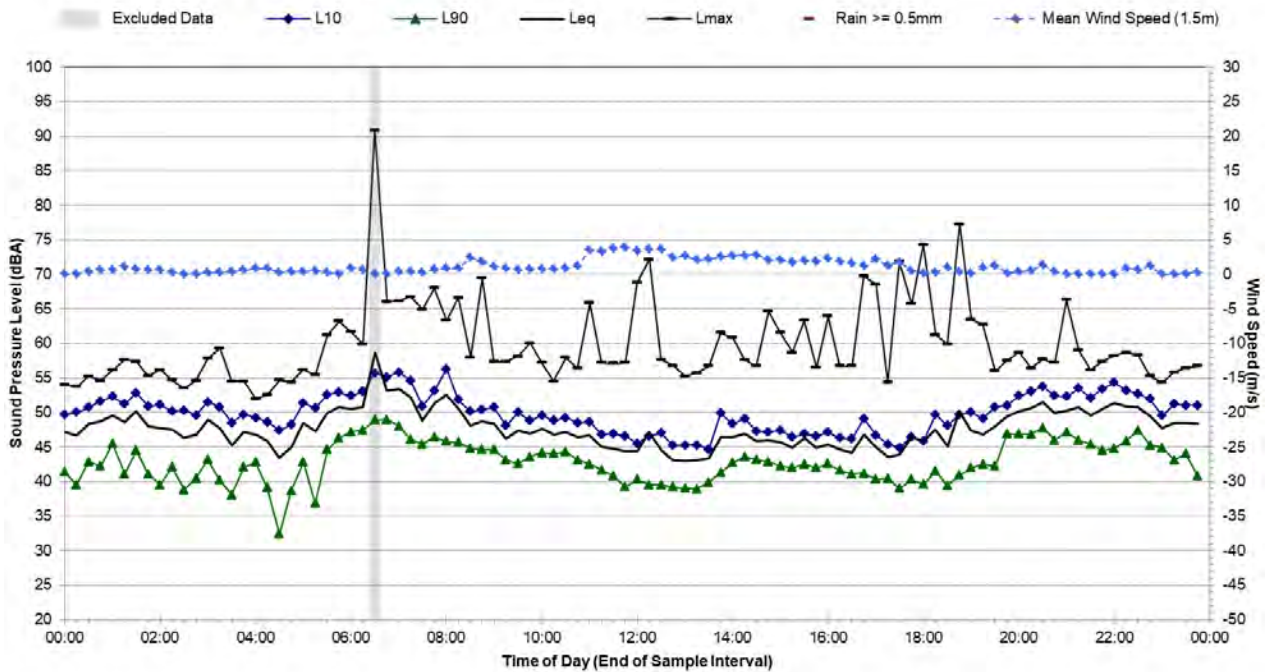
L09 - 61 Hosking Road, Blackman's Point - Tuesday, 30 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

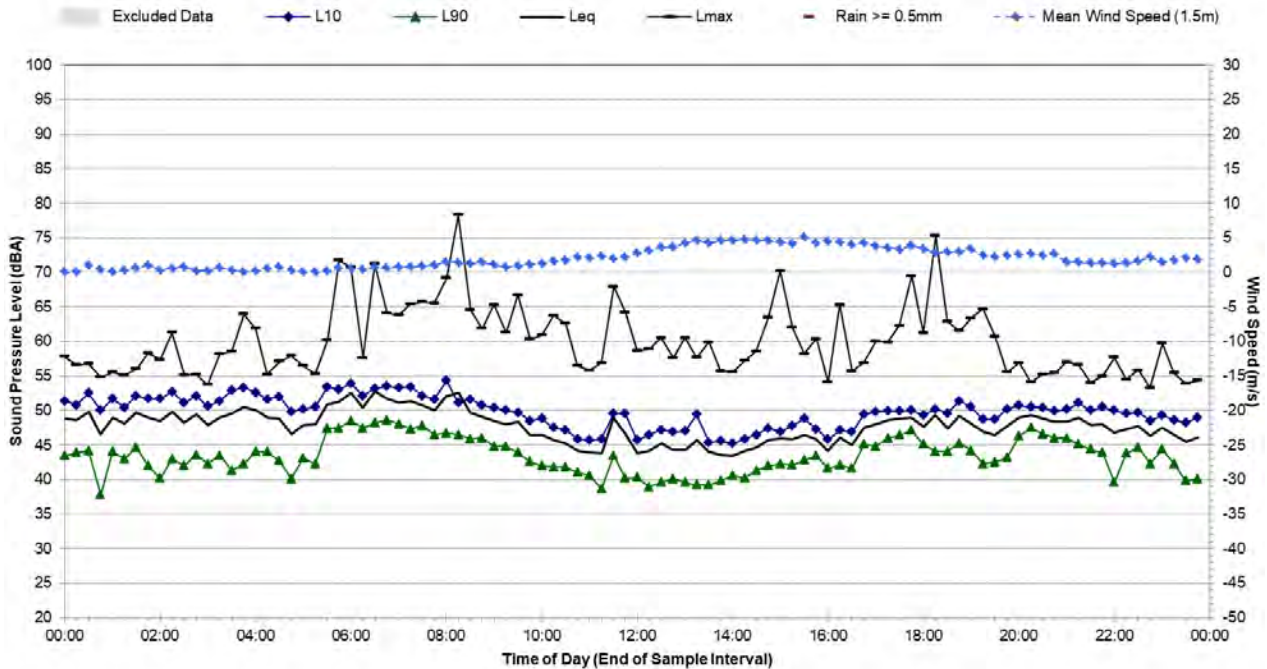
Statistical Ambient Noise Levels

L09 - 61 Hosking Road, Blackman's Point - Wednesday, 31 October 2018



Statistical Ambient Noise Levels

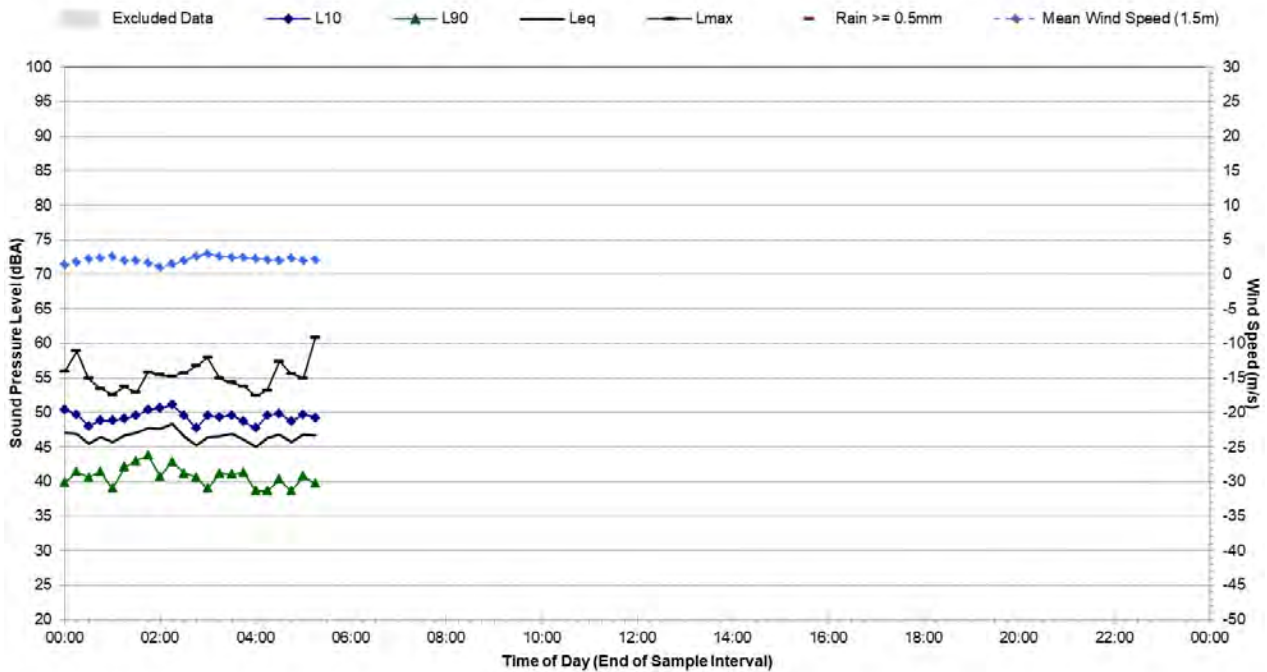
L09 - 61 Hosking Road, Blackman's Point - Thursday, 1 November 2018





Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

Statistical Ambient Noise Levels

L09 - 61 Hosking Road, Blackman's Point - Friday, 2 November 2018

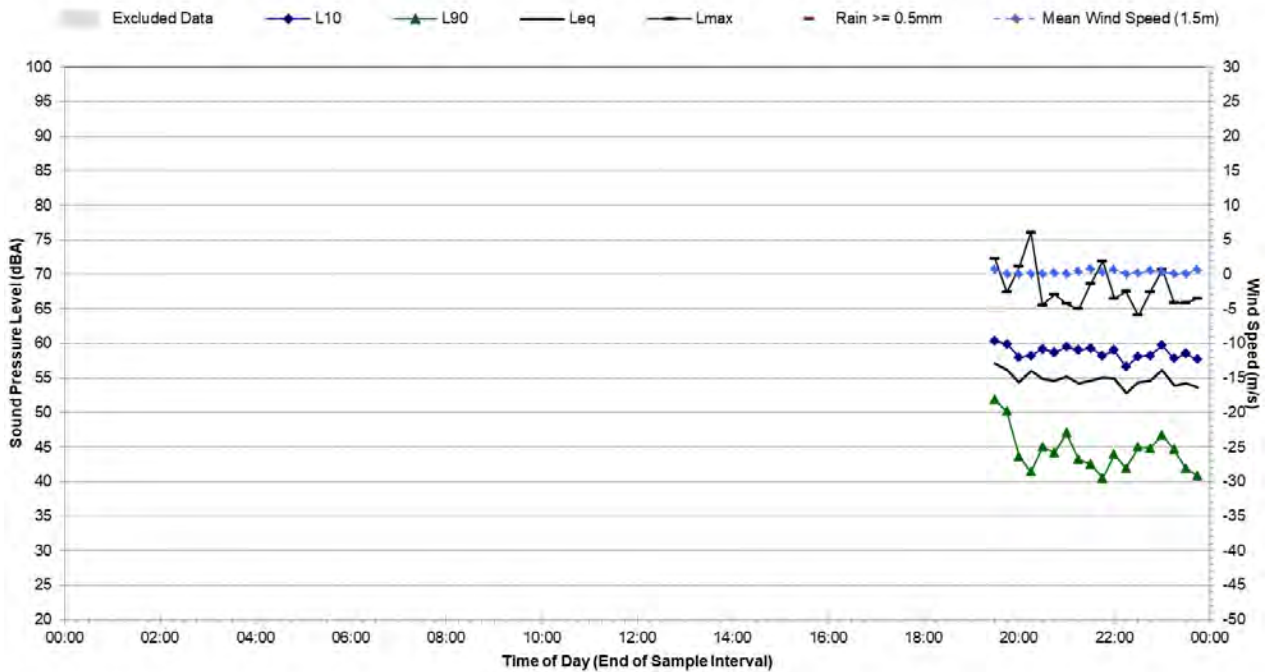


Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

Noise Monitoring Location	L.10				Map of Noise Monitoring Location	
Noise Monitoring Address	19 Glen Ewan Road, Sancrox					
Logger Device Type: ARL NGARA, Logger Serial: 878007 Sound Level Meter Device Type: Brüel and Kjær 2270, Sound Level Meter Serial No: 2414604						
Recorded Noise Levels (LAmax): 22/10/2018: Light vehicle traffic: 55 dBA, Truck passbys: 57-65 dBA, Dog barking: 56-58, Background: 43-45. 06/11/2018: Light vehicle traffic: 51-54 dBA, Truck passbys: 55-68 dBA, Background: 35-40 dBA.						
Ambient Noise Logging Results – NPfI Defined Time Periods					Photo of Noise Monitoring Location	
Monitoring Period	Noise Level (dBA)					
	RBL	LAeq	L10	L1		
Daytime	45	55	56	62		
Evening	41	54	58	63		
Night-time	37	53	57	63		
Ambient Noise Logging Results – RNP Defined Time Periods						
Monitoring Period	Noise Level (dBA)					
	LAeq(period)		LAeq(1hour)			
Daytime (7am-10pm)	54		56			
Night-time (10pm-7am)	53		56			
Attended Noise Measurement Results						
Date	Start Time	Measured Noise Level (dBA)				
		LA90	LAeq	LAmax		
22/10/2018	19:24	51	56	67		
22/10/2018	19:40	46	54	65		
06/11/2018	02:15	42	54	72		
06/11/2018	02:30	37	53	76		

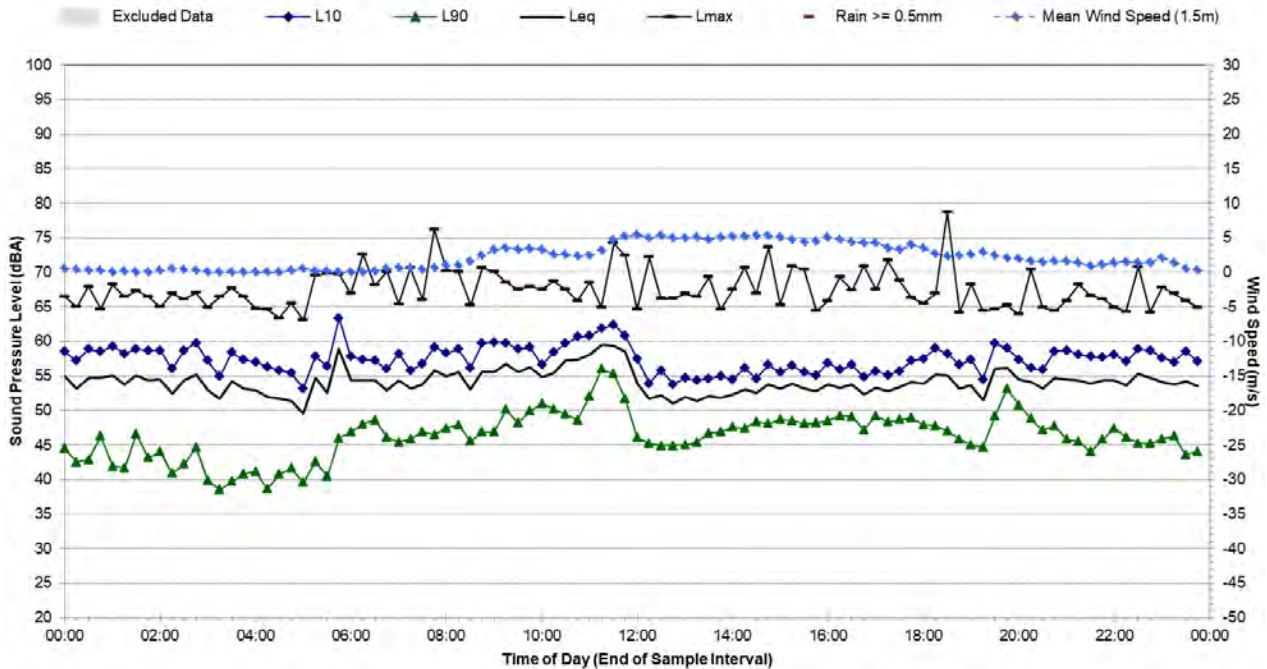
Statistical Ambient Noise Levels

L10 - 19 Glen Ewan Road, Sancrox - Monday, 22 October 2018



Statistical Ambient Noise Levels

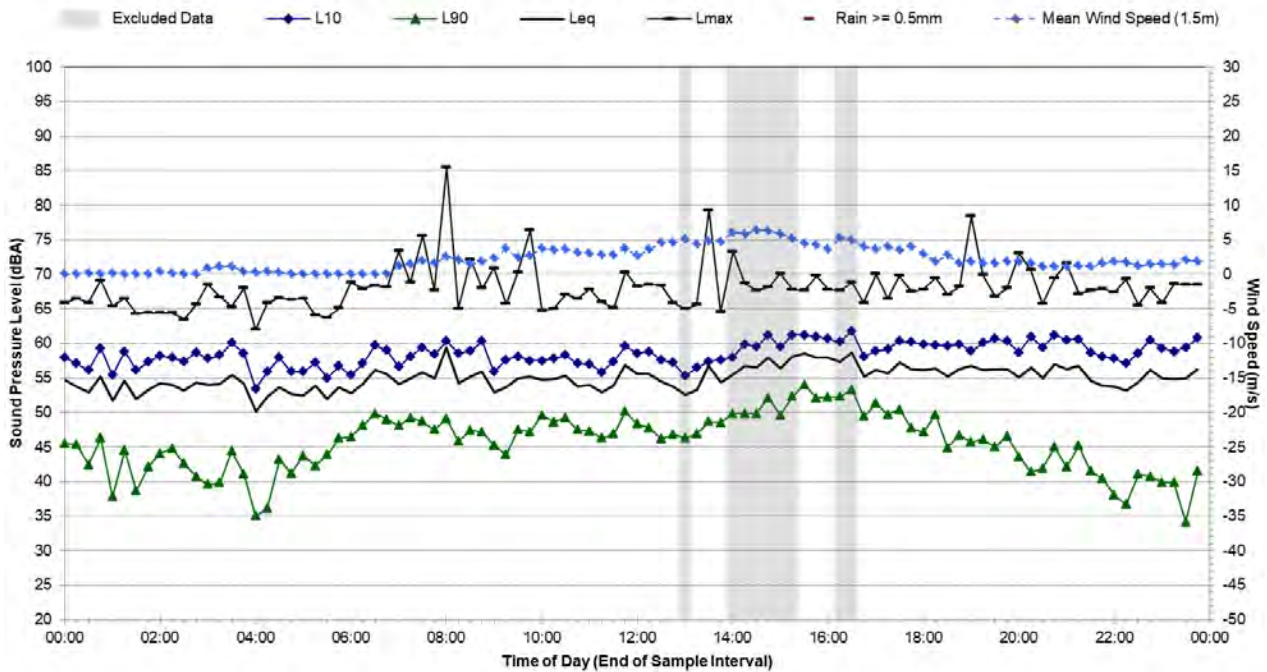
L10 - 19 Glen Ewan Road, Sancrox - Tuesday, 23 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

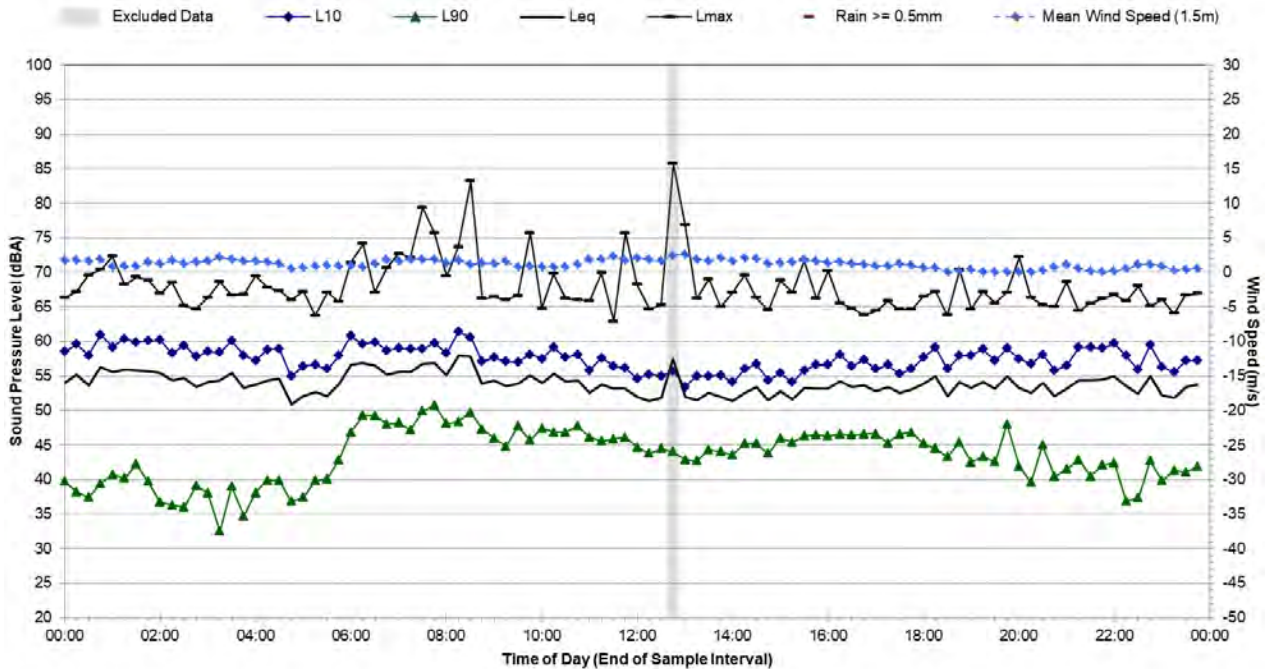
Statistical Ambient Noise Levels

L10 - 19 Glen Ewan Road, Sancrox - Wednesday, 24 October 2018



Statistical Ambient Noise Levels

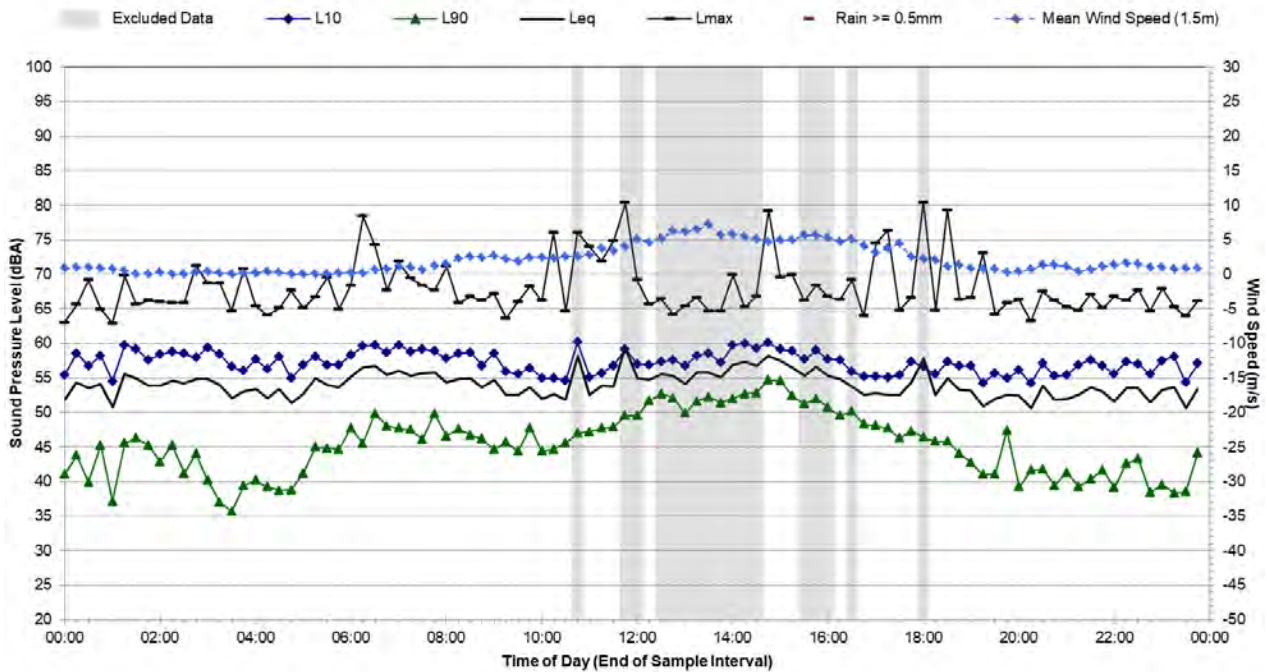
L10 - 19 Glen Ewan Road, Sancrox - Thursday, 25 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

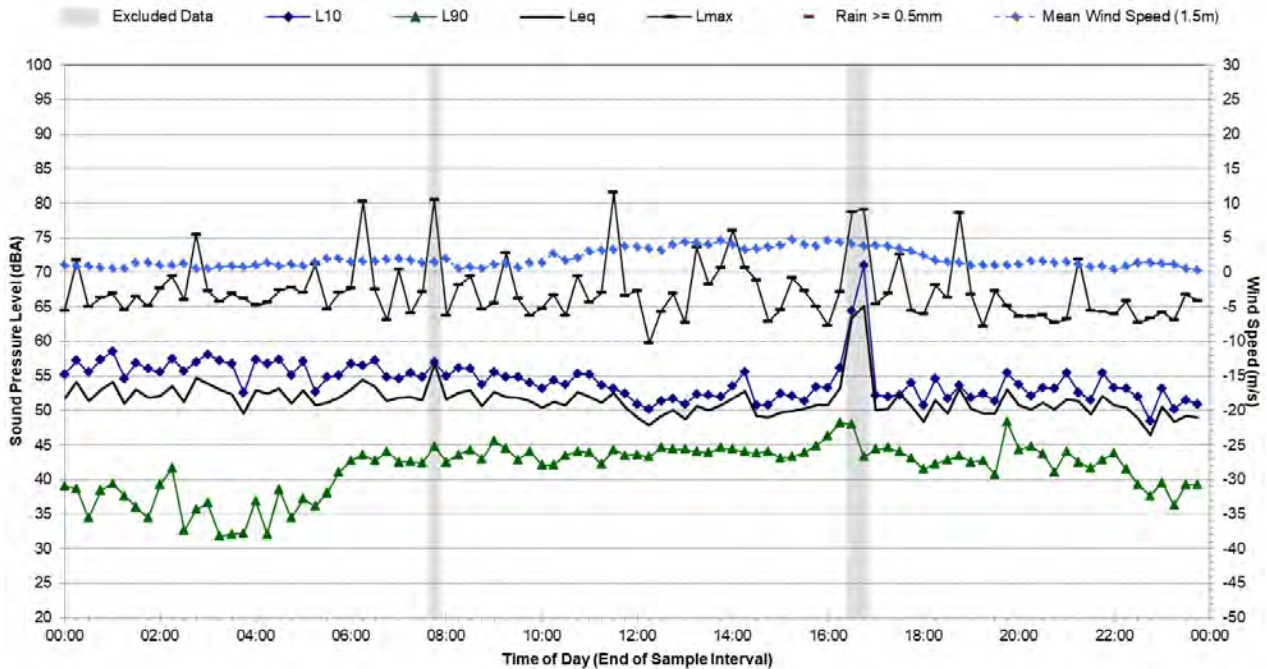
Statistical Ambient Noise Levels

L10 - 19 Glen Ewan Road, Sancrox - Friday, 26 October 2018



Statistical Ambient Noise Levels

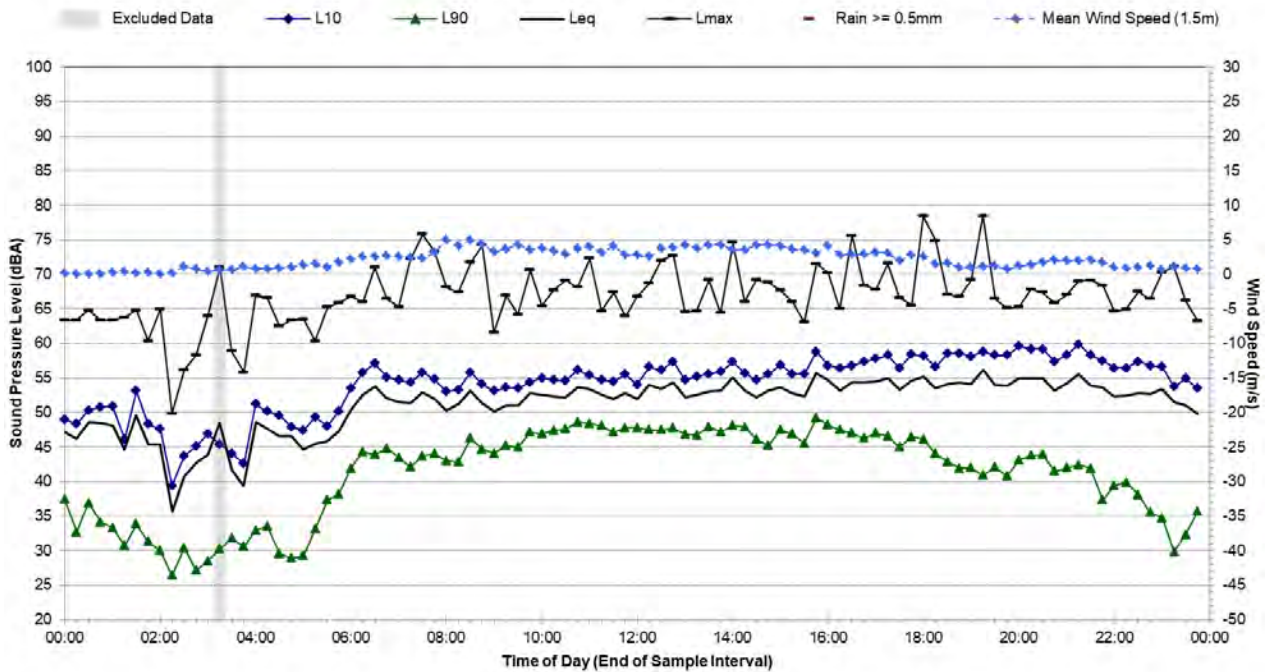
L10 - 19 Glen Ewan Road, Sancrox - Saturday, 27 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

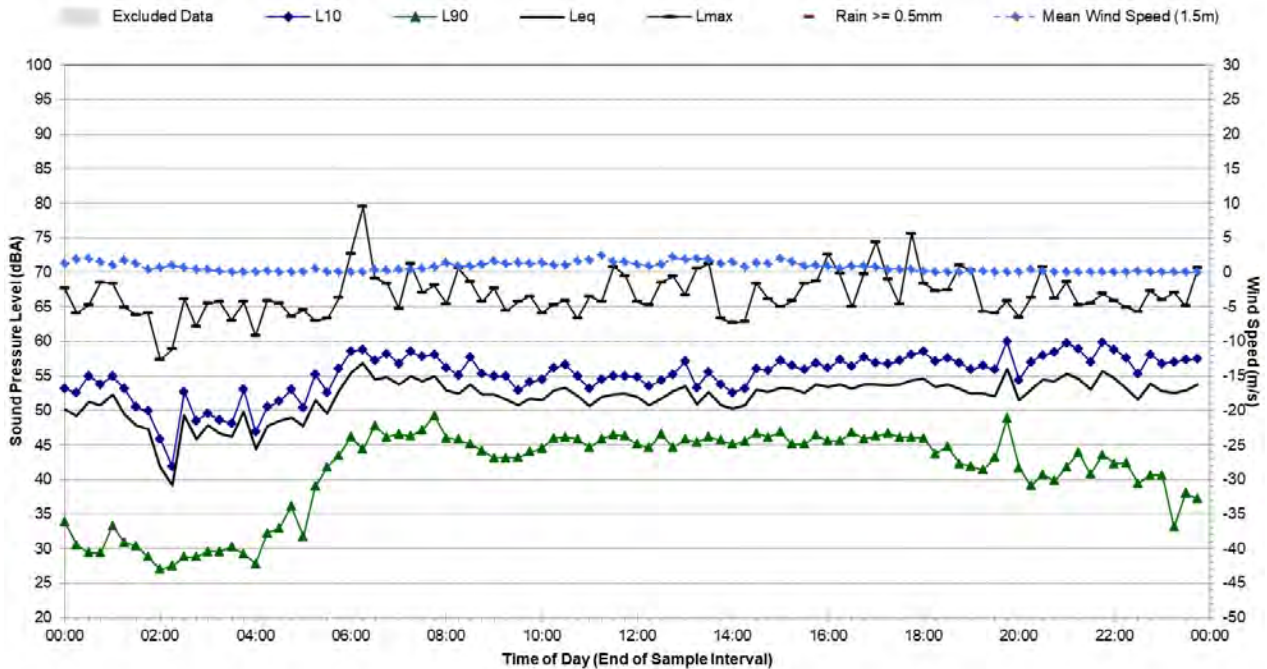
Statistical Ambient Noise Levels

L10 - 19 Glen Ewan Road, Sancrox - Sunday, 28 October 2018



Statistical Ambient Noise Levels

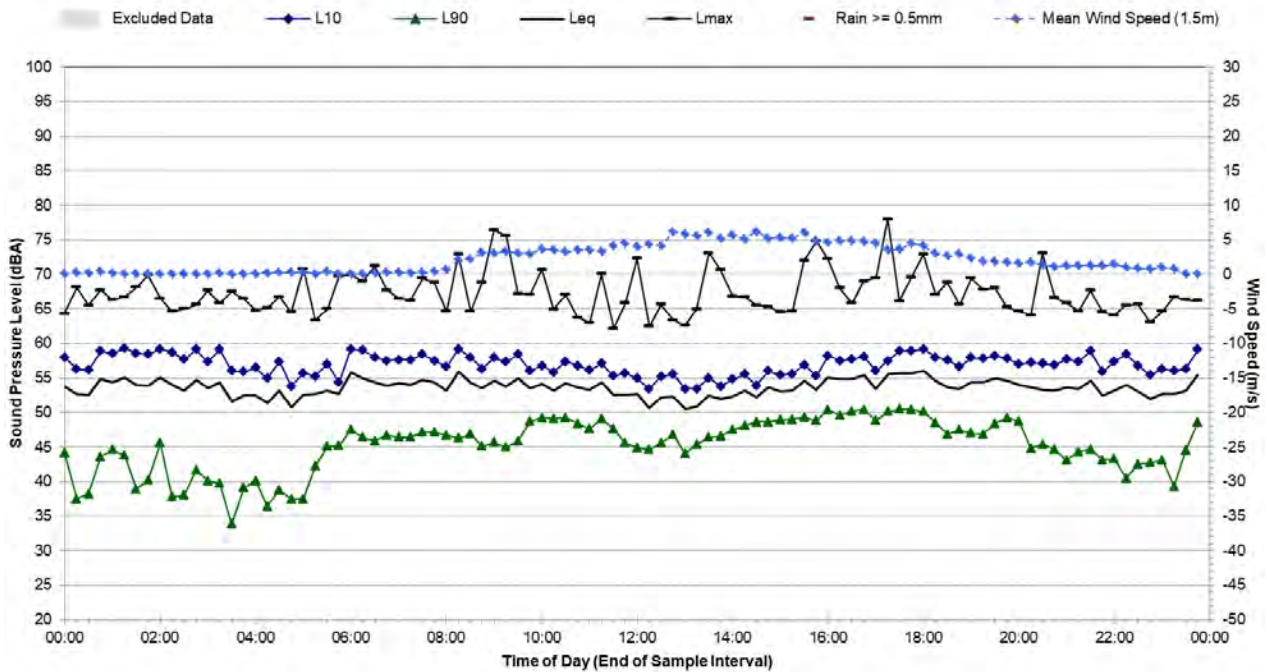
L10 - 19 Glen Ewan Road, Sancrox - Monday, 29 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

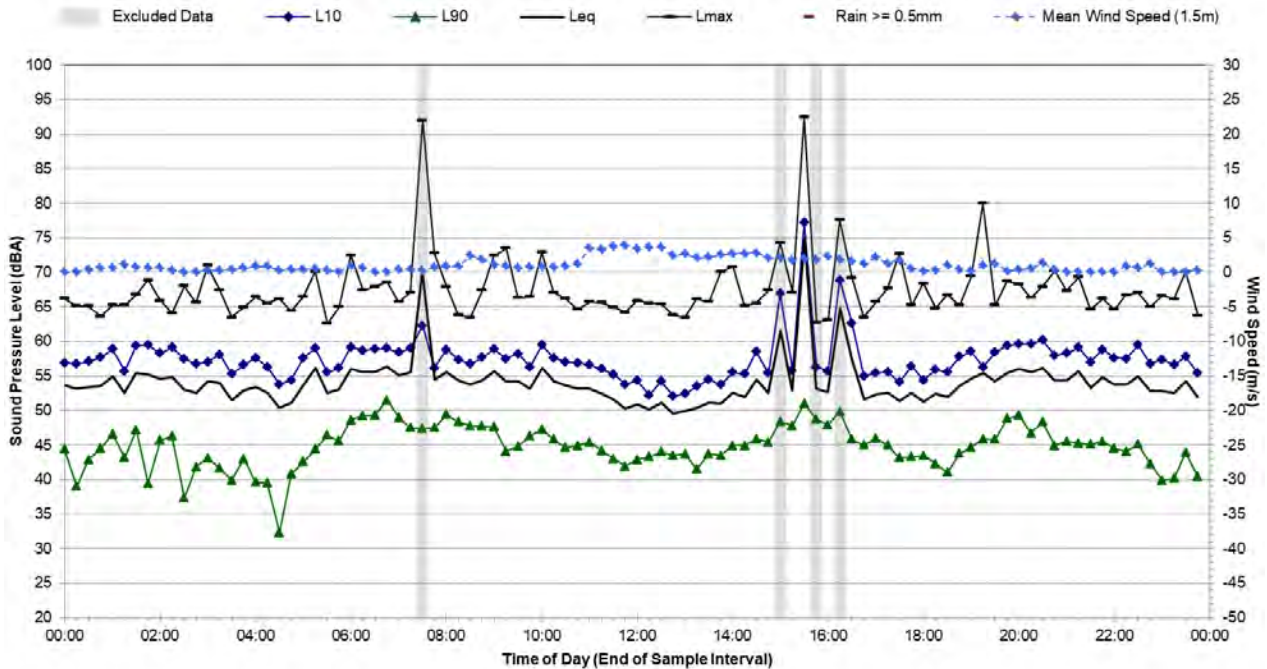
Statistical Ambient Noise Levels

L10 - 19 Glen Ewan Road, Sancrox - Tuesday, 30 October 2018



Statistical Ambient Noise Levels

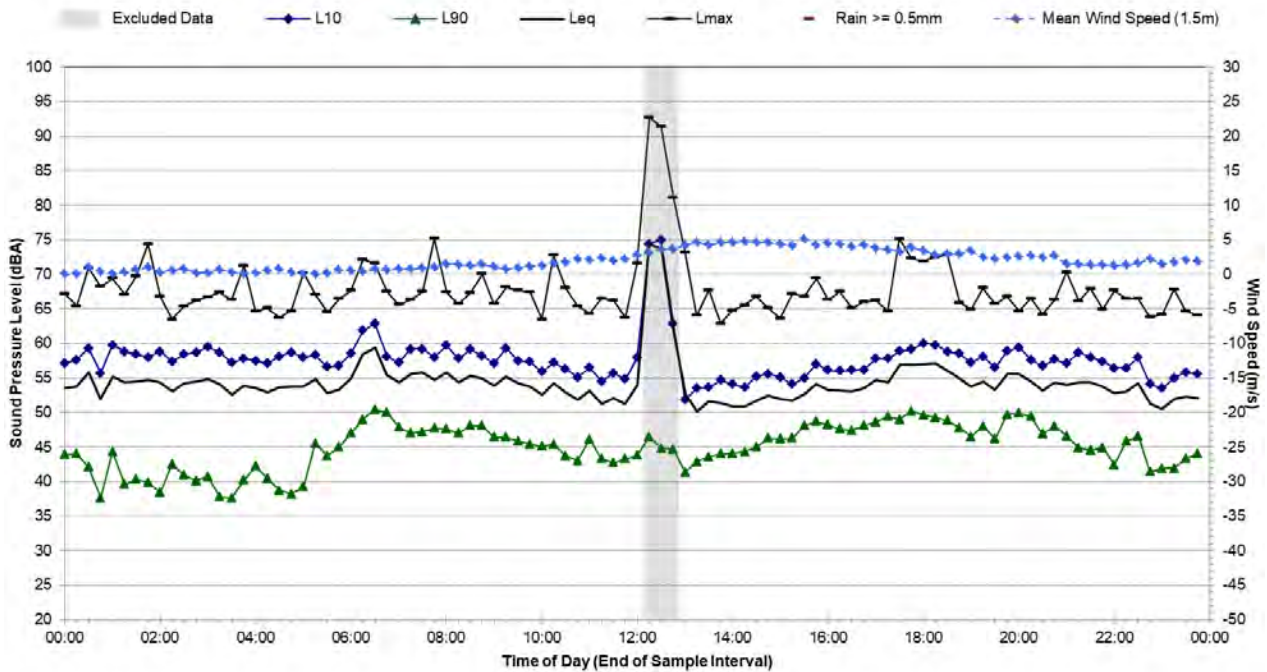
L10 - 19 Glen Ewan Road, Sancrox - Wednesday, 31 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

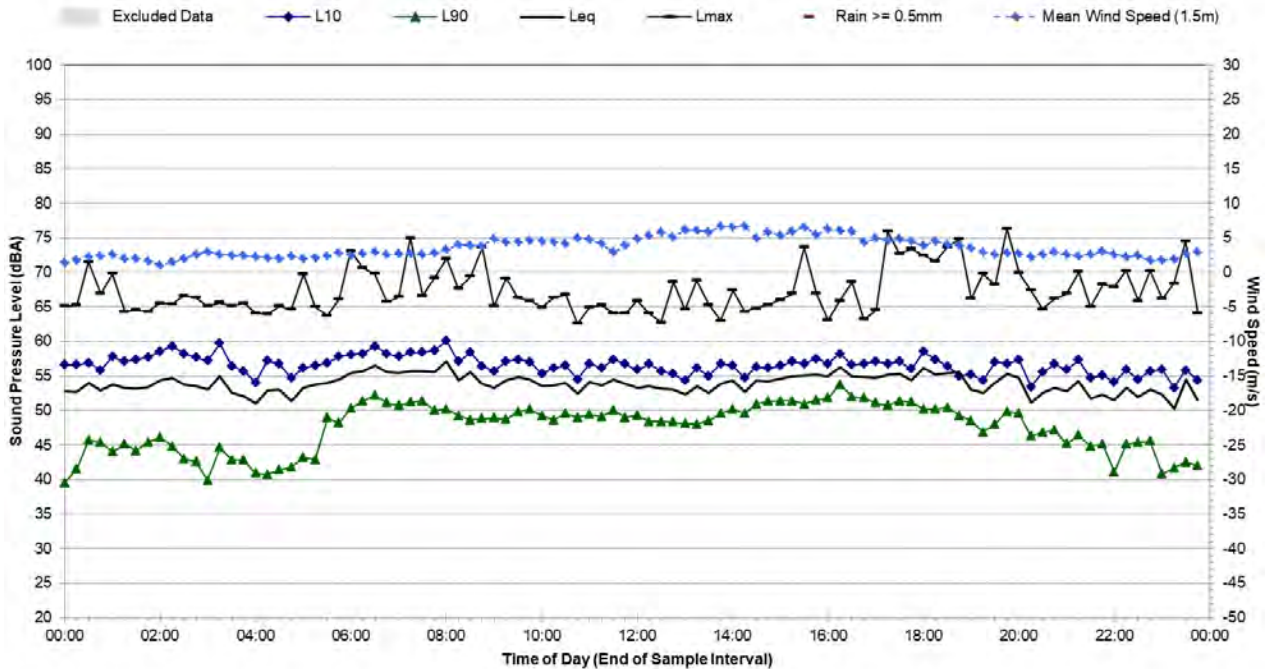
Statistical Ambient Noise Levels

L10 - 19 Glen Ewan Road, Sancrox - Thursday, 1 November 2018



Statistical Ambient Noise Levels

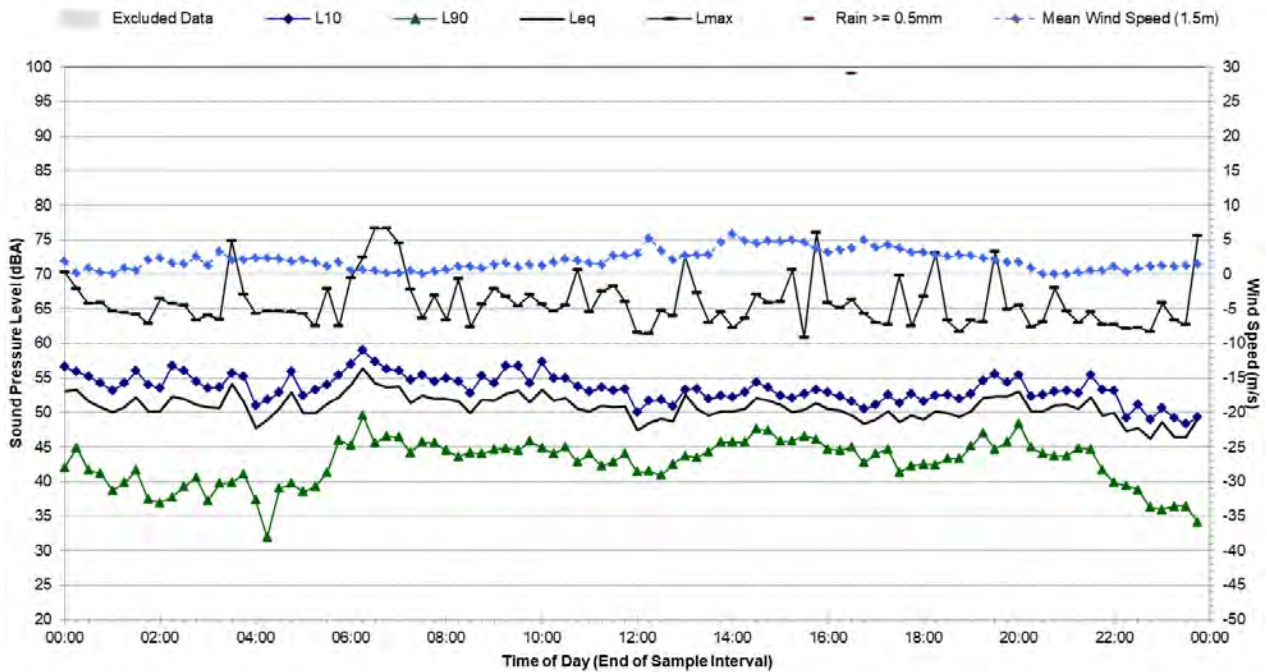
L10 - 19 Glen Ewan Road, Sancrox - Friday, 2 November 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

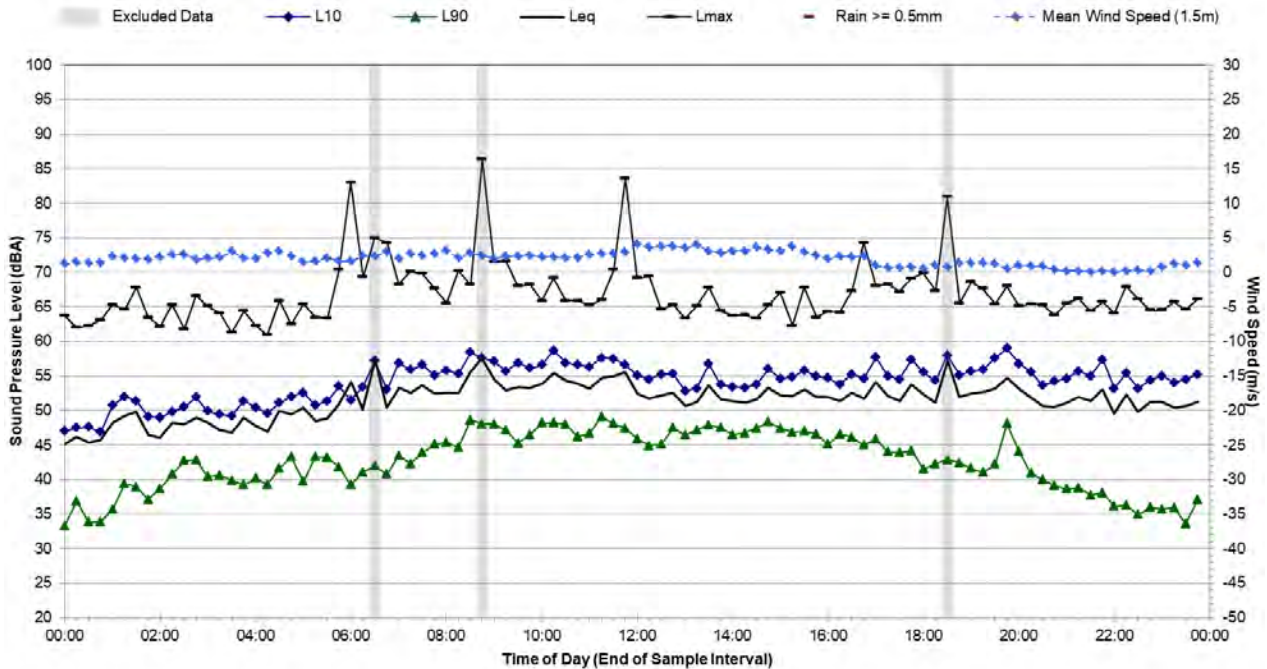
Statistical Ambient Noise Levels

L10 - 19 Glen Ewan Road, Sancrox - Saturday, 3 November 2018



Statistical Ambient Noise Levels

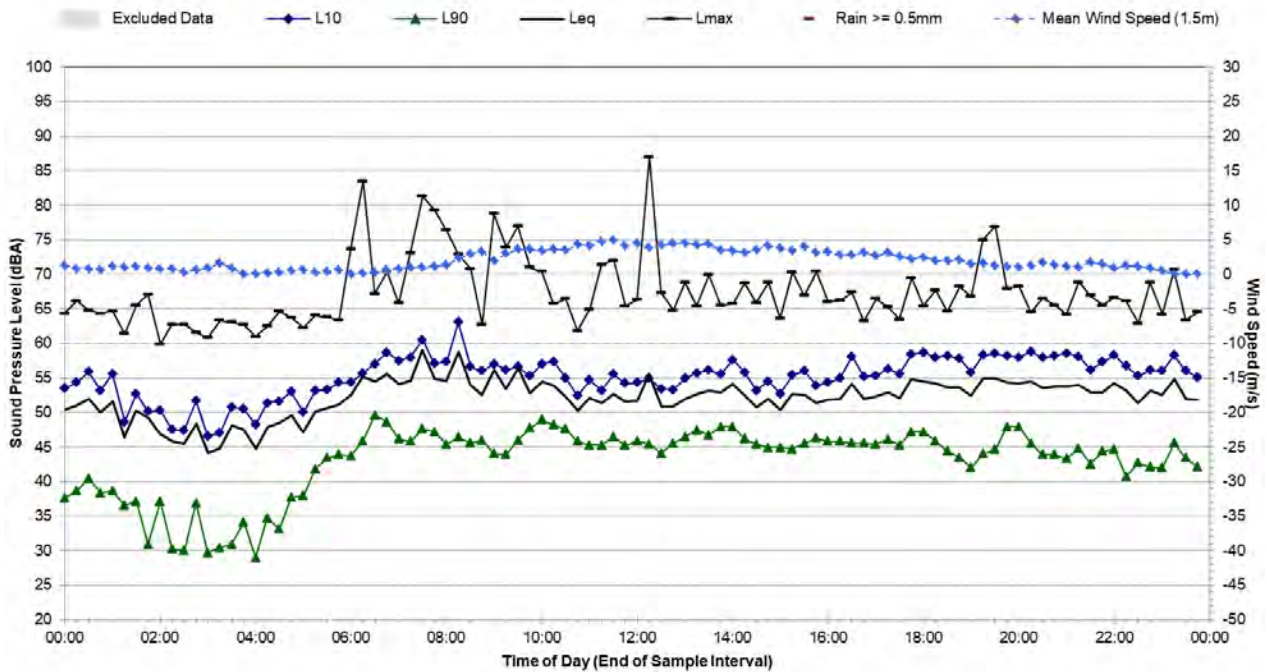
L10 - 19 Glen Ewan Road, Sancrox - Sunday, 4 November 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

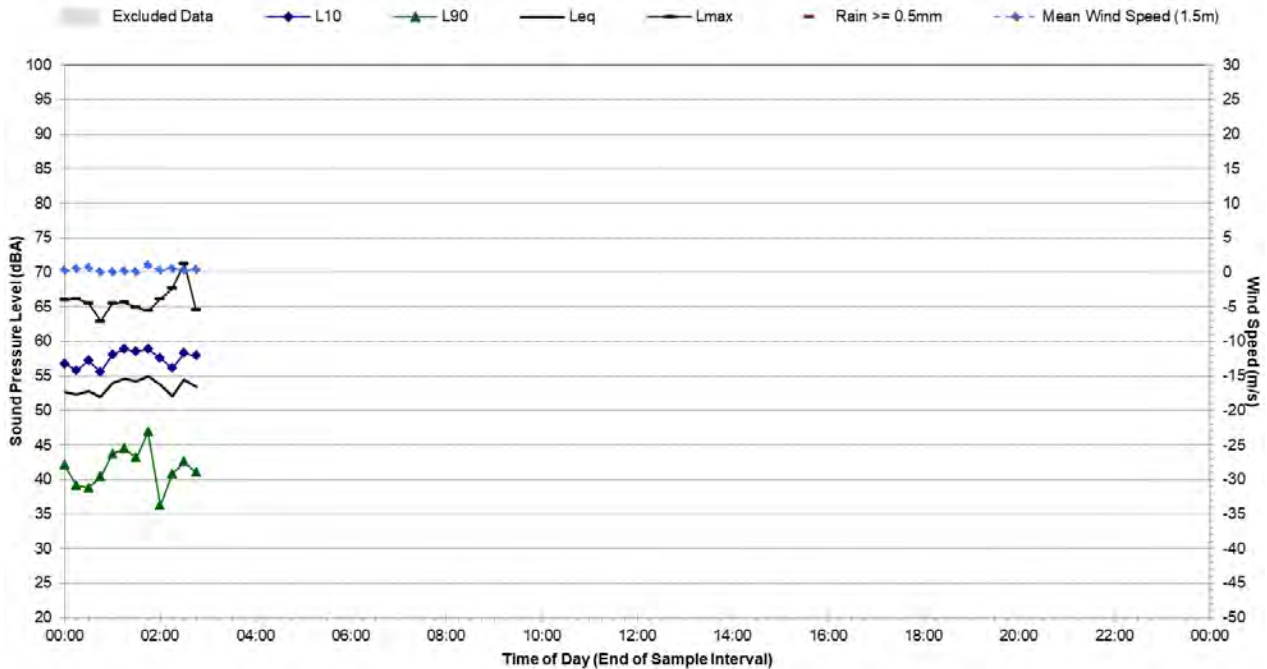
Statistical Ambient Noise Levels

L10 - 19 Glen Ewan Road, Sancrox - Monday, 5 November 2018





Statistical Ambient Noise Levels

L10 - 19 Glen Ewan Road, Sancrox - Tuesday, 6 November 2018

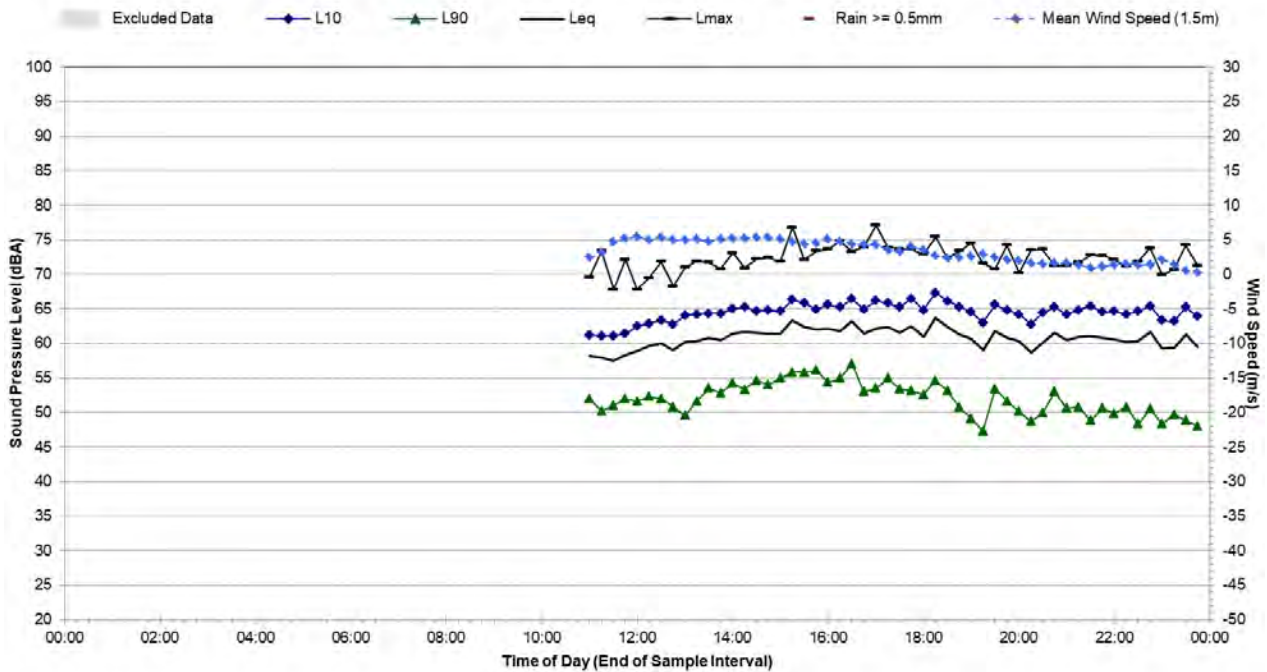


Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

Noise Monitoring Location	L.11				Map of Noise Monitoring Location	
Noise Monitoring Address	47 Glen Ewan Road, Sancrox					
Logger Device Type: ARL NGARA, Logger Serial: 878079F Sound Level Meter Device Type: Brüel and Kjær 2270, Sound Level Meter Serial No: 2414604						
Recorded Noise Levels (LAmax): 23/10/2018: Light vehicle traffic: 48-50 dBA, Truck passbys: 58-68, Motorbikes: 54-66 dBA, Thudding from bridge and road join: 58 dBA, Background: 46-48 dBA. 06/11/2018: Light vehicle traffic: 47-51 dBA, Truck passbys: 52-63 dBA, Thudding from bridge and road join: 51 dBA, Background: 36-42 dBA.						
Ambient Noise Logging Results – NPfI Defined Time Periods					Photo of Noise Monitoring Location	
Monitoring Period	Noise Level (dBA)					
	RBL	LAeq	L10	L1		
Daytime	46	59	61	65		
Evening	46	59	62	66		
Night-time	40	57	62	67		
Ambient Noise Logging Results – RNP Defined Time Periods						
Monitoring Period	Noise Level (dBA)					
	LAeq(period)		LAeq(1hour)			
Daytime (7am-10pm)	59		62			
Night-time (10pm-7am)	57		61			
Attended Noise Measurement Results						
Date	Start Time	Measured Noise Level (dBA)				
		LA90	LAeq	LAmax		
23/10/2018	10:30	50	56	68		
06/11/2018	02:22	39	51	63		

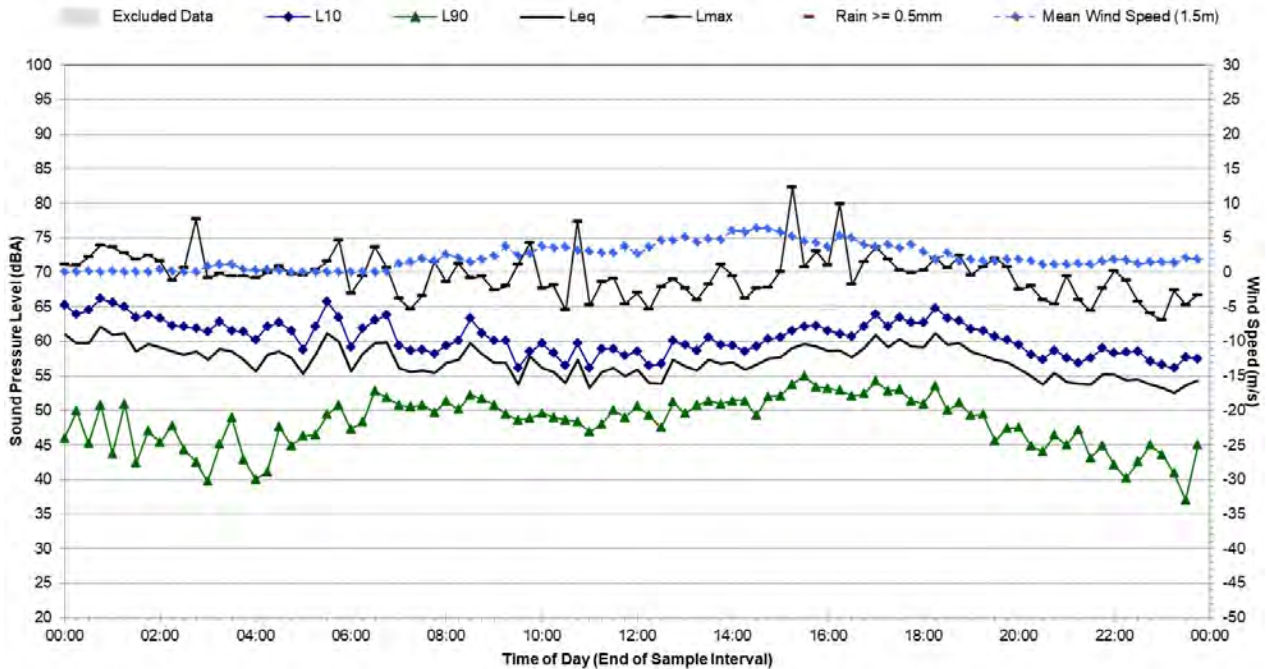
Statistical Ambient Noise Levels

L11 - Glen Ewan Road, Sancrox - Tuesday, 23 October 2018



Statistical Ambient Noise Levels

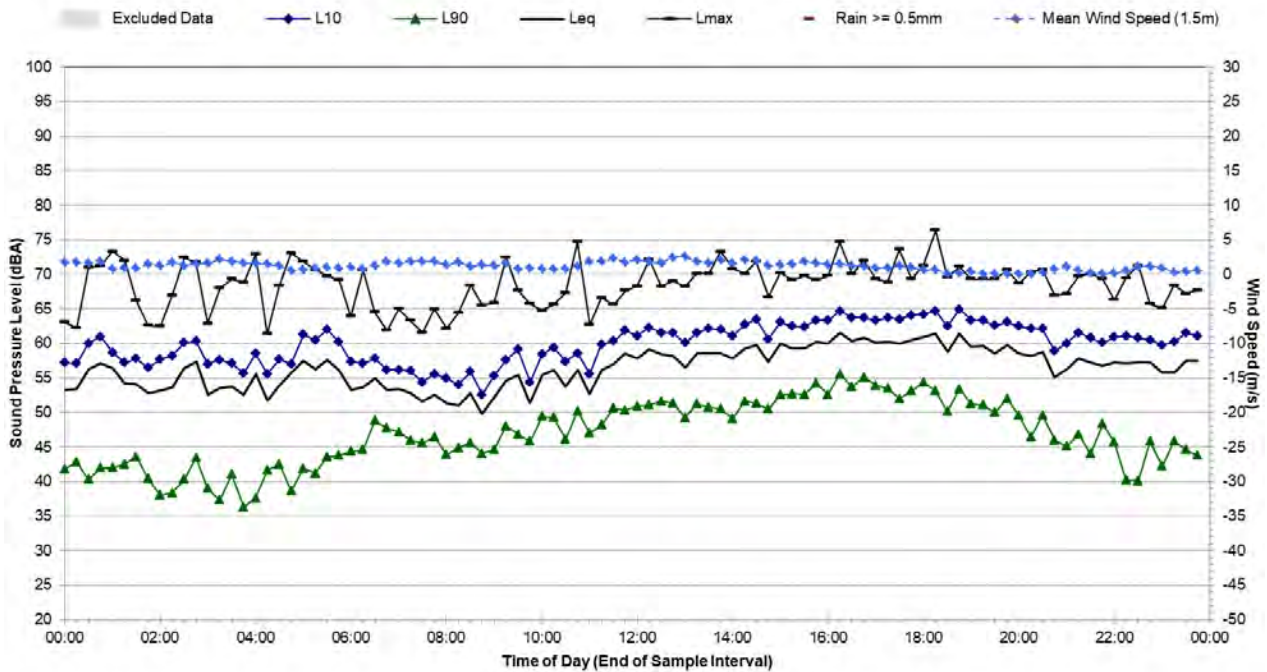
L11 - Glen Ewan Road, Sancrox - Wednesday, 24 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

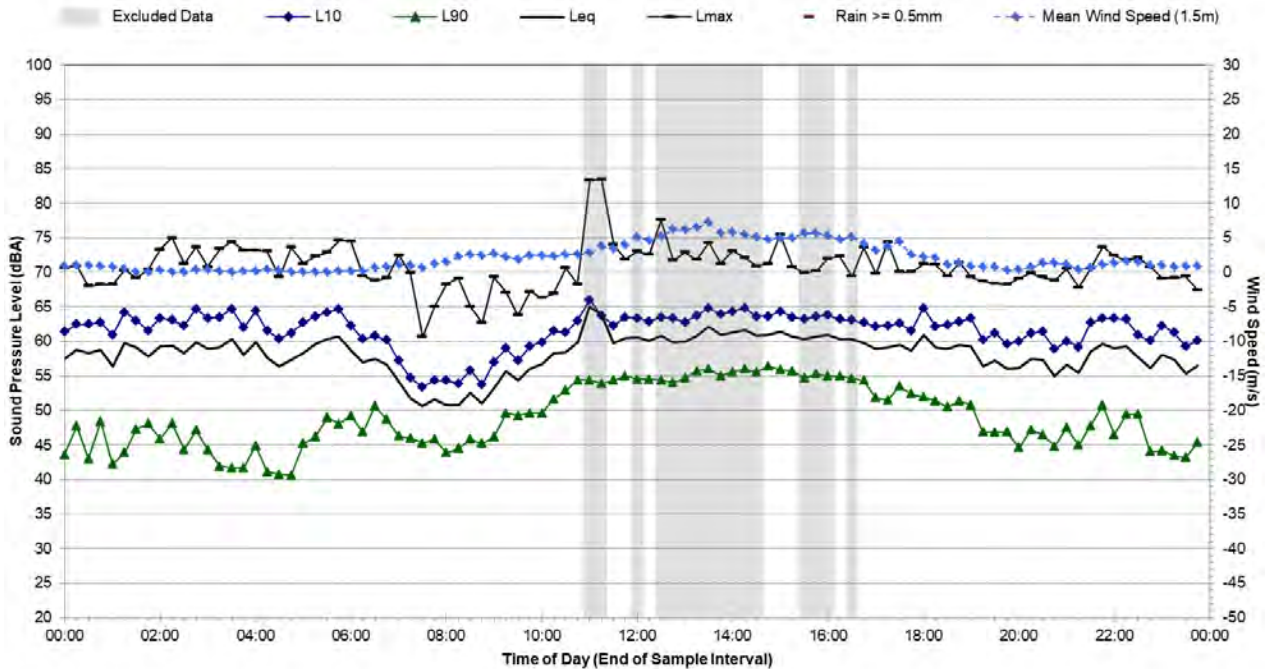
Statistical Ambient Noise Levels

L11 - Glen Ewan Road, Sancrox - Thursday, 25 October 2018



Statistical Ambient Noise Levels

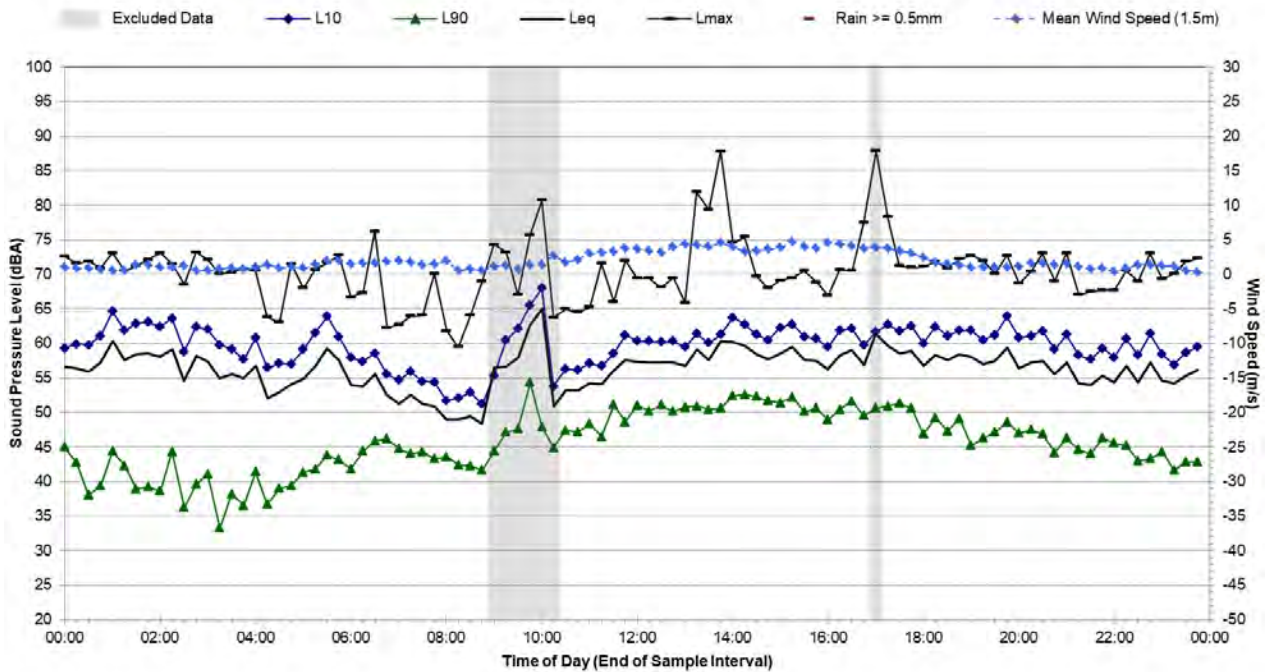
L11 - Glen Ewan Road, Sancrox - Friday, 26 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

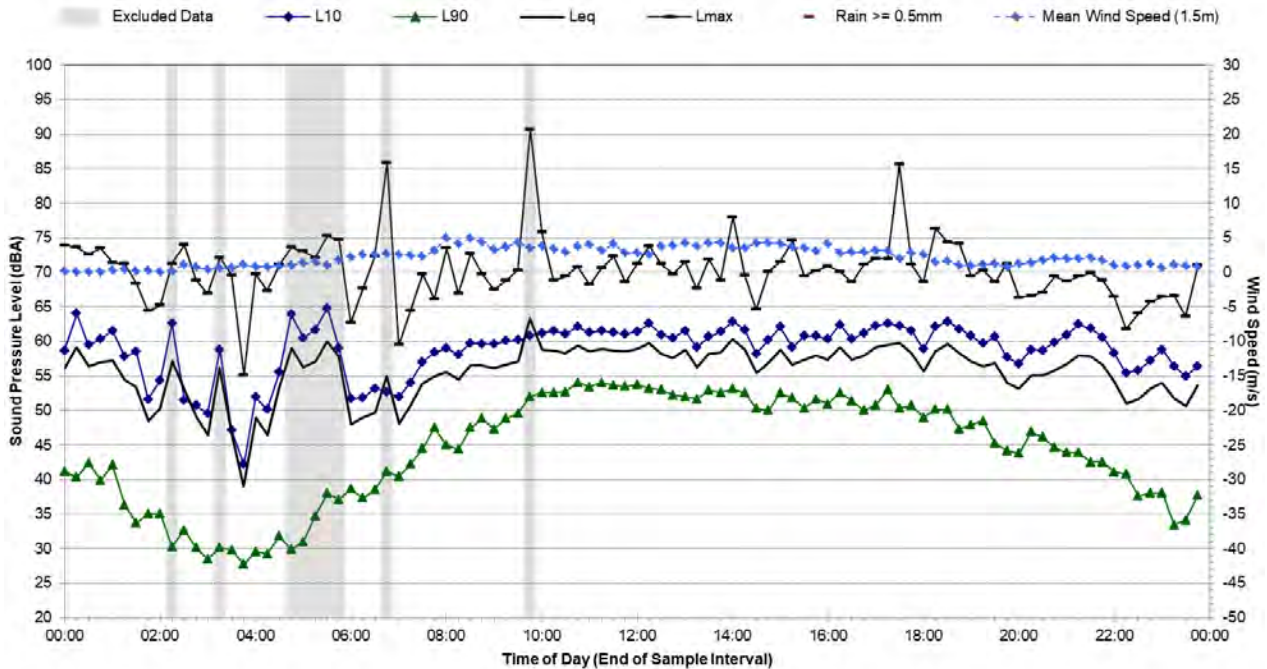
Statistical Ambient Noise Levels

L11 - Glen Ewan Road, Sancrox - Saturday, 27 October 2018



Statistical Ambient Noise Levels

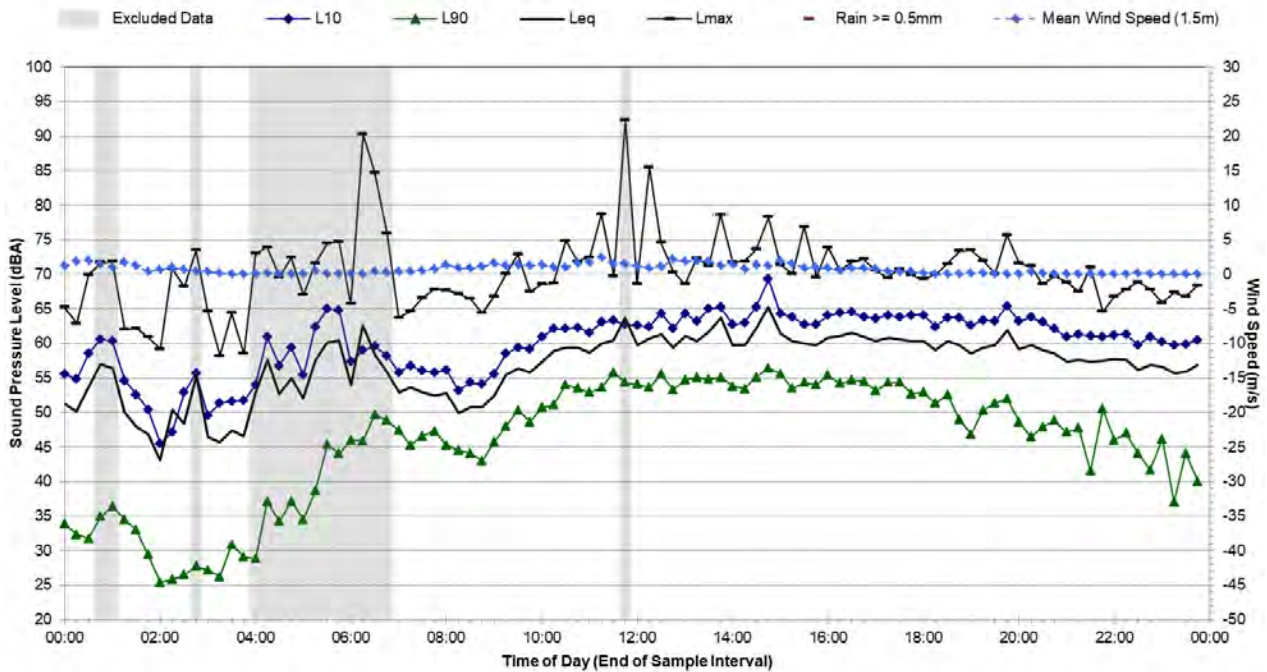
L11 - Glen Ewan Road, Sancrox - Sunday, 28 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

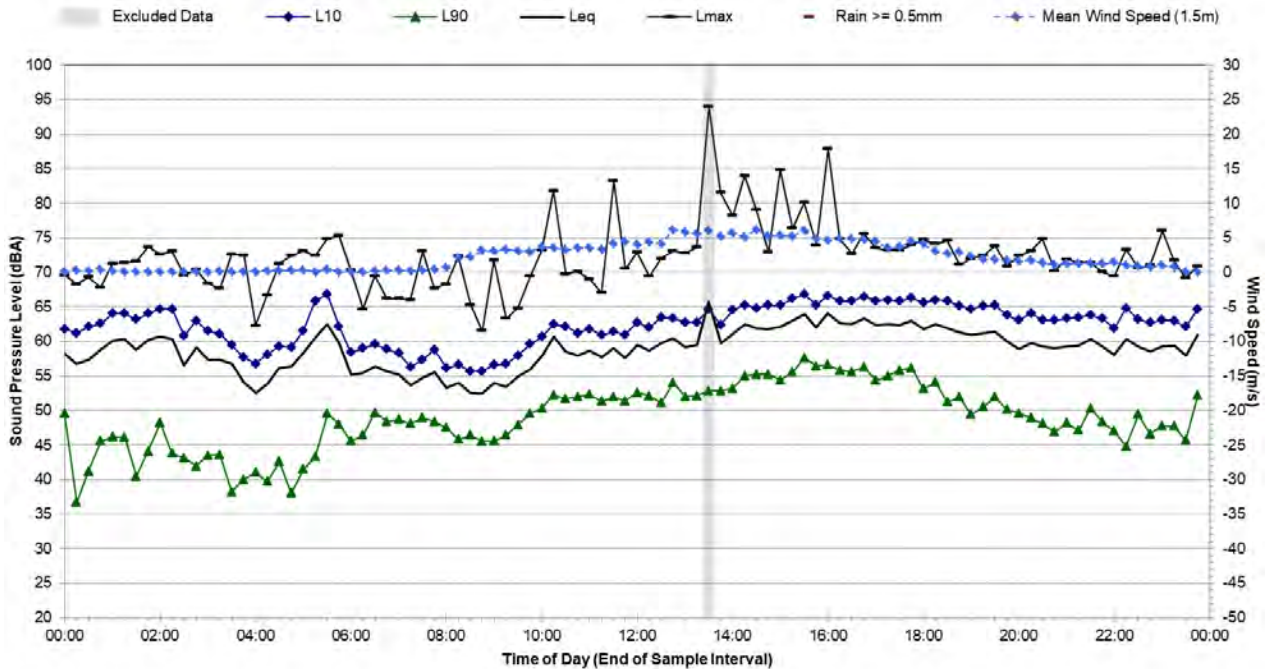
Statistical Ambient Noise Levels

L11 - Glen Ewan Road, Sancrox - Monday, 29 October 2018



Statistical Ambient Noise Levels

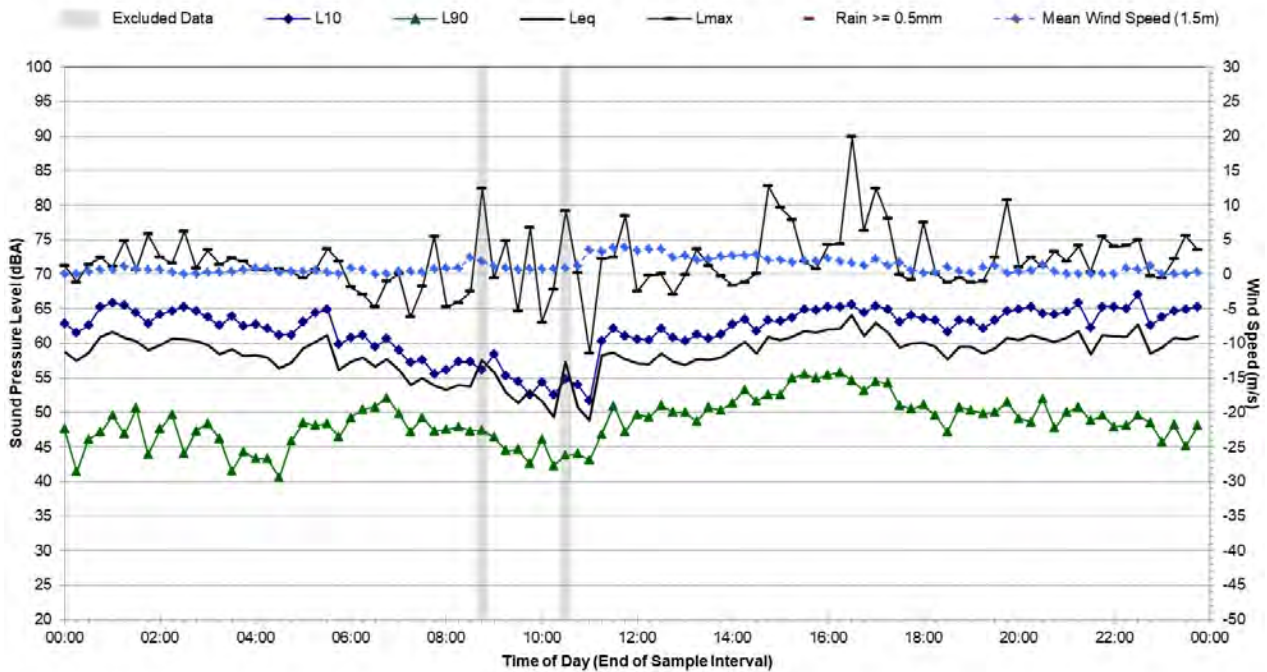
L11 - Glen Ewan Road, Sancrox - Tuesday, 30 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

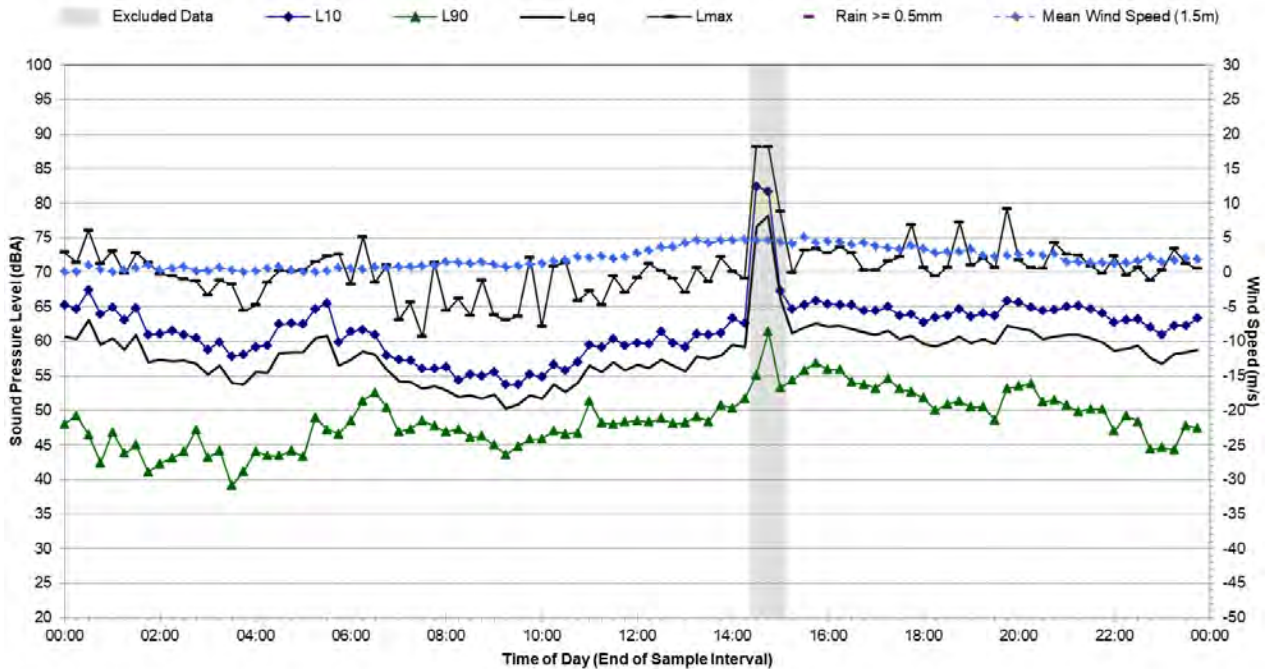
Statistical Ambient Noise Levels

L11 - Glen Ewan Road, Sancrox - Wednesday, 31 October 2018



Statistical Ambient Noise Levels

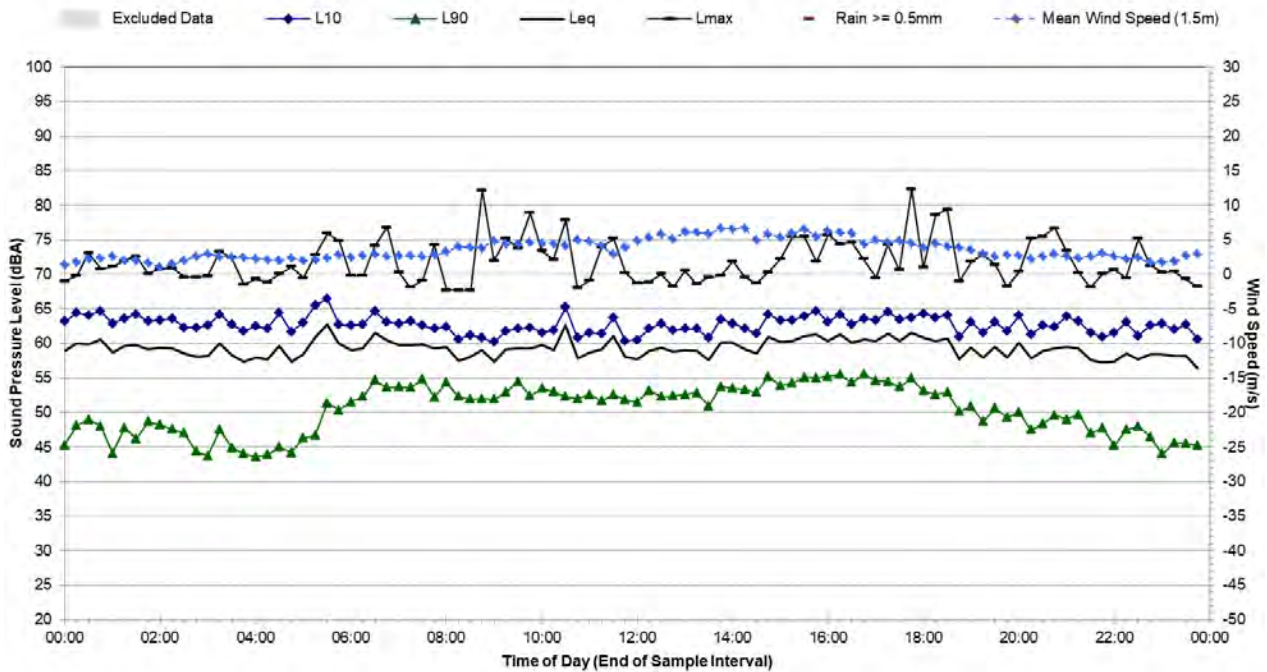
L11 - Glen Ewan Road, Sancrox - Thursday, 1 November 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

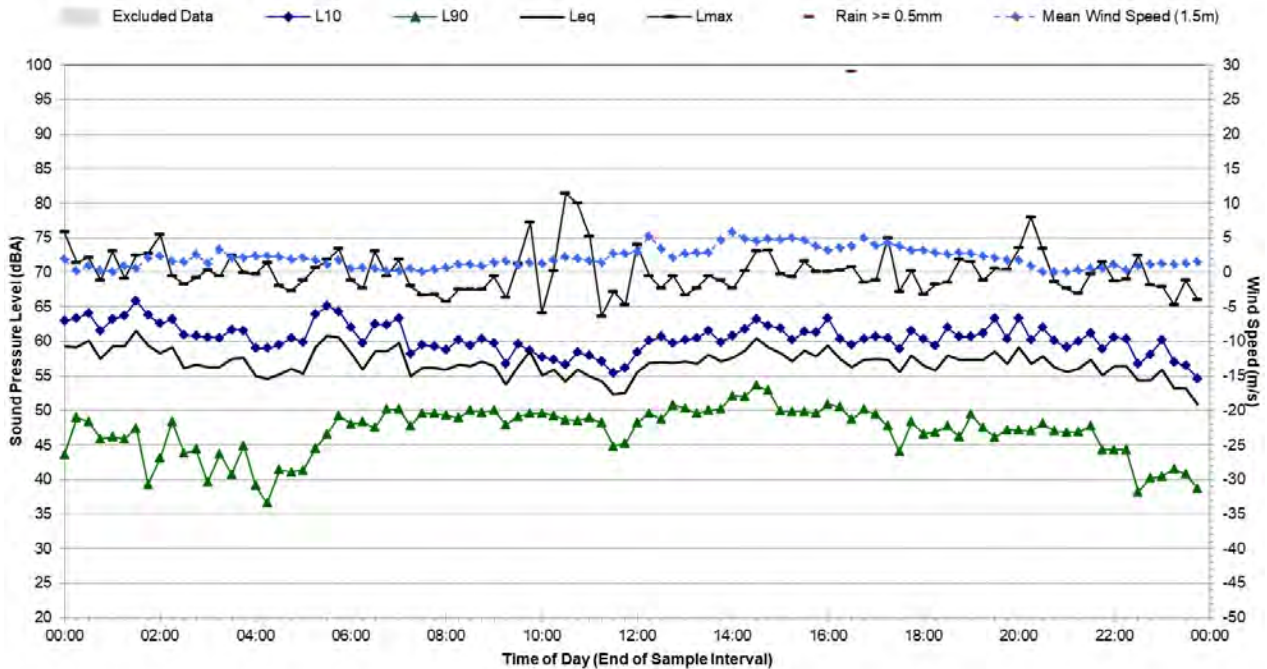
Statistical Ambient Noise Levels

L11 - Glen Ewan Road, Sancrox - Friday, 2 November 2018



Statistical Ambient Noise Levels

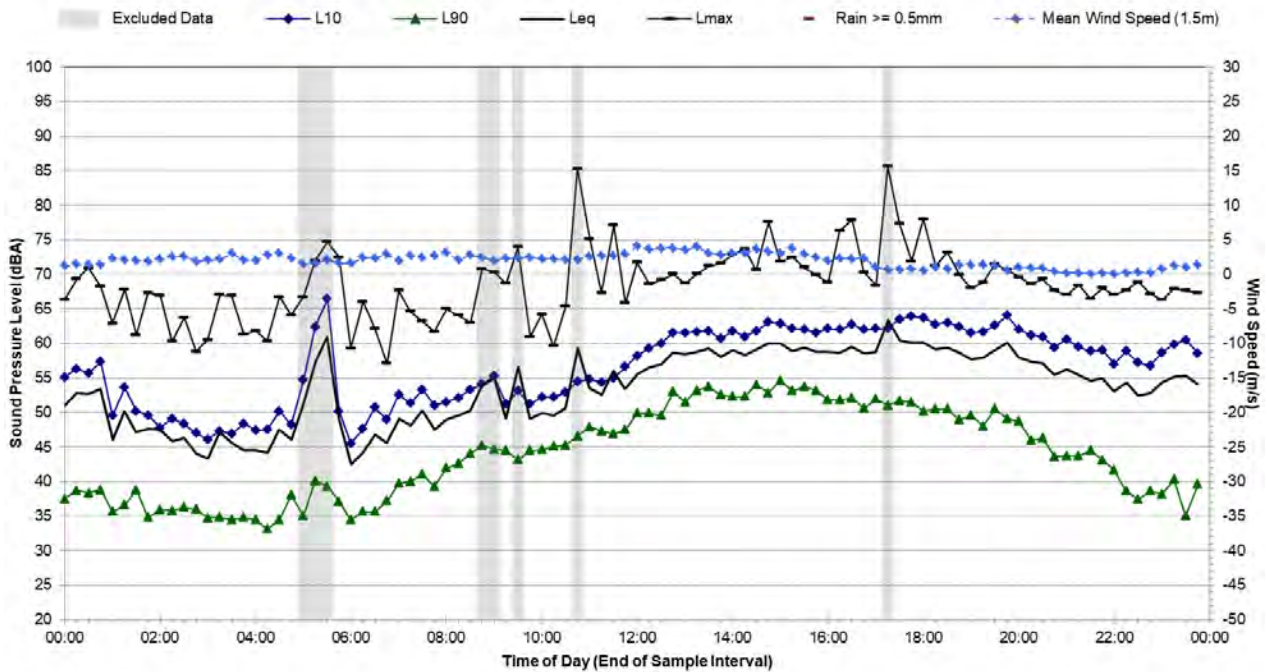
L11 - Glen Ewan Road, Sancrox - Saturday, 3 November 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

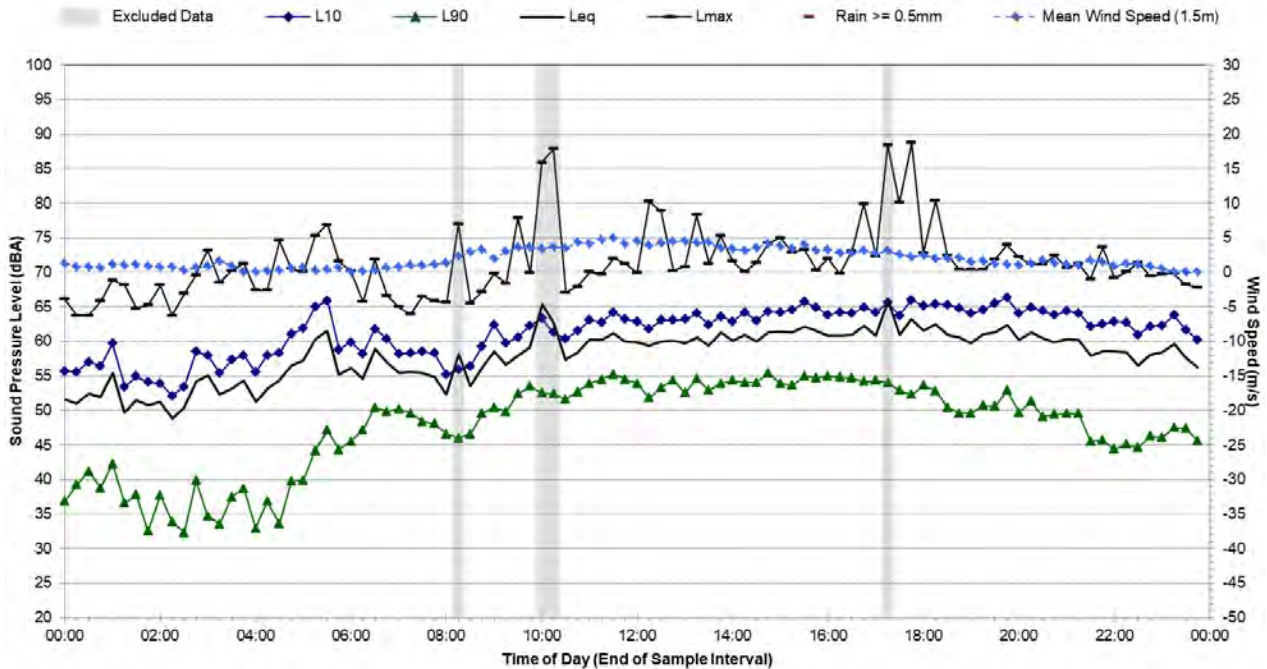
Statistical Ambient Noise Levels

L11 - Glen Ewan Road, Sancrox - Sunday, 4 November 2018



Statistical Ambient Noise Levels

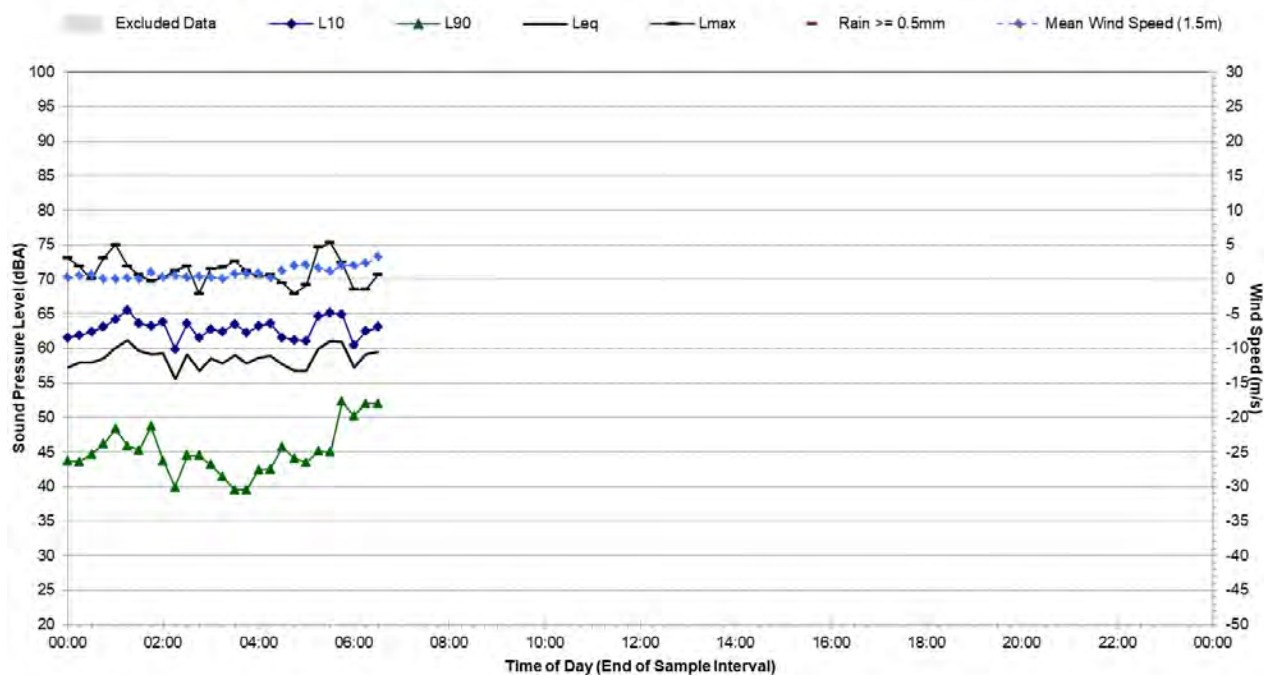
L11 - Glen Ewan Road, Sancrox - Monday, 5 November 2018





Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

Statistical Ambient Noise Levels

L11 - Glen Ewan Road, Sancrox - Tuesday, 6 November 2018



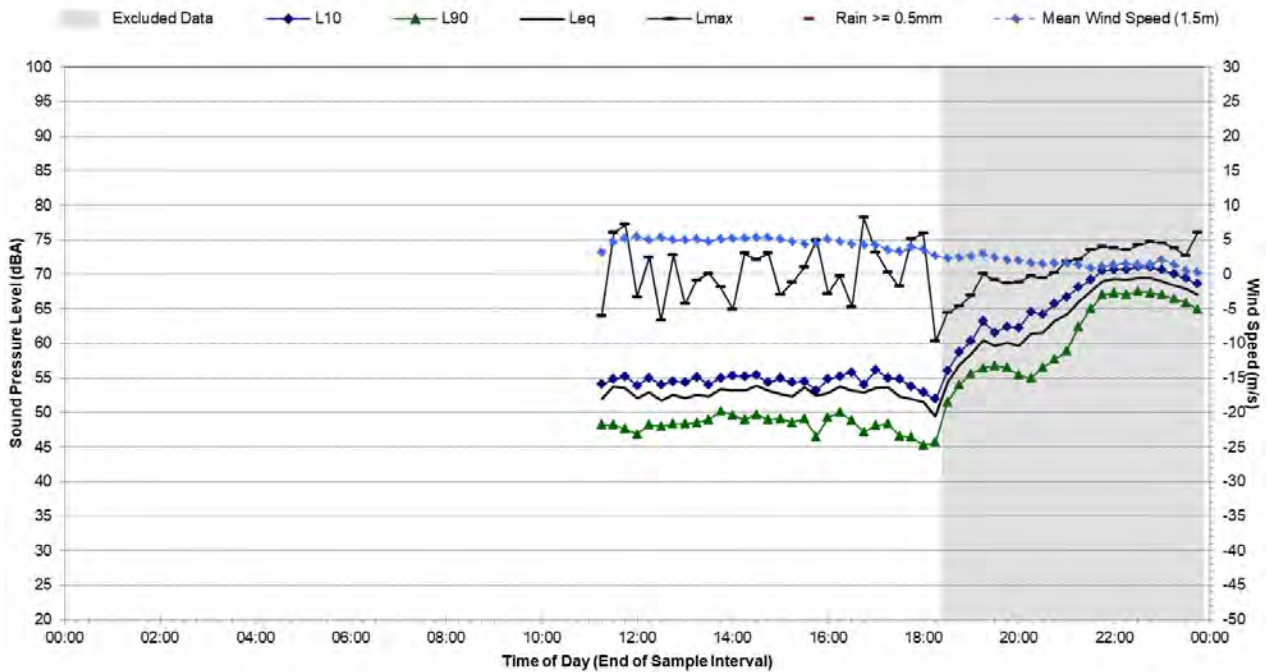
Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

Noise Monitoring Location	L.12				
Noise Monitoring Address	28 Bushland Drive, Sancrox				
Logger Device Type: ARL NGARA, Logger Serial: 87801E Sound Level Meter Device Type: Brüel and Kjær 2270, Sound Level Meter Serial No: 2414604					
Recorded Noise Levels (LAmax): 23/10/2018: Light vehicle traffic: 47-50 dBA, Truck passbys: 48-60 dBA, Birds: 49-63 dBA, Insects and Bugs: 50-56 dBA. 05/11/2018: Truck passbys: 52-58 dBA, Insects and Bugs: 55-56 dBA.					
Ambient Noise Logging Results – NPfI Defined Time Periods					
Monitoring Period	Noise Level (dBA)				
	RBL	LAeq	L10	L1	
Daytime	45	52	54	57	
Evening	46	52	54	56	
Night-time	44	51	52	57	
Ambient Noise Logging Results – RNP Defined Time Periods					
Monitoring Period	Noise Level (dBA)				
	LAeq(period)		LAeq(1hour)		
Daytime (7am-10pm)	52		55		
Night-time (10pm-7am)	51		-- ¹		
Attended Noise Measurement Results					
Date	Start Time	Measured Noise Level (dBA)			
		LA90	LAeq	LAmix	
23/10/2018	11:30	48	52	64	
05/11/2018	23:51	54	57	62	

Note 1: Owing to wild life noise from a nearby water body during the evening time, there were inadequate 15 minute data available to calculate the LAeq(1 hour).

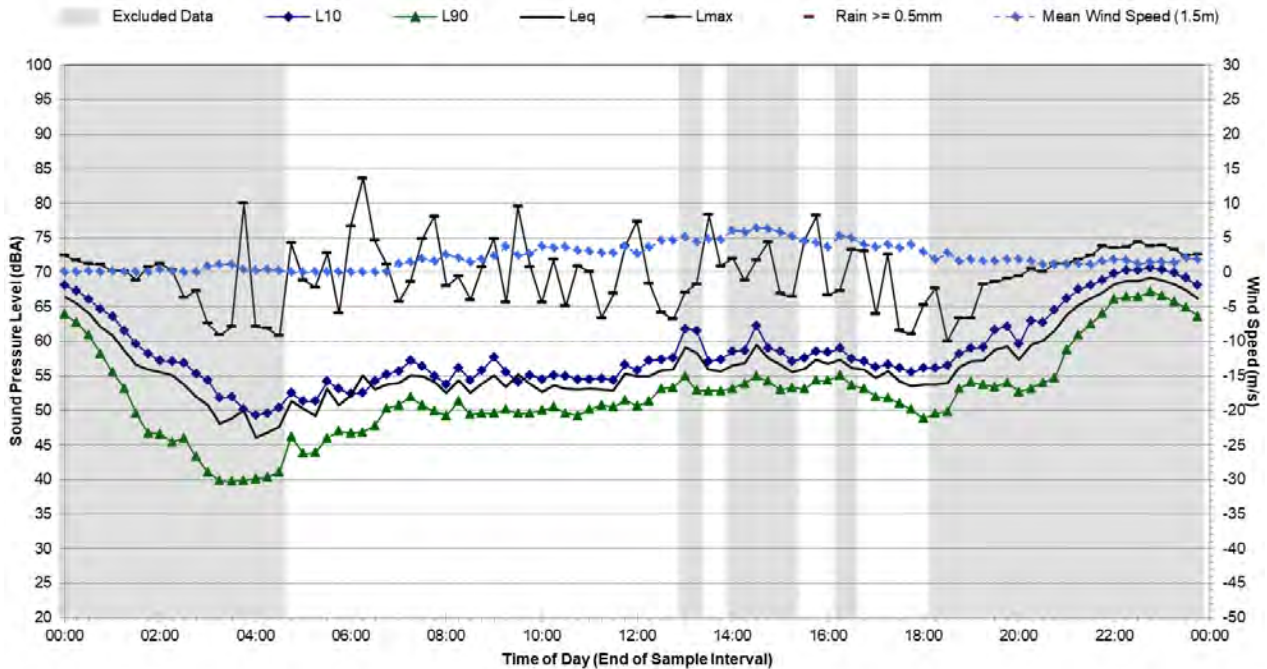
Statistical Ambient Noise Levels

L12 28 Bushland Drive, Sancrox - Tuesday, 23 October 2018



Statistical Ambient Noise Levels

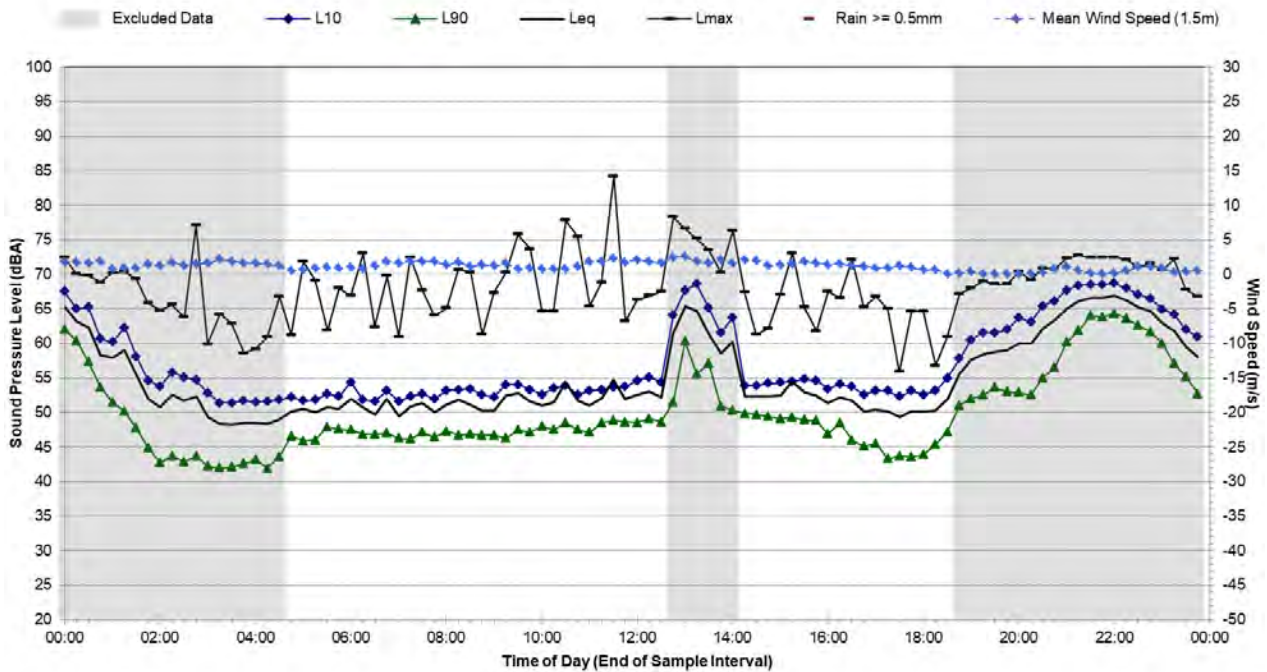
L12 28 Bushland Drive, Sancrox - Wednesday, 24 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

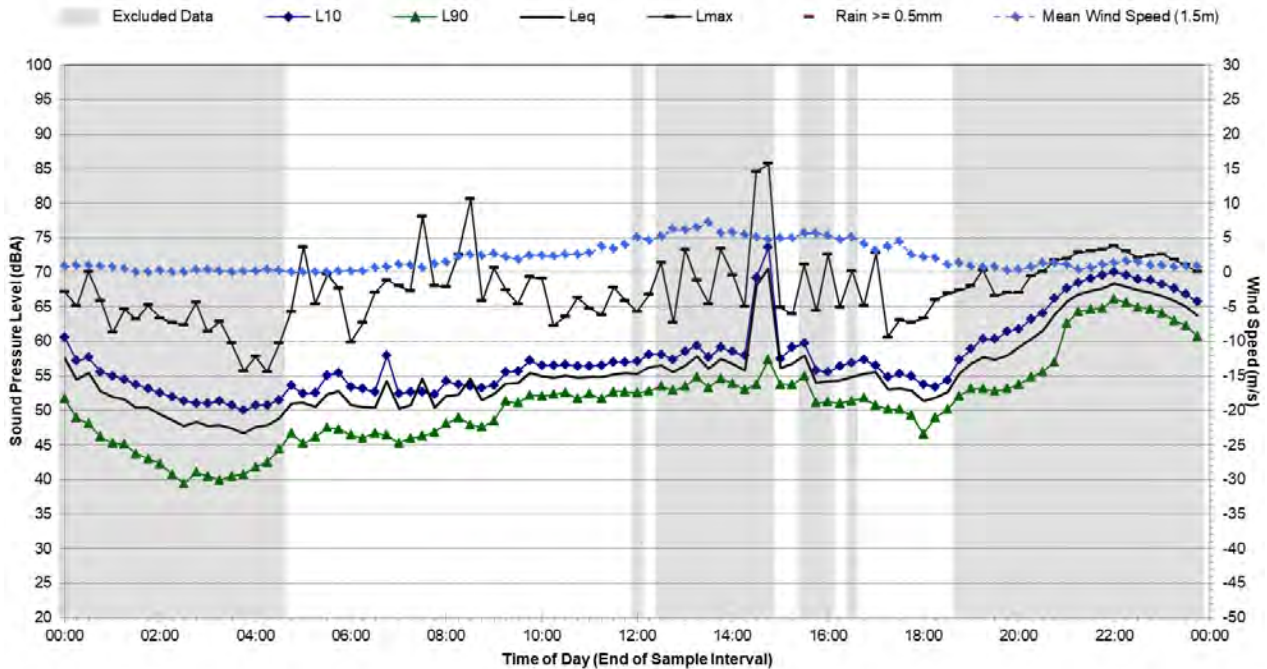
Statistical Ambient Noise Levels

L12 28 Bushland Drive, Sancro - Thursday, 25 October 2018



Statistical Ambient Noise Levels

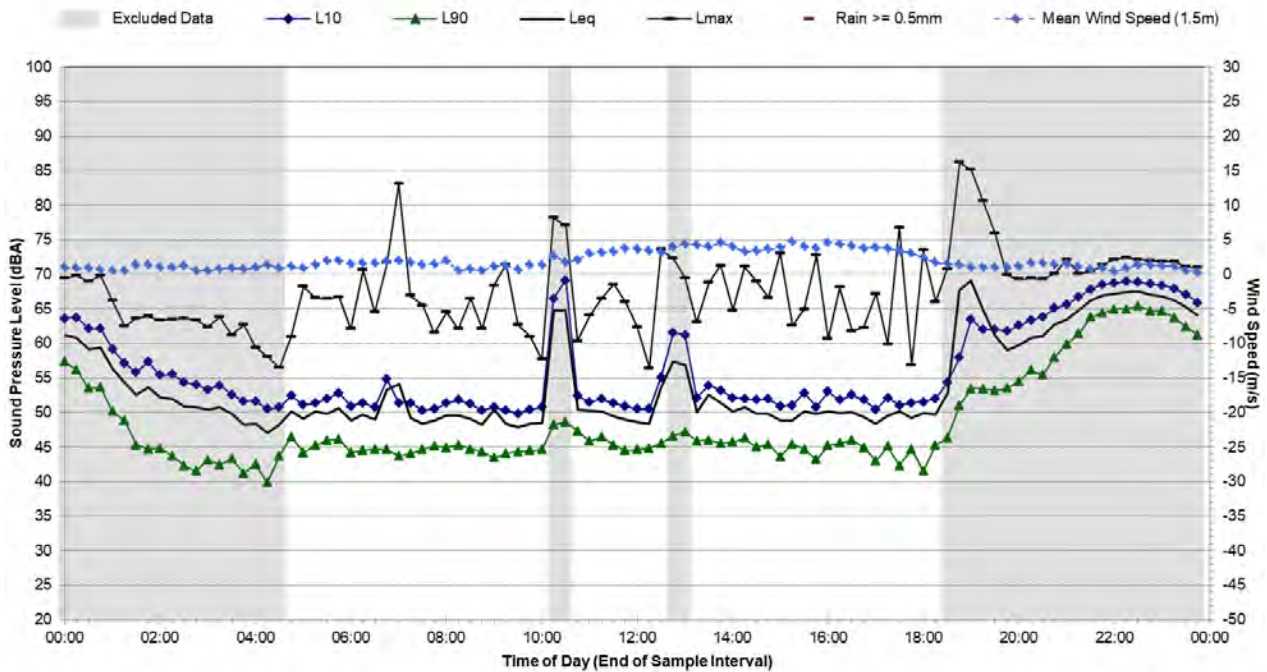
L12 28 Bushland Drive, Sancro - Friday, 26 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

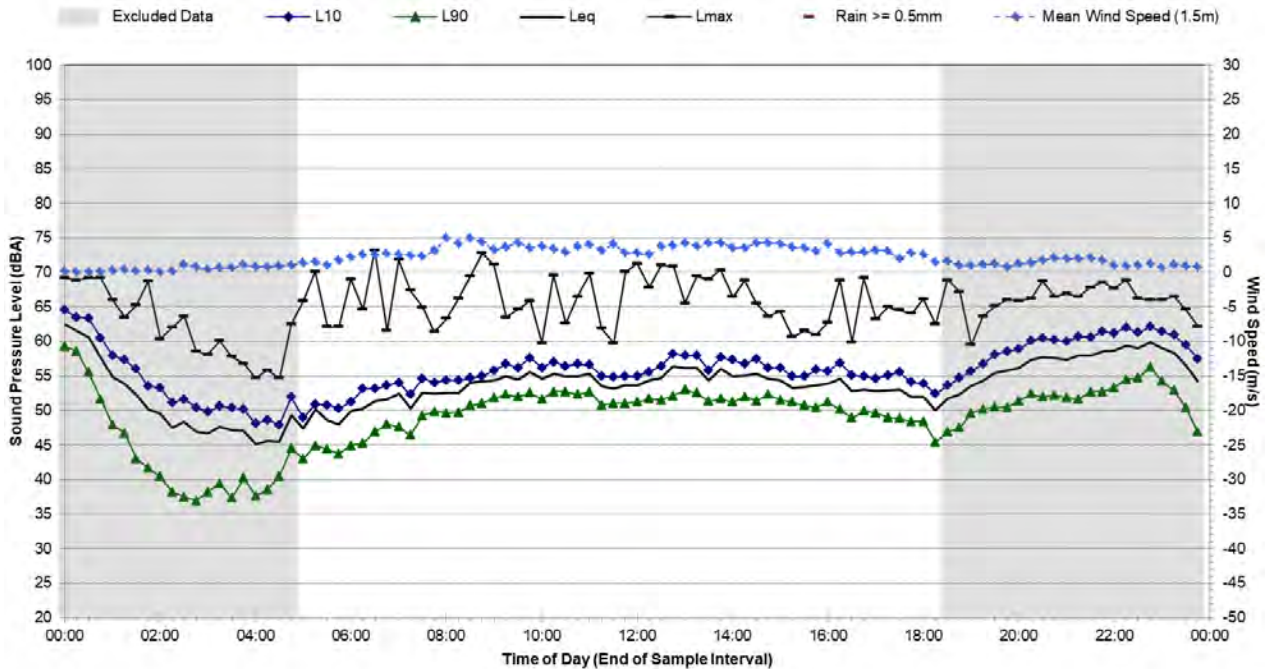
Statistical Ambient Noise Levels

L12 28 Bushland Drive, Sancrox - Saturday, 27 October 2018



Statistical Ambient Noise Levels

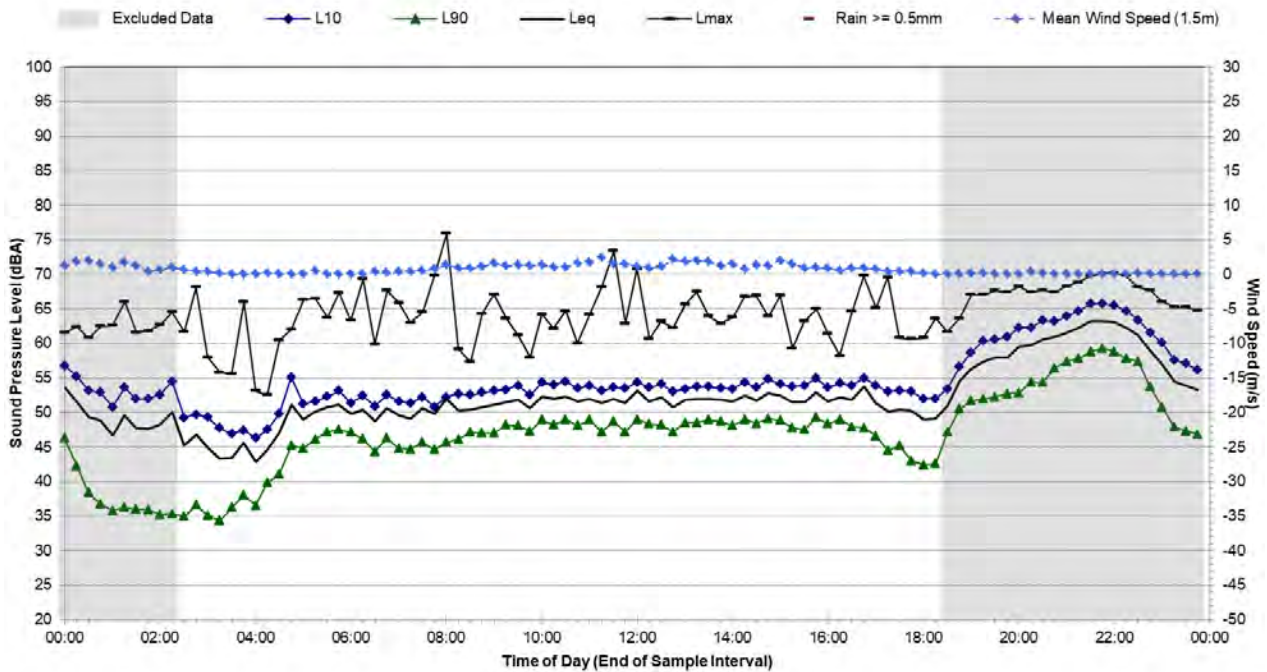
L12 28 Bushland Drive, Sancrox - Sunday, 28 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

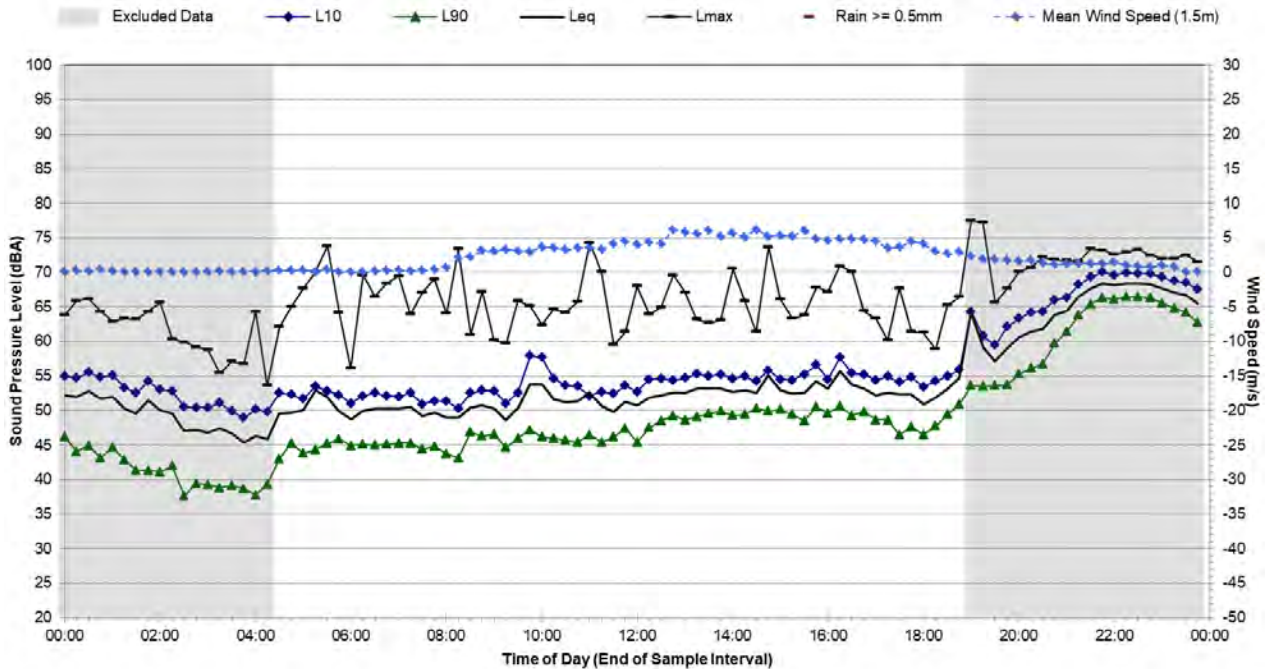
Statistical Ambient Noise Levels

L12 28 Bushland Drive, Sancrox - Monday, 29 October 2018



Statistical Ambient Noise Levels

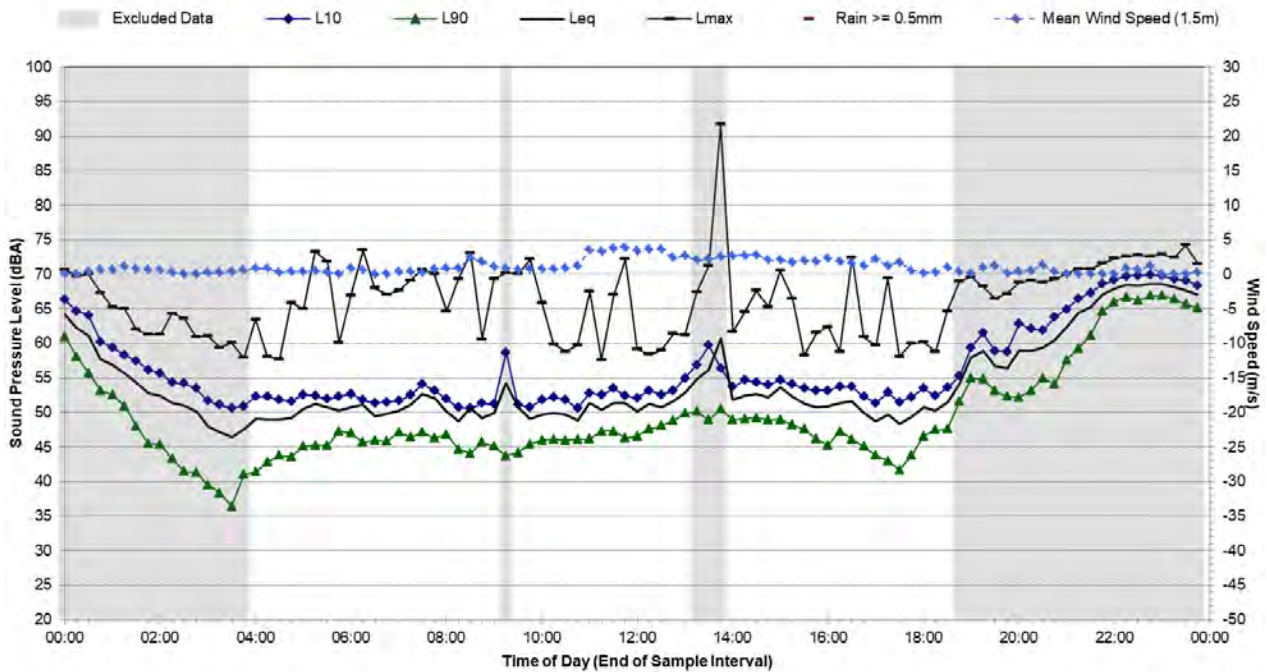
L12 28 Bushland Drive, Sancrox - Tuesday, 30 October 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

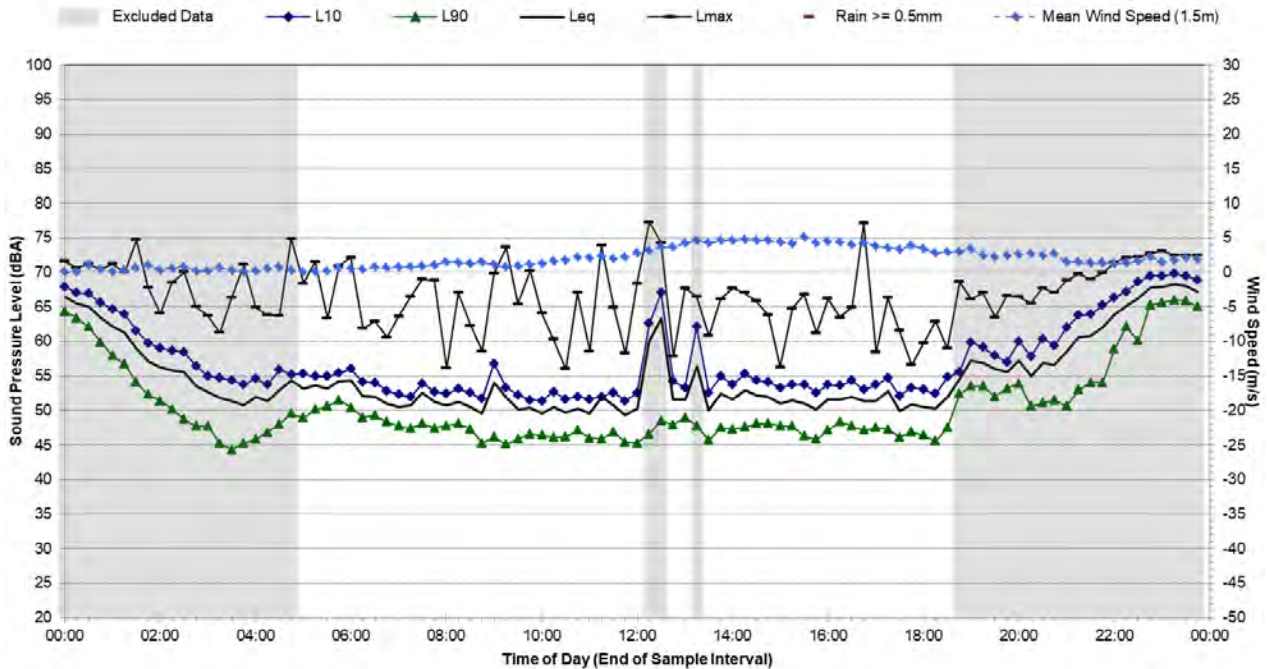
Statistical Ambient Noise Levels

L12 28 Bushland Drive, Sancrox - Wednesday, 31 October 2018



Statistical Ambient Noise Levels

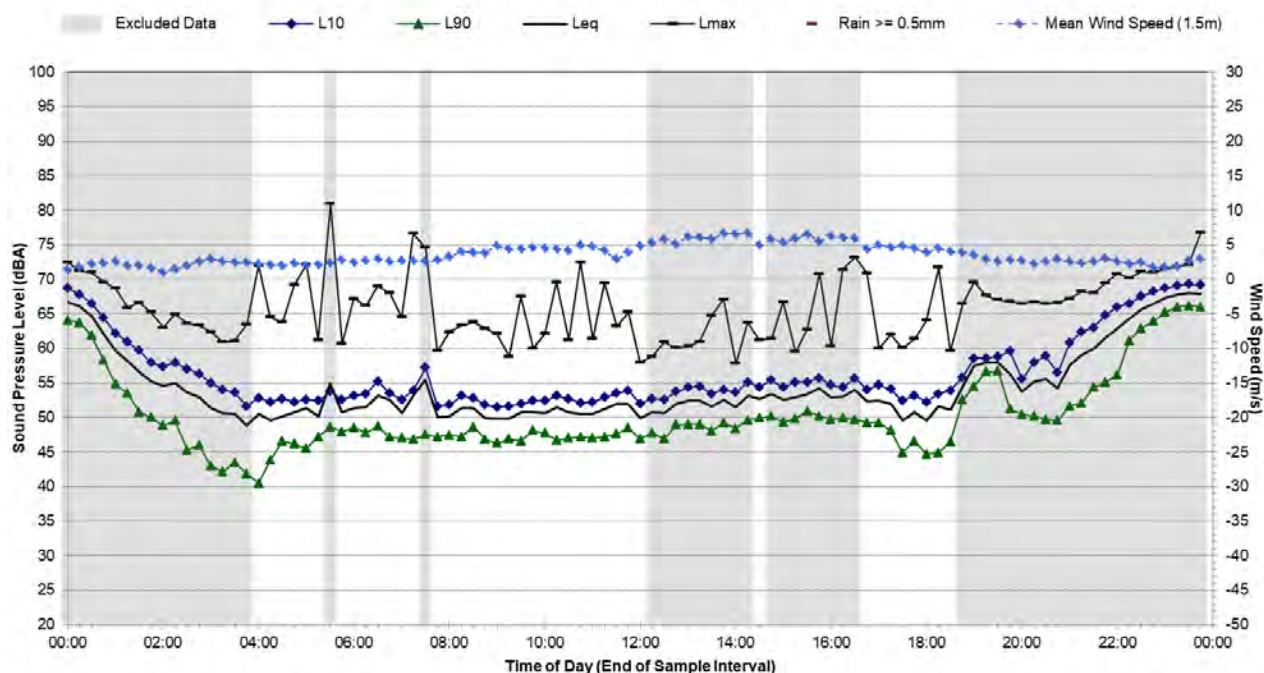
L12 28 Bushland Drive, Sancrox - Thursday, 1 November 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

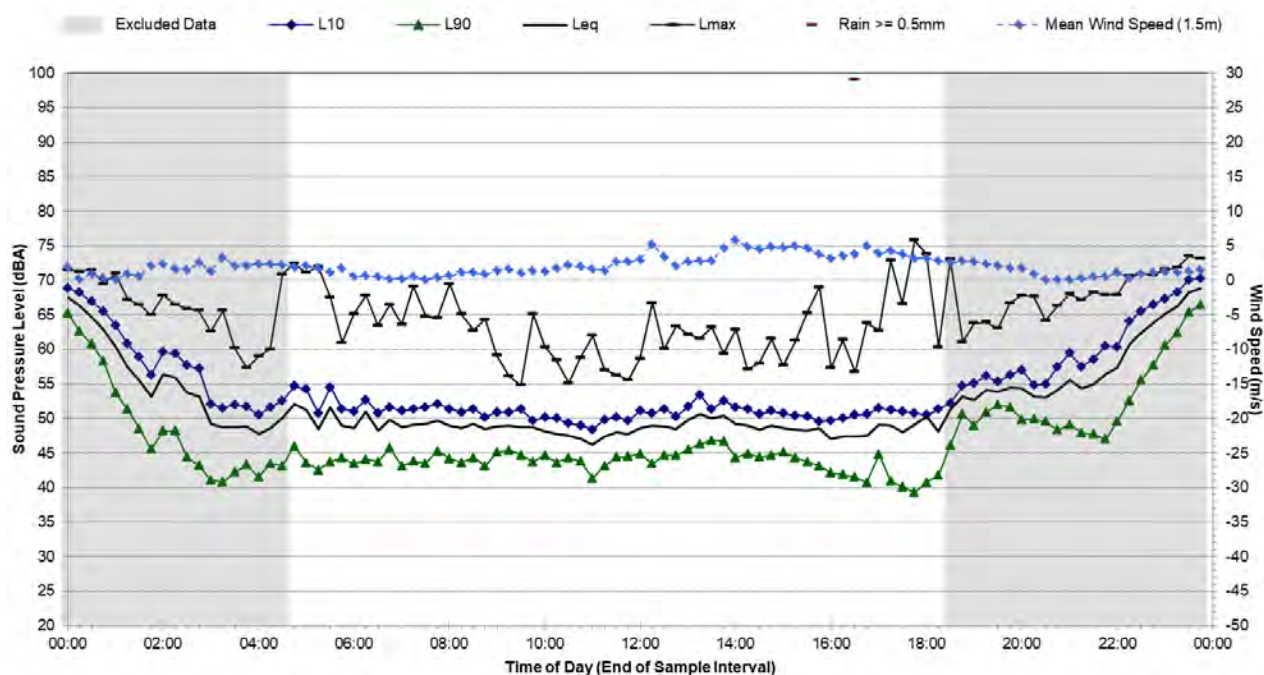
Statistical Ambient Noise Levels

L12 28 Bushland Drive, Sancrox - Friday, 2 November 2018



Statistical Ambient Noise Levels

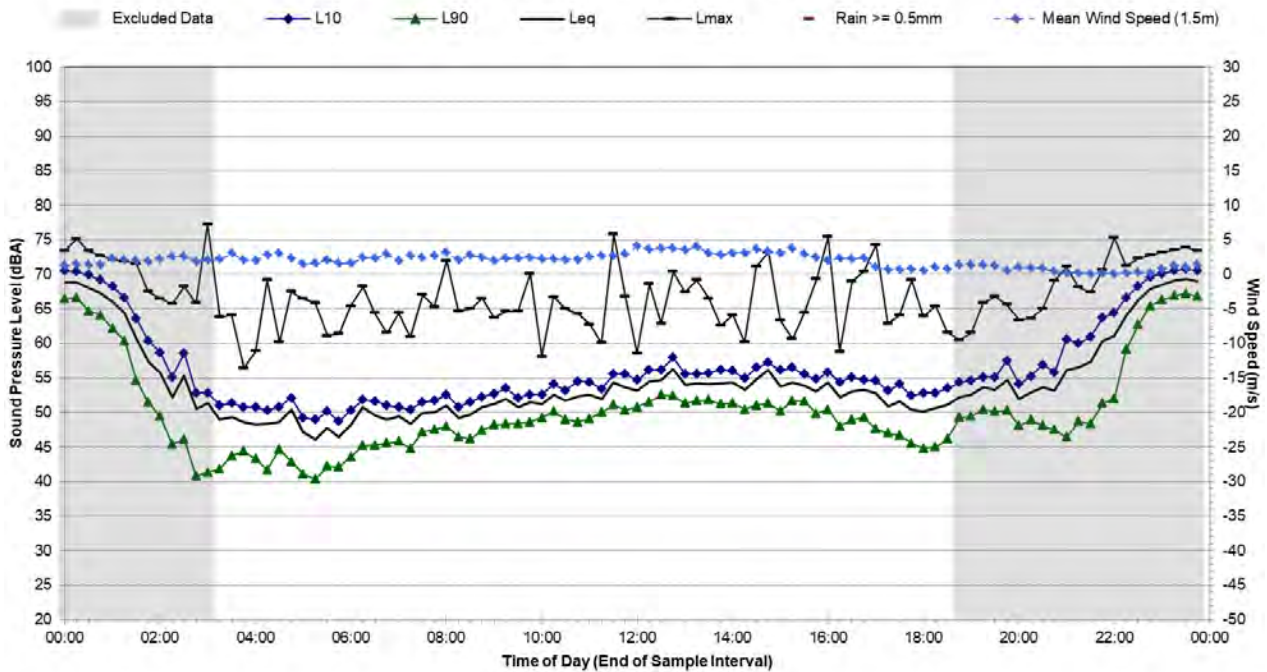
L12 28 Bushland Drive, Sancrox - Saturday, 3 November 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

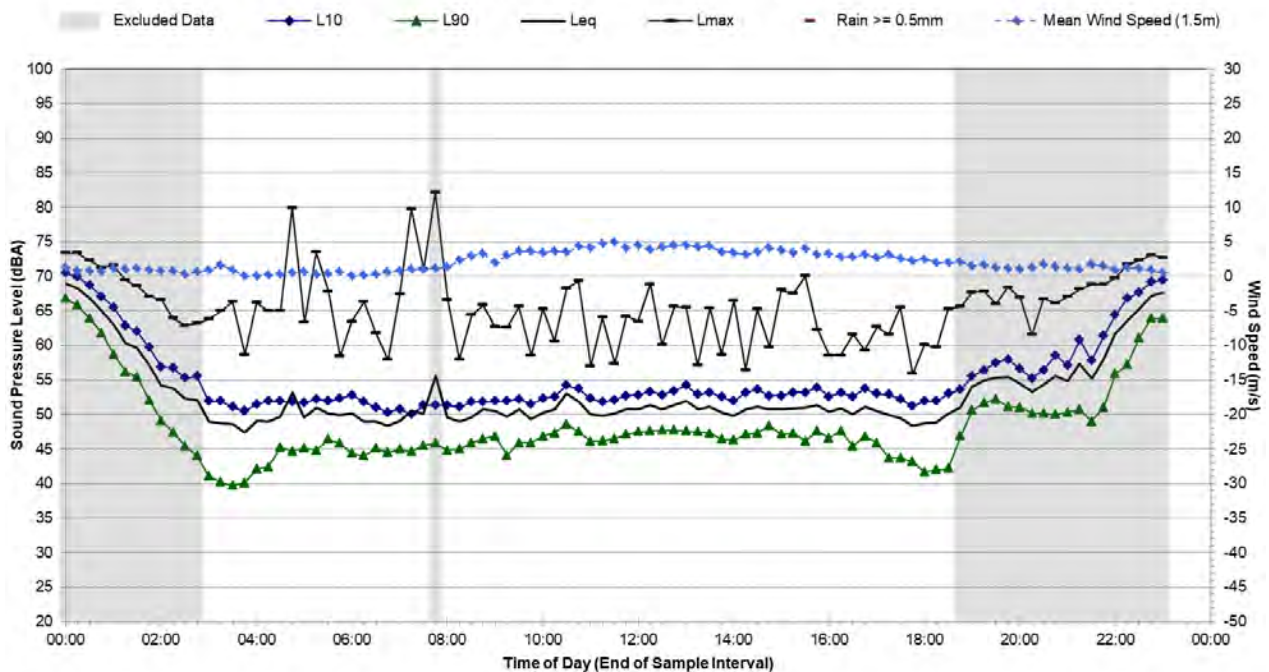
Statistical Ambient Noise Levels

L12 28 Bushland Drive, Sancrox - Sunday, 4 November 2018



Statistical Ambient Noise Levels

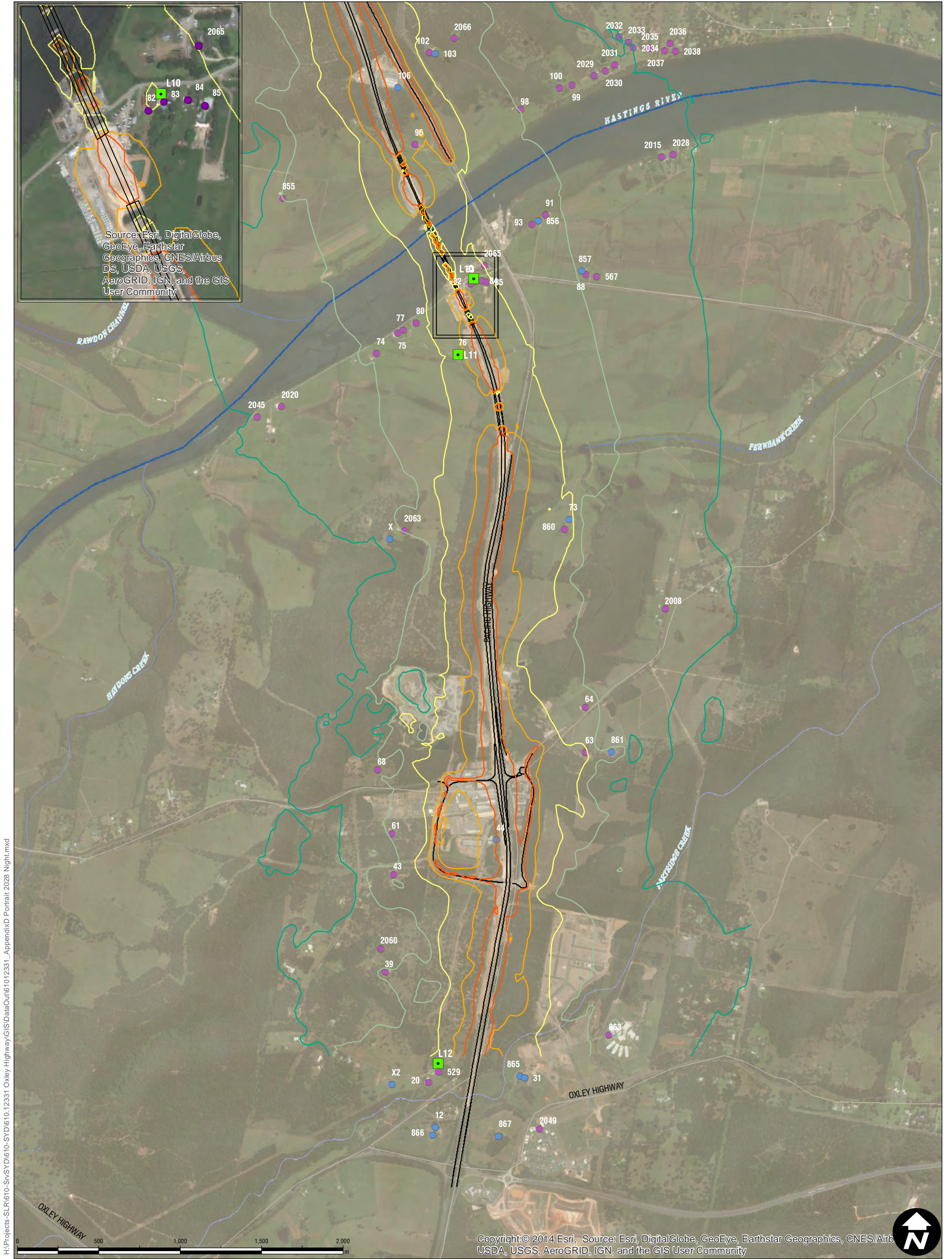
L12 28 Bushland Drive, Sancrox - Monday, 5 November 2018



Note Excluded data is based on adverse weather from the weather station located at Telegraph Point, Port Macquarie, and identified extraneous noise.

APPENDIX D

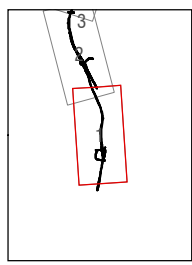
2018 and 2028 Noise Contours



H:\Projects\SLR\610-Srv\SYD\610-SYD\610-12331 Oxley Highway\GIS\Data\Out\61012331_AppendixD Portrait 2028 Night.mxd

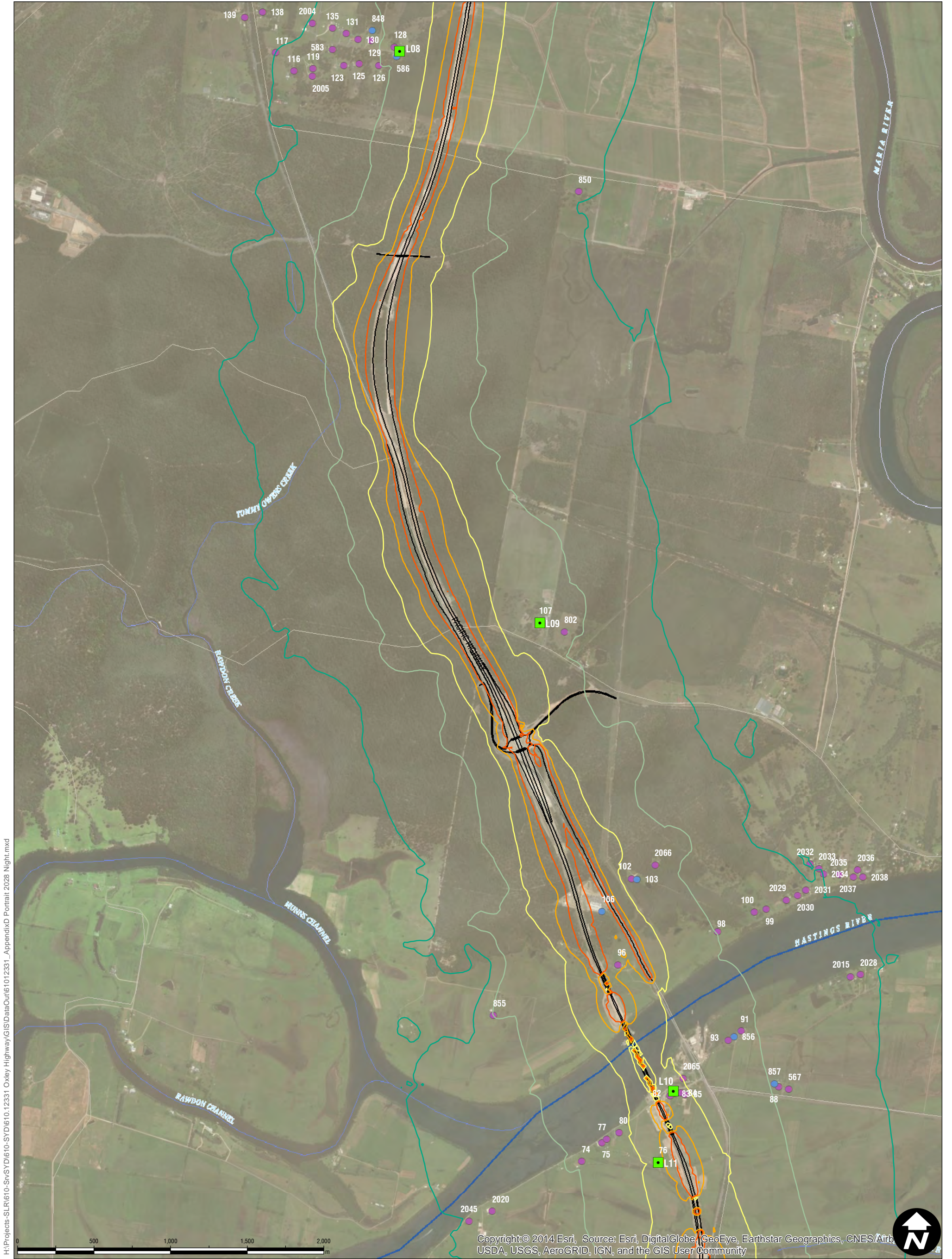


The content contained within this document may be based on third party data.
SLR Consulting Australia Pty Ltd does not guarantee the accuracy of such information.



- Noise Sensitive Receivers (Residences)
 - Non Noise Sensitive Receivers (Garages, sheds etc.)
 - Noise Logging Locations
 - Upgrade Alignment
- Day Noise Contours
- 45 dBA
 - 50 dBA
 - 55 dBA
 - 60 dBA
 - 65 dBA

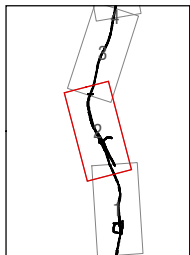
Oxley Highway to Kundaberg
Post Construction Noise Report
2018 LAeq (15hr) Day
Noise Contours



H:\Projects\SLR\610-Srv\SYD\610-SYD\610-12331 Oxley Highway\GIS\Data\Out\61012331_AppendixD Portrait 2028 Night.mxd

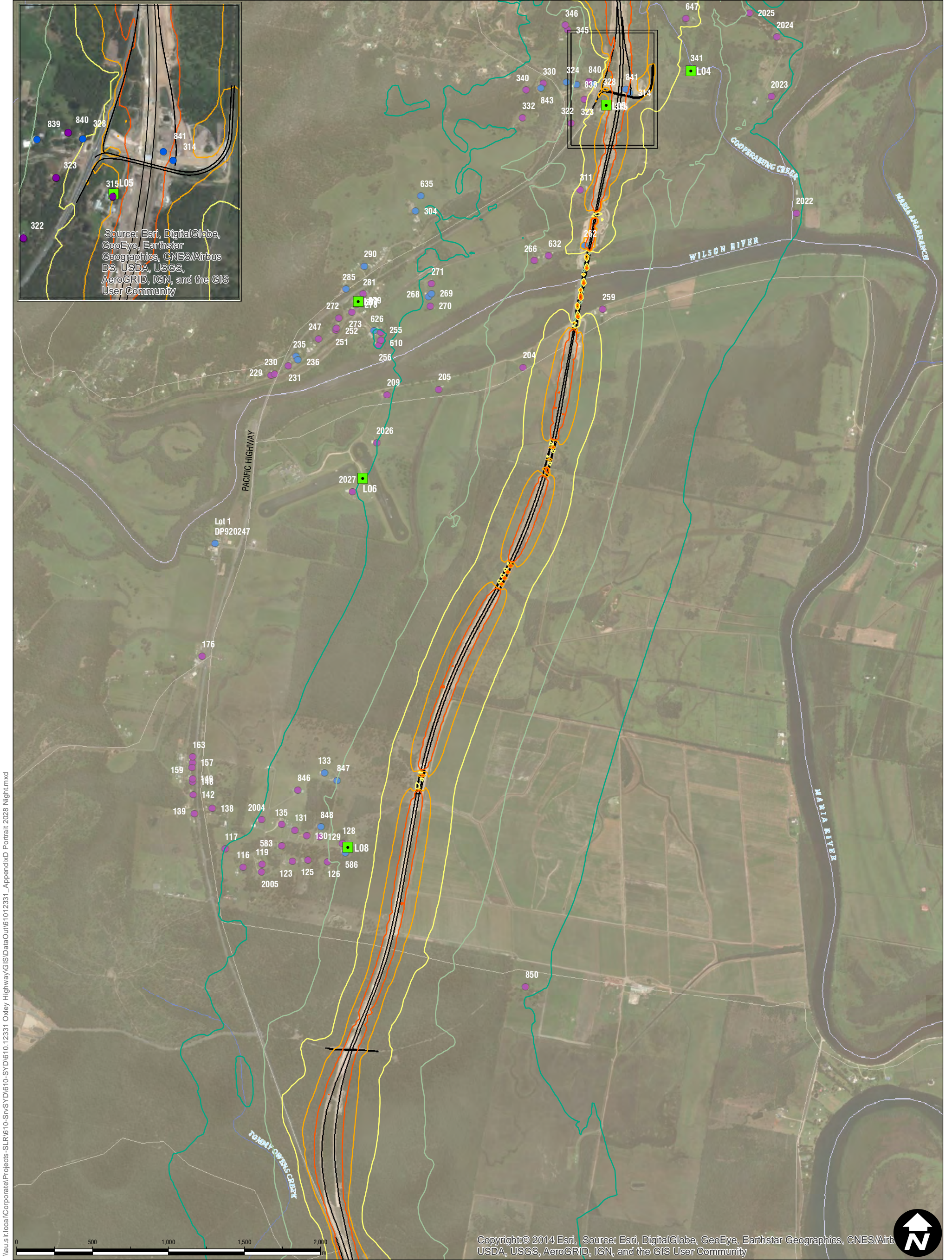


The content contained within this document may be based on third party data.
SLR Consulting Australia Pty Ltd does not guarantee the accuracy of such information.



- | | |
|--|--|
| <ul style="list-style-type: none">Noise Sensitive Receivers (Residences)Non Noise Sensitive Receivers (Garages, sheds etc.)Noise Logging LocationsUpgrade Alignment | Day Noise Contours <ul style="list-style-type: none">45 dBA50 dBA55 dBA60 dBA65 dBA |
|--|--|

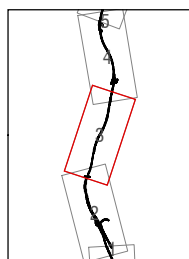
Oxley Highway to Kundaberg
Post Construction Noise Report
2018 LAeq (15hr) Day
Noise Contours



\\au.slr.local\Corporate\Projects-SLR\610-SvS\SYD\610-SYD\610.12331 Oxley Highway\GISData\Out\61012331_AppendixD Portrait 2028 Night.mxd



The content contained within this document may be based on third party data. SLR Consulting Australia Pty Ltd does not guarantee the accuracy of such information.



- Noise Sensitive Receivers (Residences)
 - Non Noise Sensitive Receivers (Garages, sheds etc.)
 - Noise Logging Locations
 - Upgrade Alignment
- Day Noise Contours**
- 45 dBA
 - 50 dBA
 - 55 dBA
 - 60 dBA
 - 65 dBA

Oxley Highway to Kundaberg

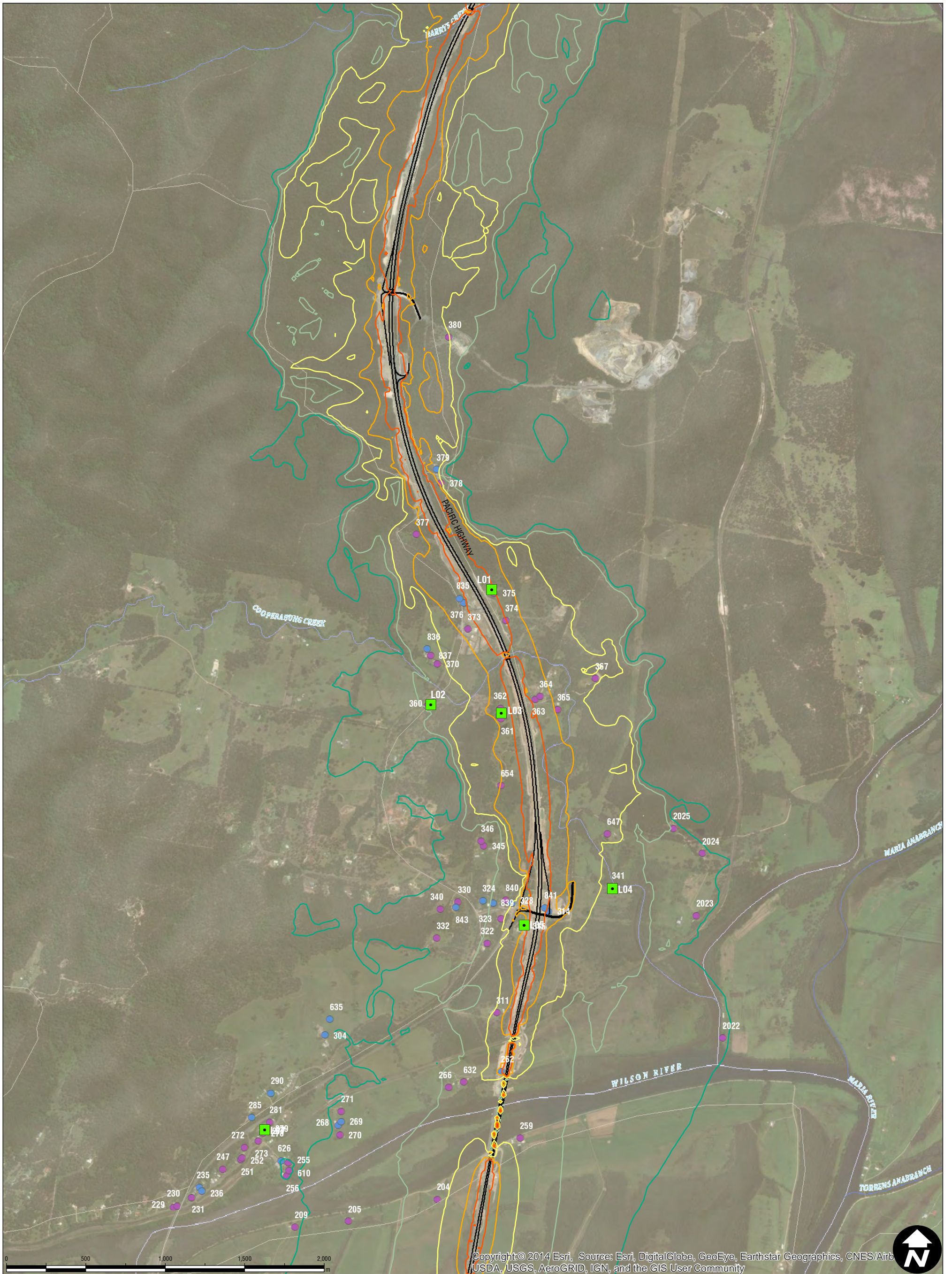
Post Construction Noise Report

2018 LAeq (15hr) Day

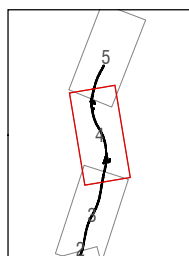
Noise Contours

APPENDIX D

\\au.slrl.local\Corporate\Projects-SLR\610-Sydney-Sydney\610-12331 Oxley Highway\GISData\Output\61012331_AppendixD Portrait 2028 Night.mxd



The content contained within this document may be based on third party data. SLR Consulting Australia Pty Ltd does not guarantee the accuracy of such information.



- Noise Sensitive Receivers (Residences)
 - Non Noise Sensitive Receivers (Garages, sheds etc.)
 - Noise Logging Locations
 - Upgrade Alignment
- Day Noise Contours**
- 45 dBA
 - 50 dBA
 - 55 dBA
 - 60 dBA
 - 65 dBA

Oxley Highway to Kundaberg

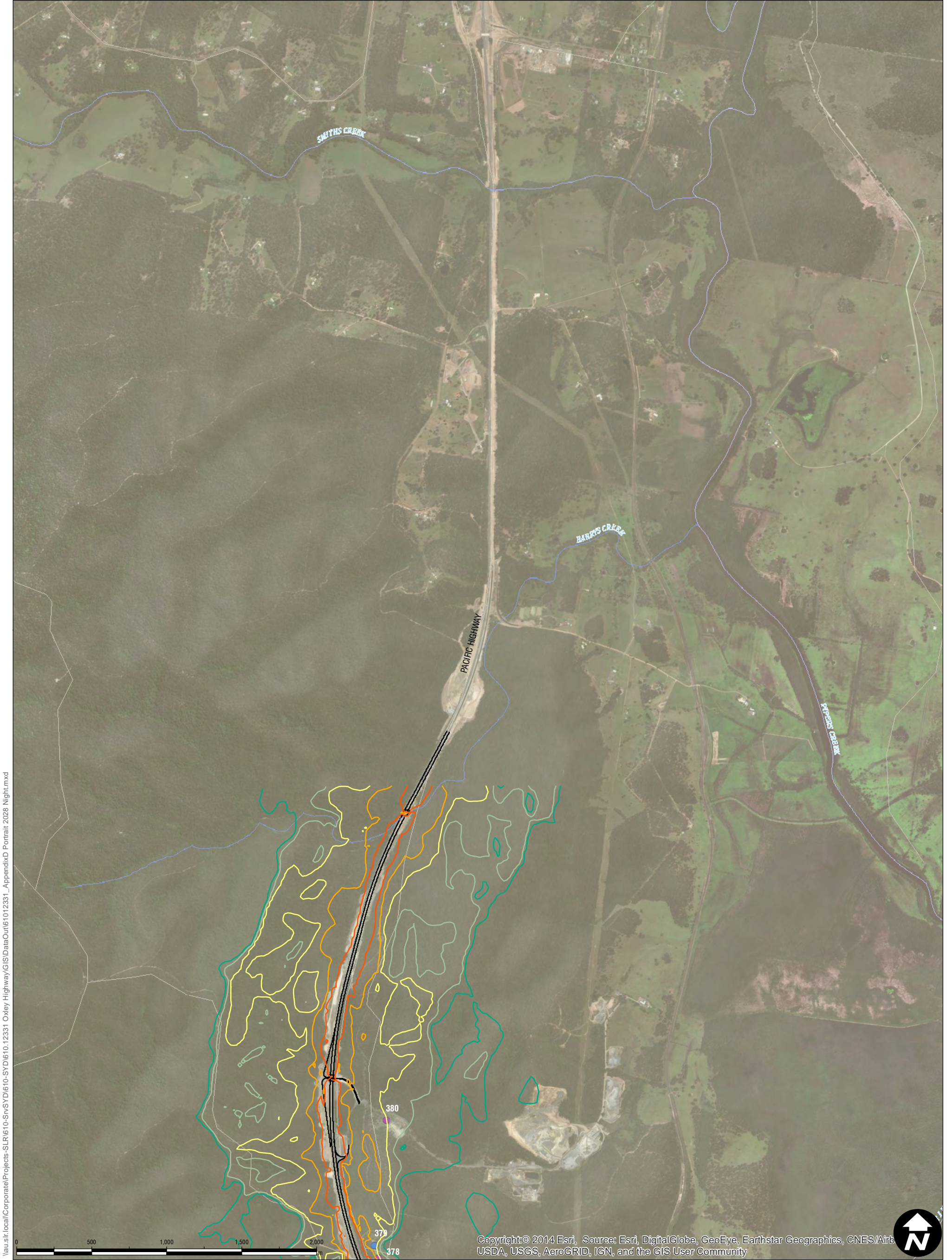
Post Construction Noise Report

2018 LAeq (15hr) Day

Noise Contours

APPENDIX D

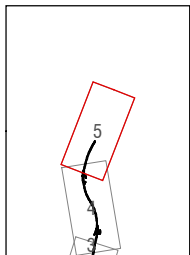
Page 4 of 5



\\au.slr.local\Corporate\Projects-SLR\610-SvSYD\610-SYD\610.12331 Oxley Highway\GISData\Out61012331_AppendixD Portrait 2028 Night.mxd

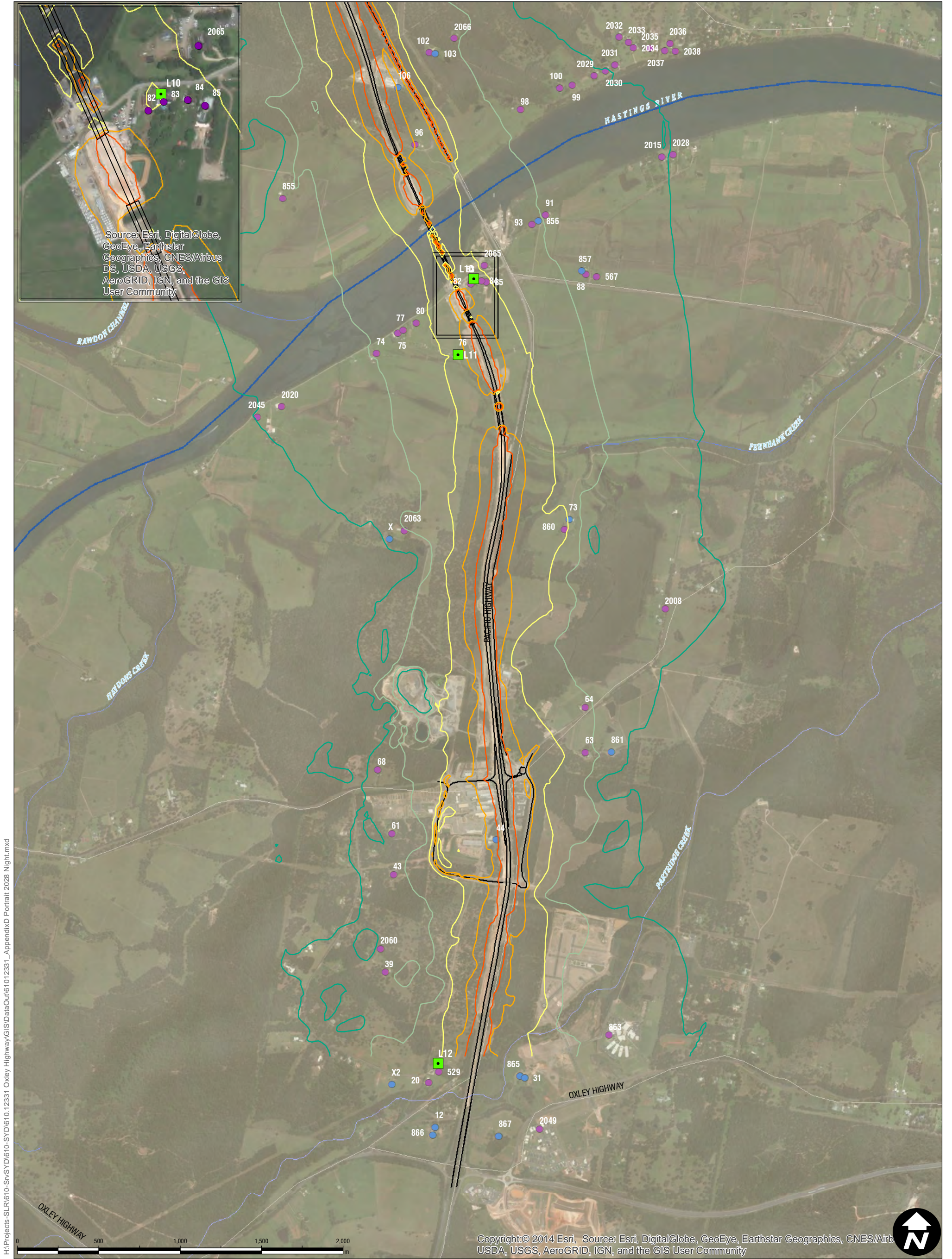


The content contained within this document may be based on third party data.
SLR Consulting Australia Pty Ltd does not guarantee the accuracy of such information.



- Noise Sensitive Receivers (Residences)
 - Non Noise Sensitive Receivers (Garages, sheds etc.)
 - Noise Logging Locations
 - Upgrade Alignment
- Day Noise Contours**
- 45 dBA
 - 50 dBA
 - 55 dBA
 - 60 dBA
 - 65 dBA

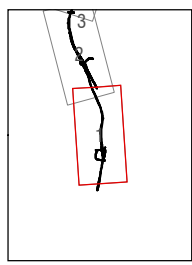
Oxley Highway to Kundaberg
Post Construction Noise Report
2018 LAeq (15hr) Day
Noise Contours



H:\Projects\SLR\610-Srv\SYD\610-SYD\610-12331 Oxley Highway\GIS\Data\Out\61012331_AppendixD_Porrait 2028 Night.mxd



The content contained within this document may be based on third party data.
SLR Consulting Australia Pty Ltd does not guarantee the accuracy of such information.



- Noise Sensitive Receivers (Residences)
 - Non Noise Sensitive Receivers (Garages, sheds etc.)
 - Noise Logging Locations
 - Upgrade Alignment
- Day Noise Contours
- 45 dBA
 - 50 dBA
 - 55 dBA
 - 60 dBA
 - 65 dBA

Oxley Highway to Kundaberg

Post Construction Noise Report
2018 LAeq (9hr) Night
Noise Contours

APPENDIX D

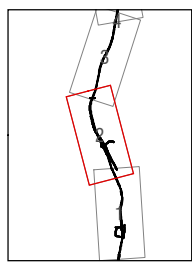
Page 1 of 5



H:\Projects\SLR\610-Srv\SYD\610-SYD\610-12331 Oxley Highway\GIS\Data\Out\61012331_AppendixD Portrait 2028 Night.mxd



The content contained within this document may be based on third party data.
SLR Consulting Australia Pty Ltd does not guarantee the accuracy of such information.

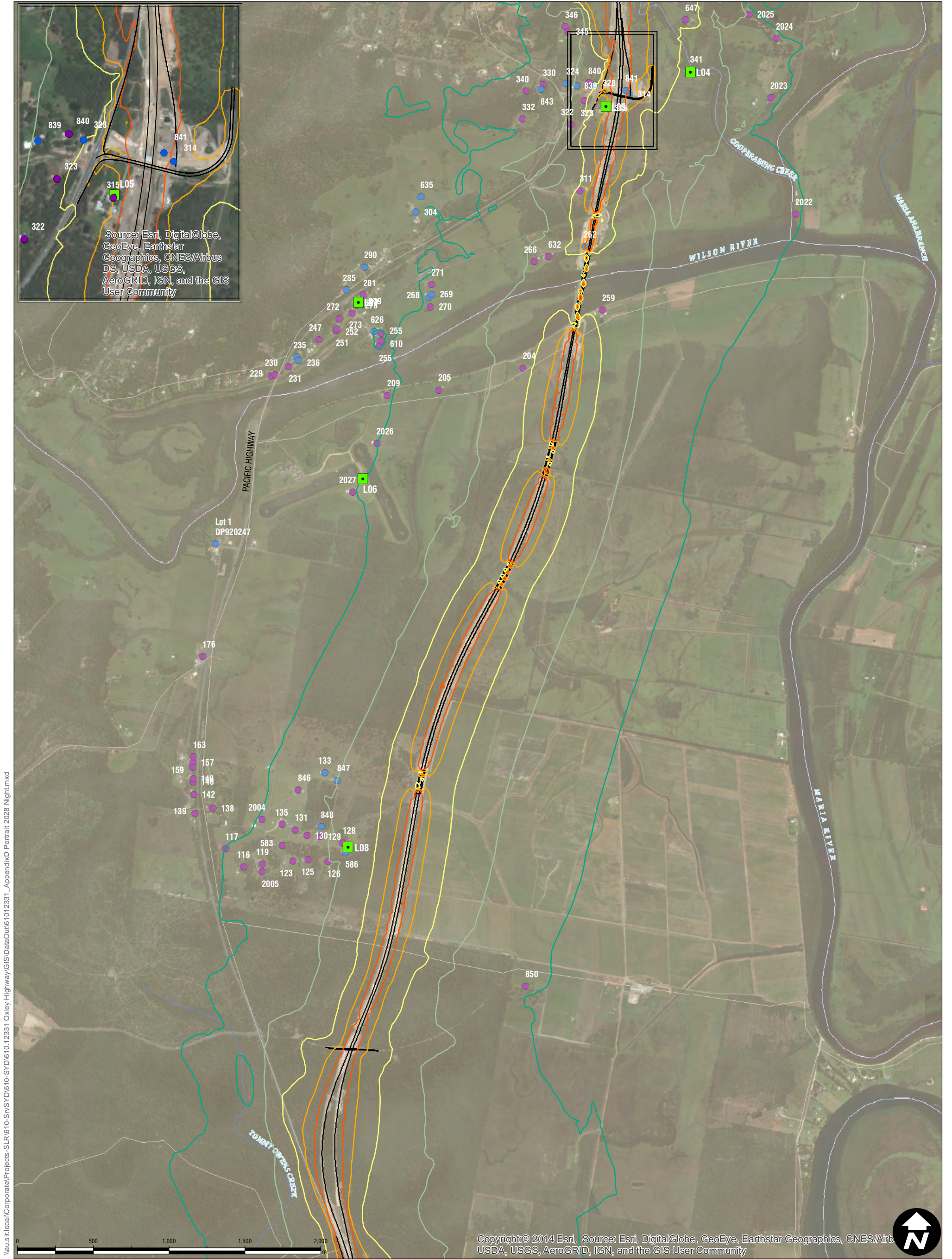


- Noise Sensitive Receivers (Residences)
 - Non Noise Sensitive Receivers (Garages, sheds etc.)
 - Noise Logging Locations
 - Upgrade Alignment
- Day Noise Contours**
- 45 dBA
 - 50 dBA
 - 55 dBA
 - 60 dBA
 - 65 dBA

Oxley Highway to Kundaberg

Post Construction Noise Report
2018 LAeq (9hr) Night
Noise Contours

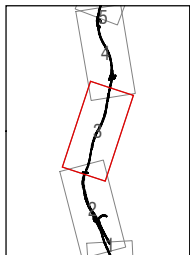
APPENDIX D



\\au.slr.local\Corporate\Projects-SLR\610-Sydney\610-Sydney\GISData\Output\61012331_Oxley Highway\GISData\Output\61012331_AppendixD Portrait 2028 Night.mxd



The content contained within this document may be based on third party data. SLR Consulting Australia Pty Ltd does not guarantee the accuracy of such information.



- Noise Sensitive Receivers (Residences)
 - Non Noise Sensitive Receivers (Garages, sheds etc.)
 - Noise Logging Locations
 - Upgrade Alignment
- Day Noise Contours**
- 45 dBA
 - 50 dBA
 - 55 dBA
 - 60 dBA
 - 65 dBA

Oxley Highway to Kundaberg

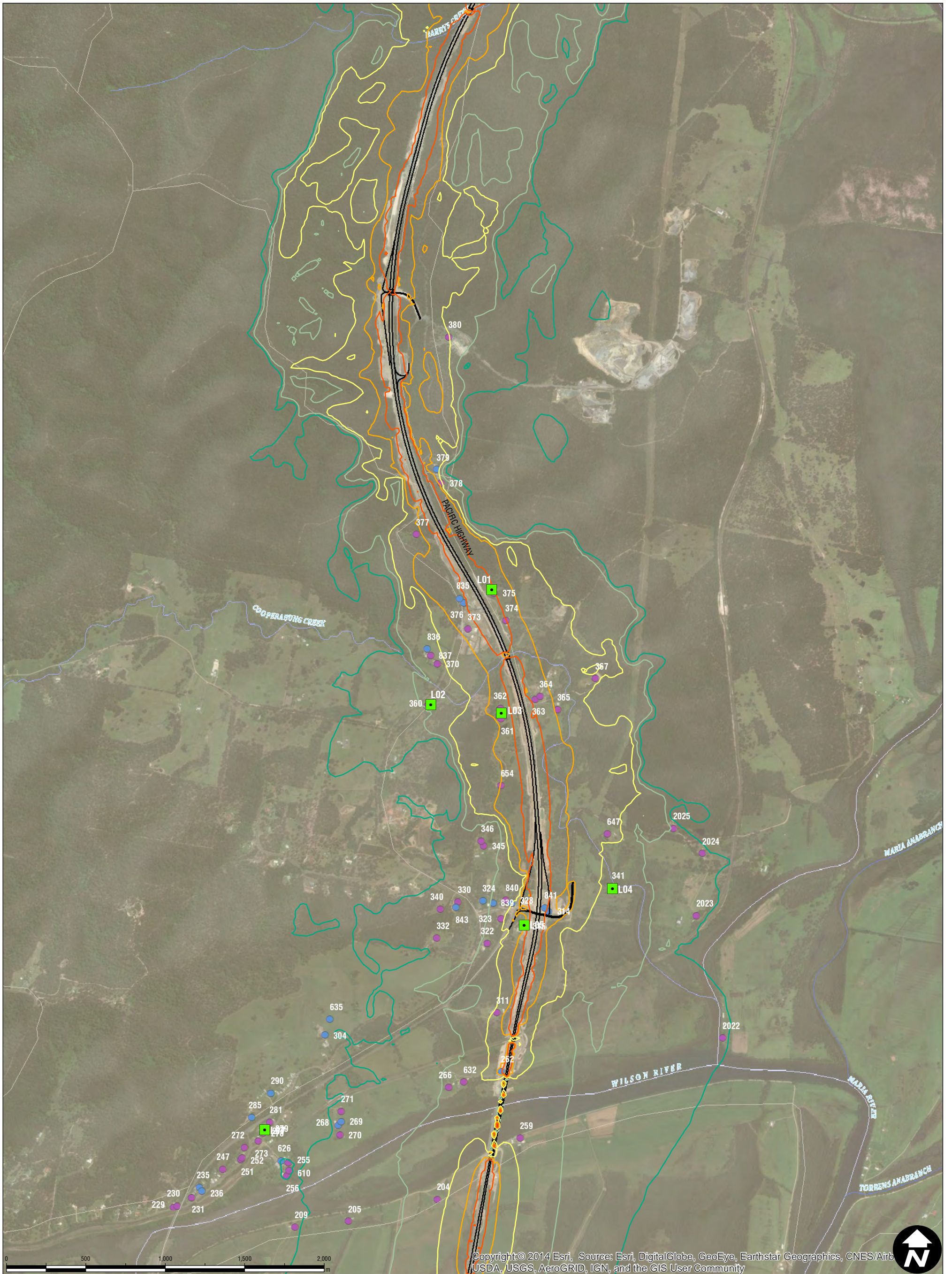
Post Construction Noise Report

2018 LAeq (15hr) Day

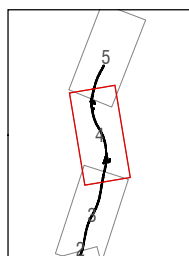
Noise Contours

APPENDIX D

\\au.slrl.local\Corporate\Projects-SLR\610-Sydney\610-Sydney\GISData\Output\61012331_AppendixD_Porrait_2028_Night.mxd



The content contained within this document may be based on third party data. SLR Consulting Australia Pty Ltd does not guarantee the accuracy of such information.



- Noise Sensitive Receivers (Residences)
 - Non Noise Sensitive Receivers (Garages, sheds etc.)
 - Noise Logging Locations
 - Upgrade Alignment
- Day Noise Contours**
- 45 dBA
 - 50 dBA
 - 55 dBA
 - 60 dBA
 - 65 dBA

Oxley Highway to Kundaberg

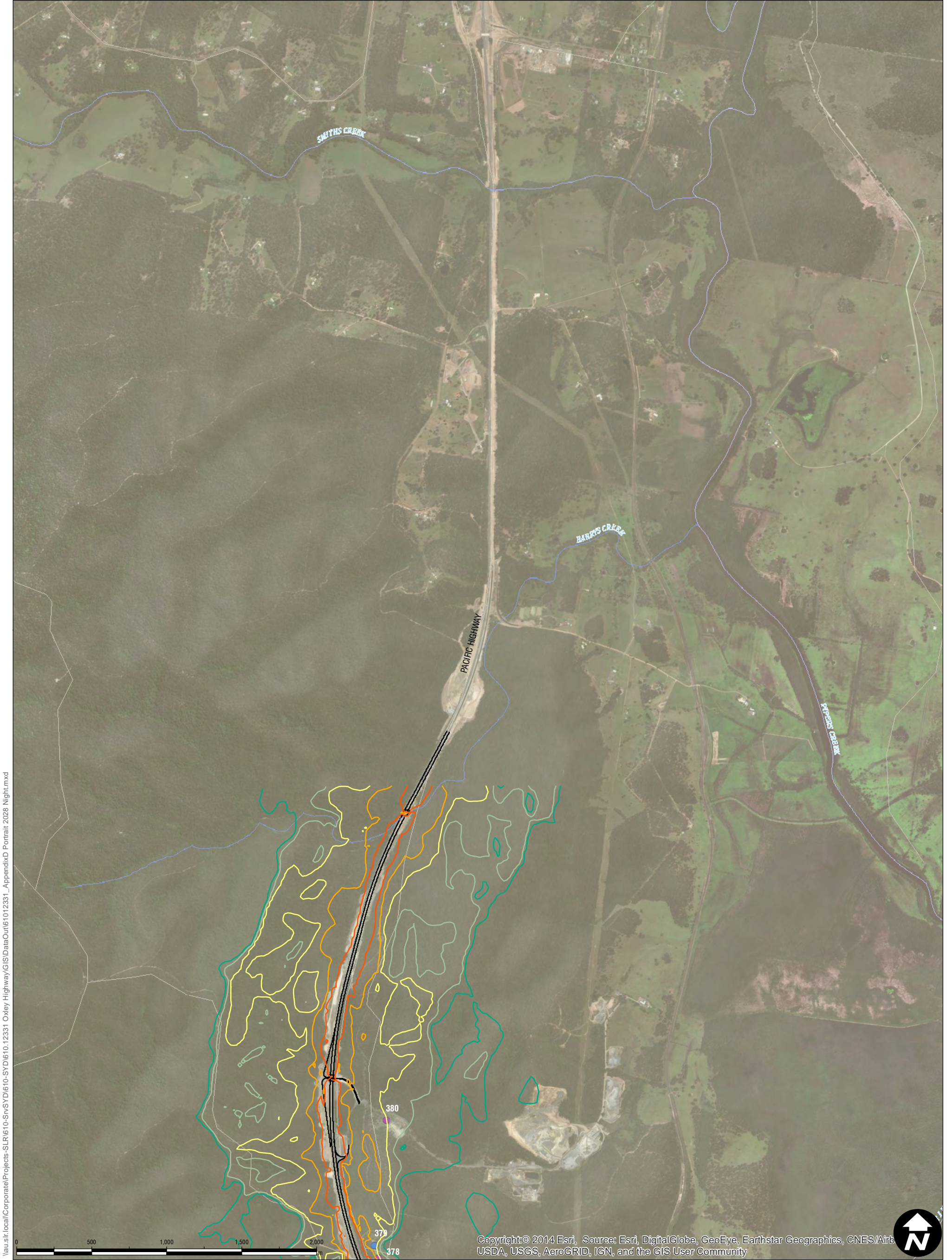
Post Construction Noise Report

2018 LAeq (15hr) Day

Noise Contours

APPENDIX D

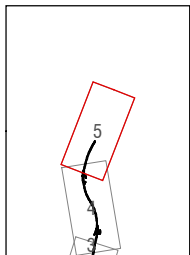
Page 4 of 5



\\au.slr.local\Corporate\Projects-SLR\610-SvSYD\610-SYD\610.12331 Oxley Highway\GISData\Out61012331_AppendixD Portrait 2028 Night.mxd

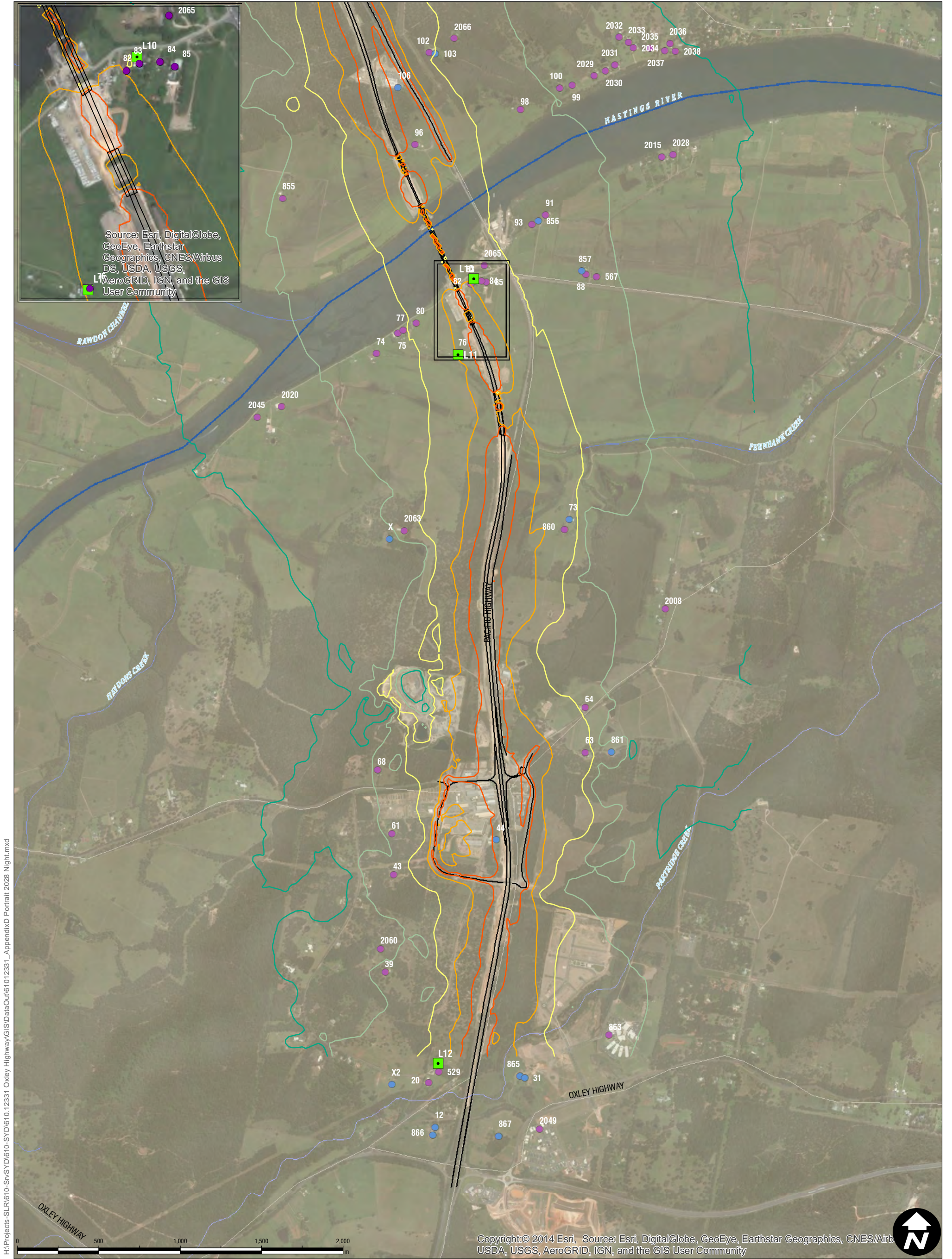


The content contained within this document may be based on third party data.
SLR Consulting Australia Pty Ltd does not guarantee the accuracy of such information.



- Noise Sensitive Receivers (Residences)
 - Non Noise Sensitive Receivers (Garages, sheds etc.)
 - Noise Logging Locations
 - Upgrade Alignment
- Day Noise Contours**
- 45 dBA
 - 50 dBA
 - 55 dBA
 - 60 dBA
 - 65 dBA

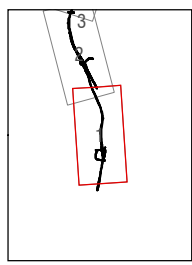
Oxley Highway to Kundaberg
Post Construction Noise Report
2018 LAeq (15hr) Day
Noise Contours



H:\Projects\SLR\610-Srv\SYD\610-SYD\610-12331 Oxley Highway\GIS\Data\Out\61012331_AppendixD Portrait 2028 Night.mxd



The content contained within this document may be based on third party data. SLR Consulting Australia Pty Ltd does not guarantee the accuracy of such information.



- Noise Sensitive Receivers (Residences)
 - Non Noise Sensitive Receivers (Garages, sheds etc.)
 - Noise Logging Locations
 - Upgrade Alignment
- Day Noise Contours
- 45 dBA
 - 50 dBA
 - 55 dBA
 - 60 dBA
 - 65 dBA

Oxley Highway to Kundaberg

Post Construction Noise Report

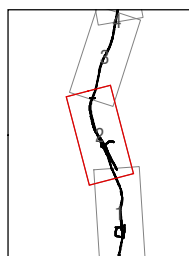
2028 LAeq (15hr) Day

Noise Contours

APPENDIX D



The content contained within this document may be based on third party data.
SLR Consulting Australia Pty Ltd does not guarantee the accuracy of such information.



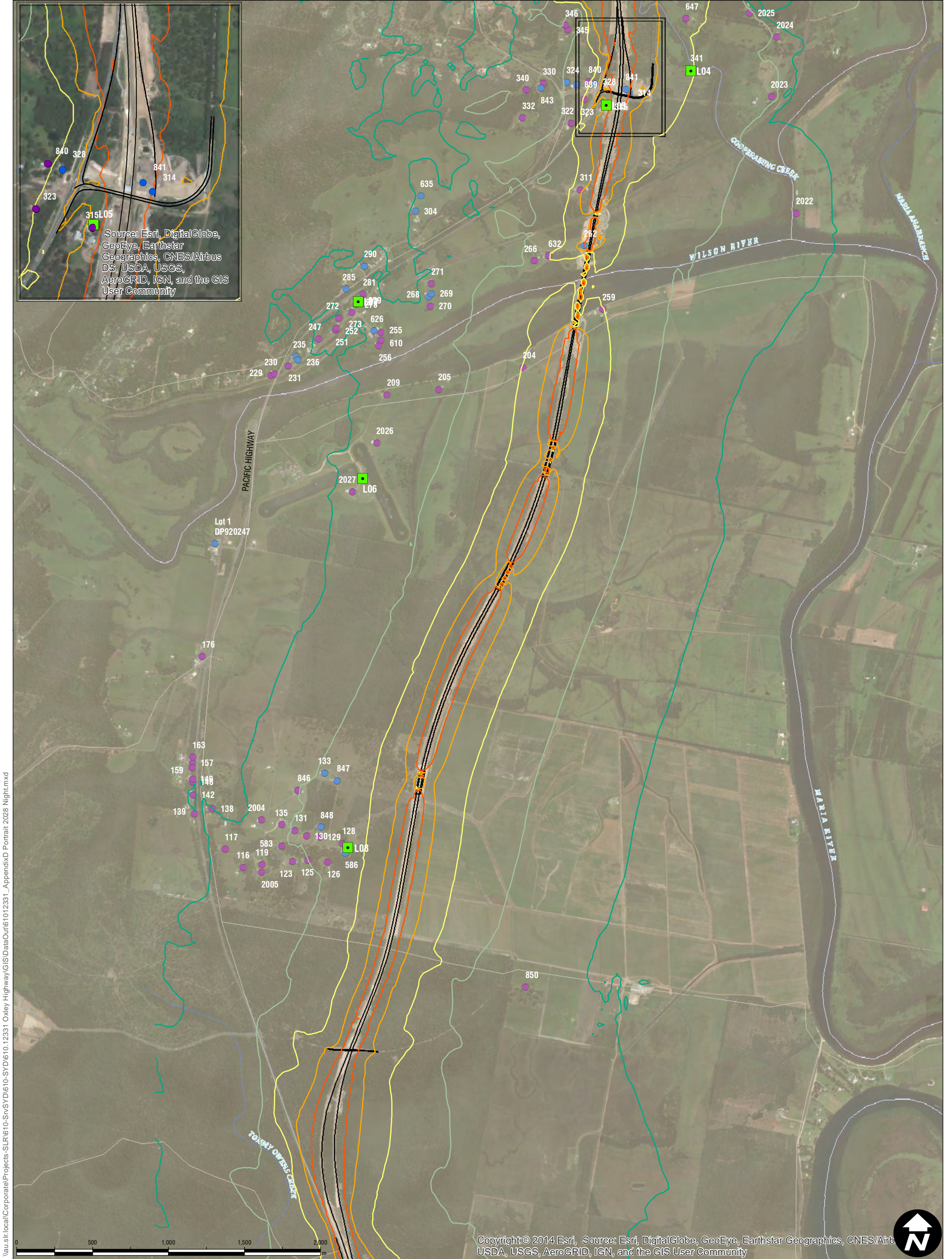
- Noise Sensitive Receivers (Residences)
 - Non Noise Sensitive Receivers (Garages, sheds etc.)
 - Noise Logging Locations
 - Upgrade Alignment
- Day Noise Contours**
- 45 dBA
 - 50 dBA
 - 55 dBA
 - 60 dBA
 - 65 dBA

Oxley Highway to Kundaberg

Post Construction Noise Report 2028 LAeq (15hr) Day Noise Contours

APPENDIX D

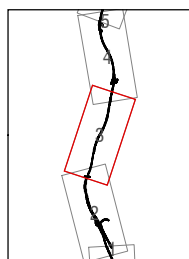
Page 2 of 5



\\au.slrl.local\Corporate\Projects-SLR\610-Sydney-Sydney\610-12331 Oxley Highway\GISData\61012331_AppendixD Portrait 2028 Night.mxd



The content contained within this document may be based on third party data.
SLR Consulting Australia Pty Ltd does not guarantee the accuracy of such information.



- Noise Sensitive Receivers (Residences)
 - Non Noise Sensitive Receivers (Garages, sheds etc.)
 - Noise Logging Locations
 - Upgrade Alignment
- Day Noise Contours**
- 45 dBA
 - 50 dBA
 - 55 dBA
 - 60 dBA
 - 65 dBA

Oxley Highway to Kundaberg

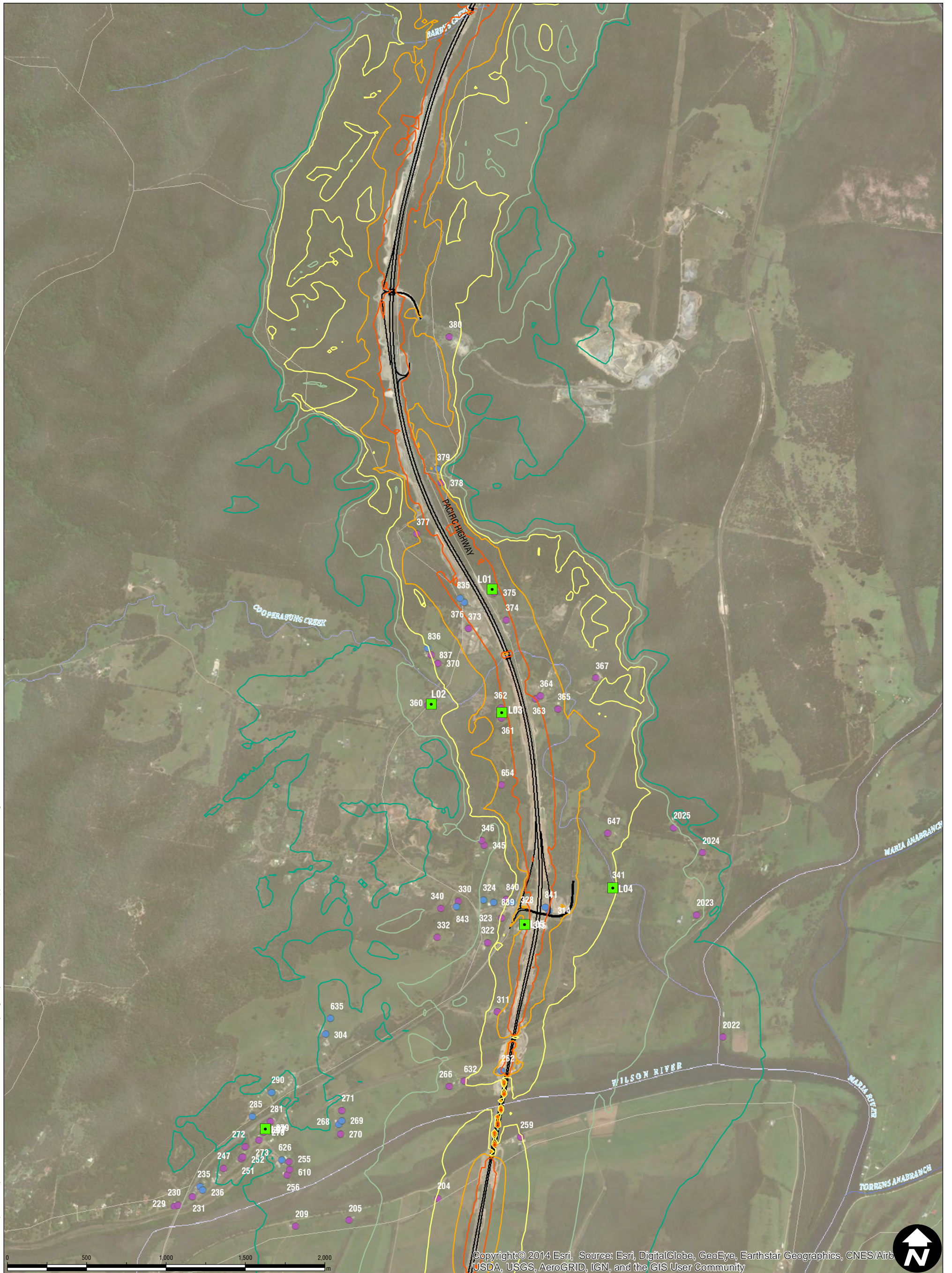
Post Construction Noise Report

2028 LAeq (15hr) Day

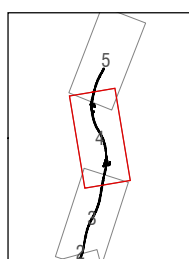
Noise Contours

APPENDIX D

\\au.slrl.local\Corporate\Projects-SLR\610-Sydney\610-Sydney\GISData\Output\61012331_Oxley Highway\GISData\Output\61012331_AppendixD Portrait 2028 Night.mxd



The content contained within this document may be based on third party data. SLR Consulting Australia Pty Ltd does not guarantee the accuracy of such information.

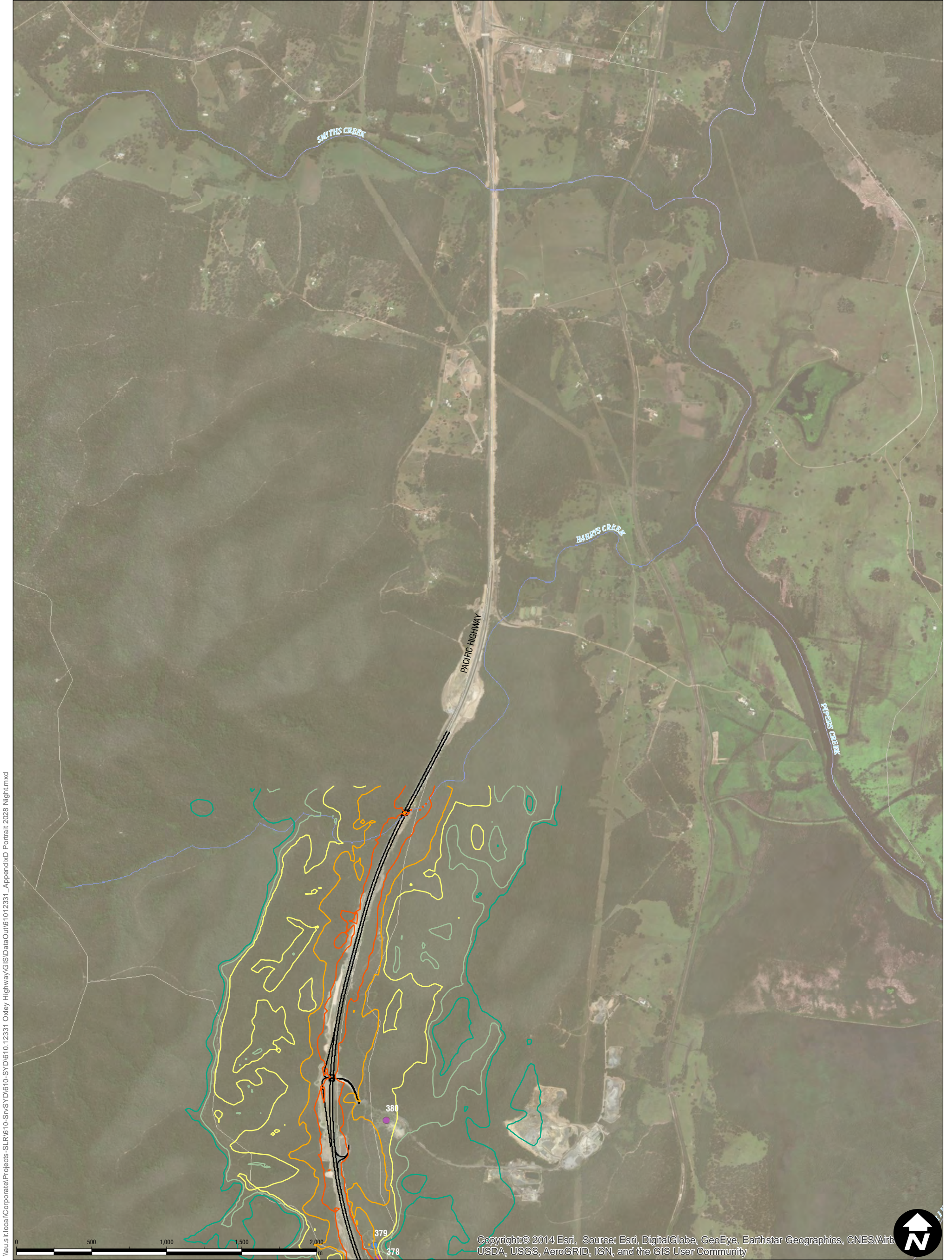


- Noise Sensitive Receivers (Residences)
 - Non Noise Sensitive Receivers (Garages, sheds etc.)
 - Noise Logging Locations
 - Upgrade Alignment
- Day Noise Contours**
- 45 dBA
 - 50 dBA
 - 55 dBA
 - 60 dBA
 - 65 dBA

Oxley Highway to Kundaberg
Post Construction Noise Report
2028 LAeq (15hr) Day
Noise Contours

APPENDIX D

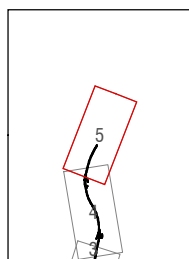
Page 4 of 5



\\au.slr.local\Corporate\Projects-SLR\610-SvSYD\610-SYD\610.12331 Oxley Highway\GISData\Out\61012331_AppendixD Portrait 2028 Night.mxd

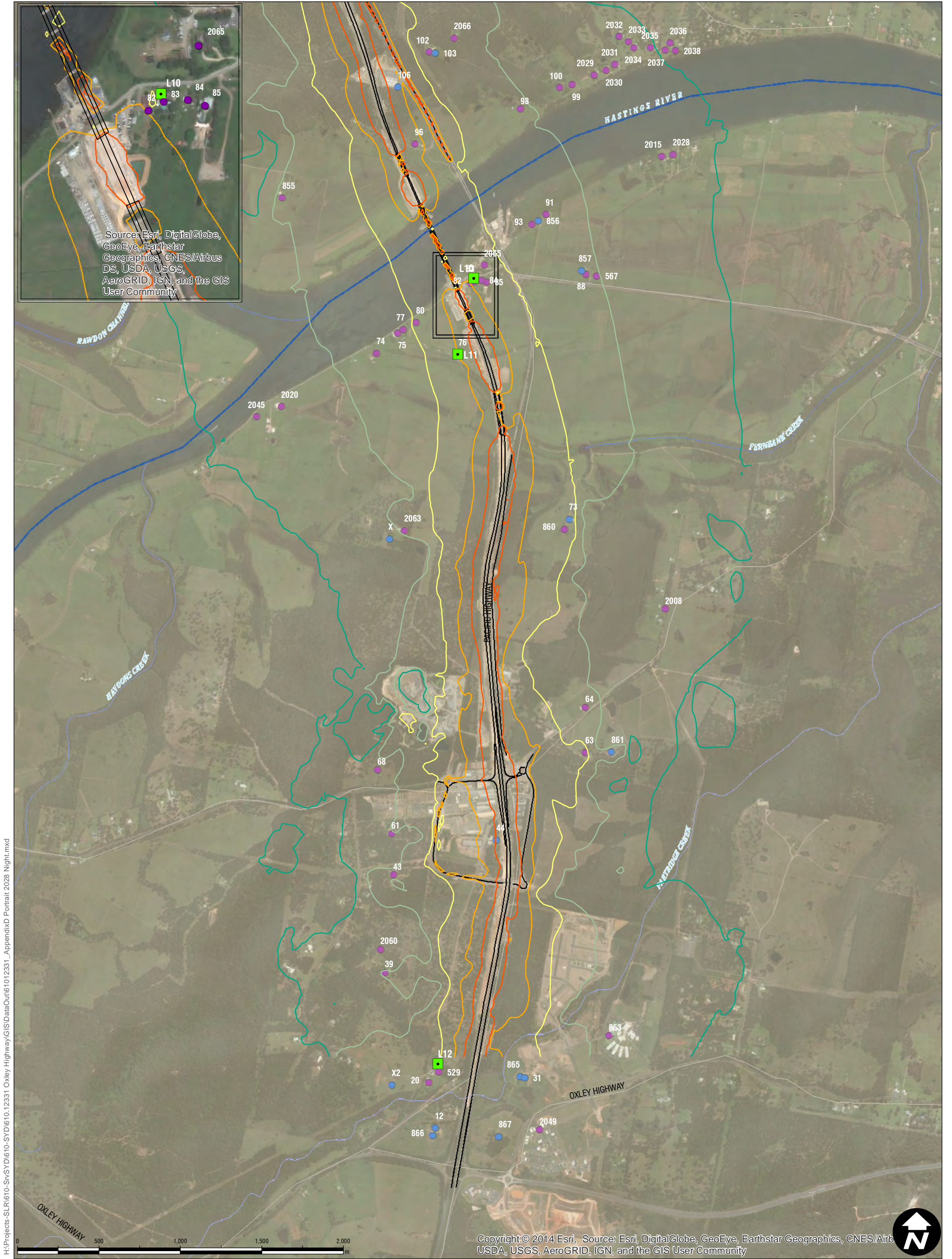


The content contained within this document may be based on third party data.
SLR Consulting Australia Pty Ltd does not guarantee the accuracy of such information.



- Noise Sensitive Receivers (Residences)
 - Non Noise Sensitive Receivers (Garages, sheds etc.)
 - Noise Logging Locations
 - Upgrade Alignment
- | Day Noise Contours | |
|--------------------|--------|
| 45 dBA | 50 dBA |
| 55 dBA | 60 dBA |
| 65 dBA | |

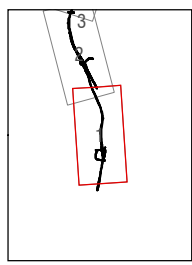
Oxley Highway to Kundaberg
Post Construction Noise Report
2028 LAeq (15hr) Day
Noise Contours



H:\Projects\SLR\610-Srv\SYD\610-SYD\610-12331 Oxley Highway\GIS\Data\Out\61012331_AppendixD Portrait 2028 Night.mxd



The content contained within this document may be based on third party data. SLR Consulting Australia Pty Ltd does not guarantee the accuracy of such information.



- Noise Sensitive Receivers (Residences)
 - Non Noise Sensitive Receivers (Garages, sheds etc.)
 - Noise Logging Locations
 - Upgrade Alignment
- Day Noise Contours**
- 45 dBA
 - 50 dBA
 - 55 dBA
 - 60 dBA
 - 65 dBA

Oxley Highway to Kundaberg

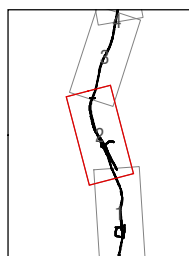
Post Construction Noise Report 2028 LAeq (9hr) Night Noise Contours

APPENDIX D

H:\Projects\SLR\610-Srv\SYD\610-SYD\610-12331 Oxley Highway\GISData\Out\61012331_AppendixD Portrait 2028 Night.mxd



The content contained within this document may be based on third party data.
SLR Consulting Australia Pty Ltd does not guarantee the accuracy of such information.



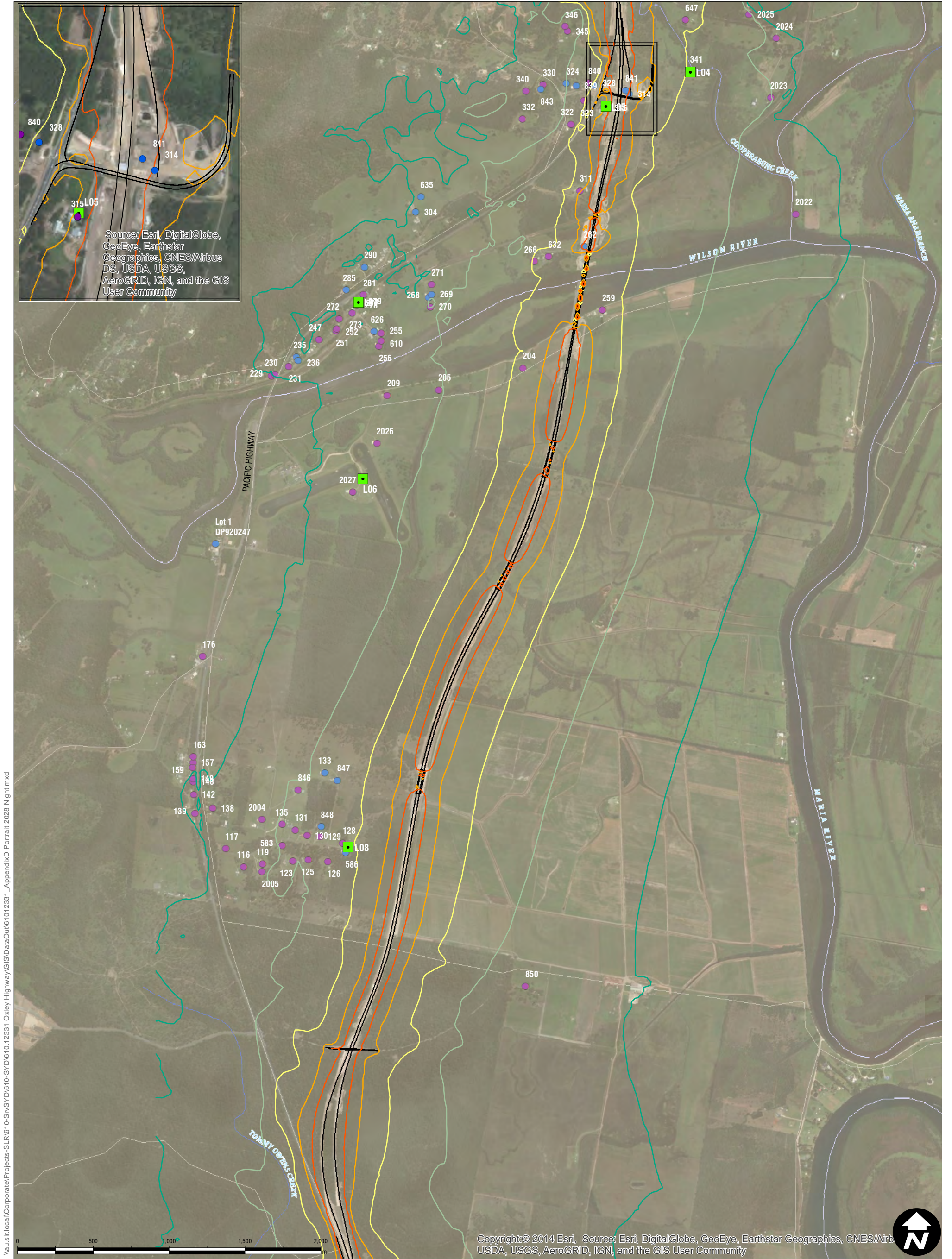
- Noise Sensitive Receivers (Residences)
 - Non Noise Sensitive Receivers (Garages, sheds etc.)
 - Noise Logging Locations
 - Upgrade Alignment
- Day Noise Contours**
- 45 dBA
 - 50 dBA
 - 55 dBA
 - 60 dBA
 - 65 dBA

Oxley Highway to Kundaberg

Post Construction Noise Report 2028 LAeq (9hr) Night Noise Contours

APPENDIX D

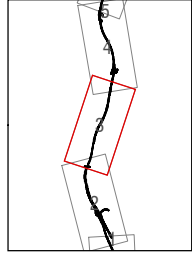
Page 2 of 5



\\au.slr.local\Corporate\Projects-SLR\610-Sydney-Sydney\610-12331 Oxley Highway\GISData\Out61012331_AppendixD Portrait 2028 Night.mxd



The content contained within this document may be based on third party data. SLR Consulting Australia Pty Ltd does not guarantee the accuracy of such information.



- Noise Sensitive Receivers (Residences)
 - Non Noise Sensitive Receivers (Garages, sheds etc.)
 - Noise Logging Locations
 - Upgrade Alignment
- Day Noise Contours**
- 45 dBA
 - 50 dBA
 - 55 dBA
 - 60 dBA
 - 65 dBA

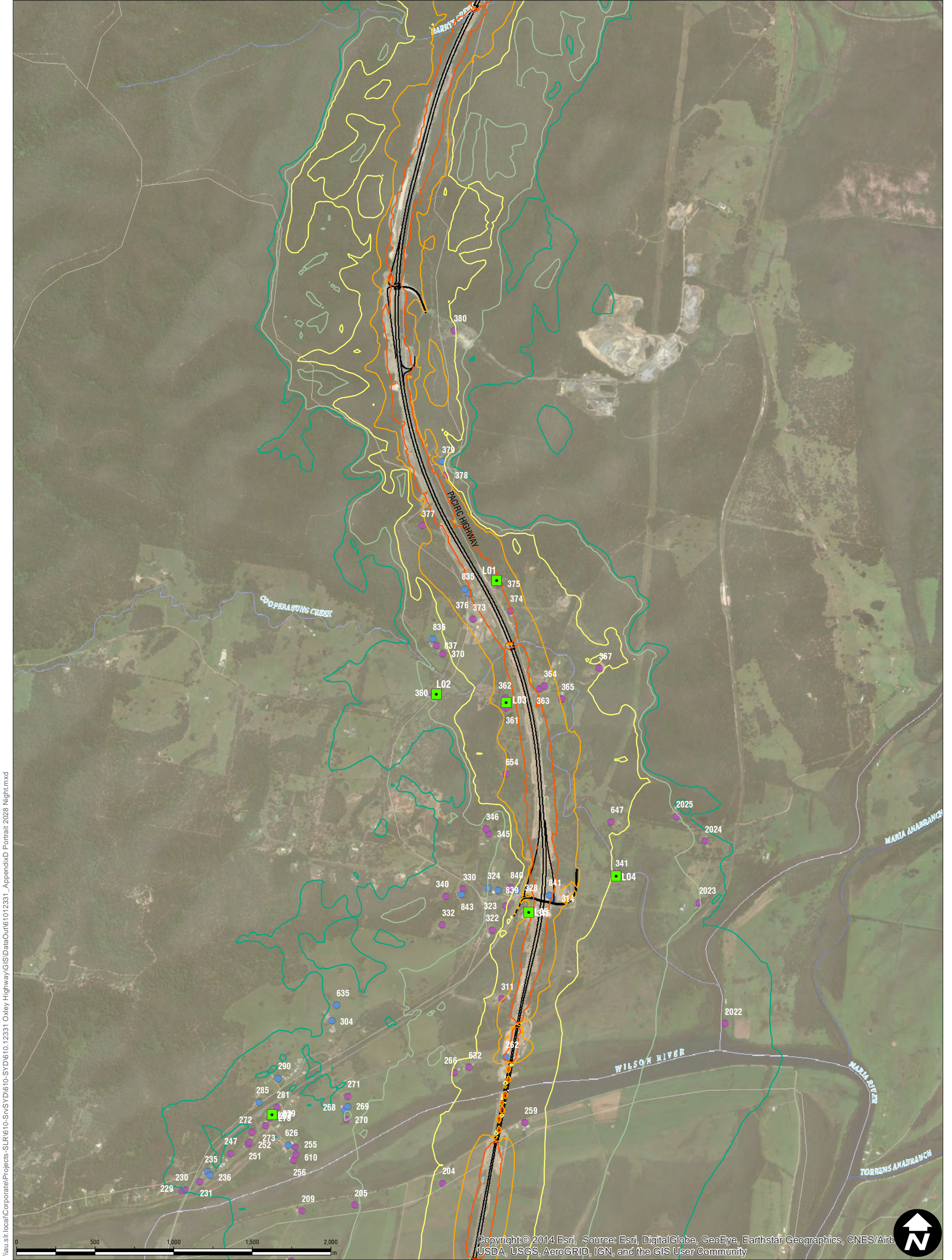
Oxley Highway to Kundaberg

Post Construction Noise Report

2028 LAeq (9hr) Night

Noise Contours

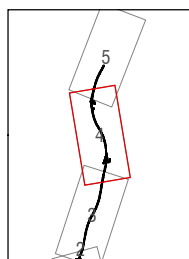
APPENDIX D



\\au.slrl.local\Corporate\Projects-SLR\610-Sr\SVD\610-SVD\610.12331_Oxley Highway\GISData\Out\61012331_AppendixD_Porrait 2028 Night.mxd



The content contained within this document may be based on third party data. SLR Consulting Australia Pty Ltd does not guarantee the accuracy of such information.

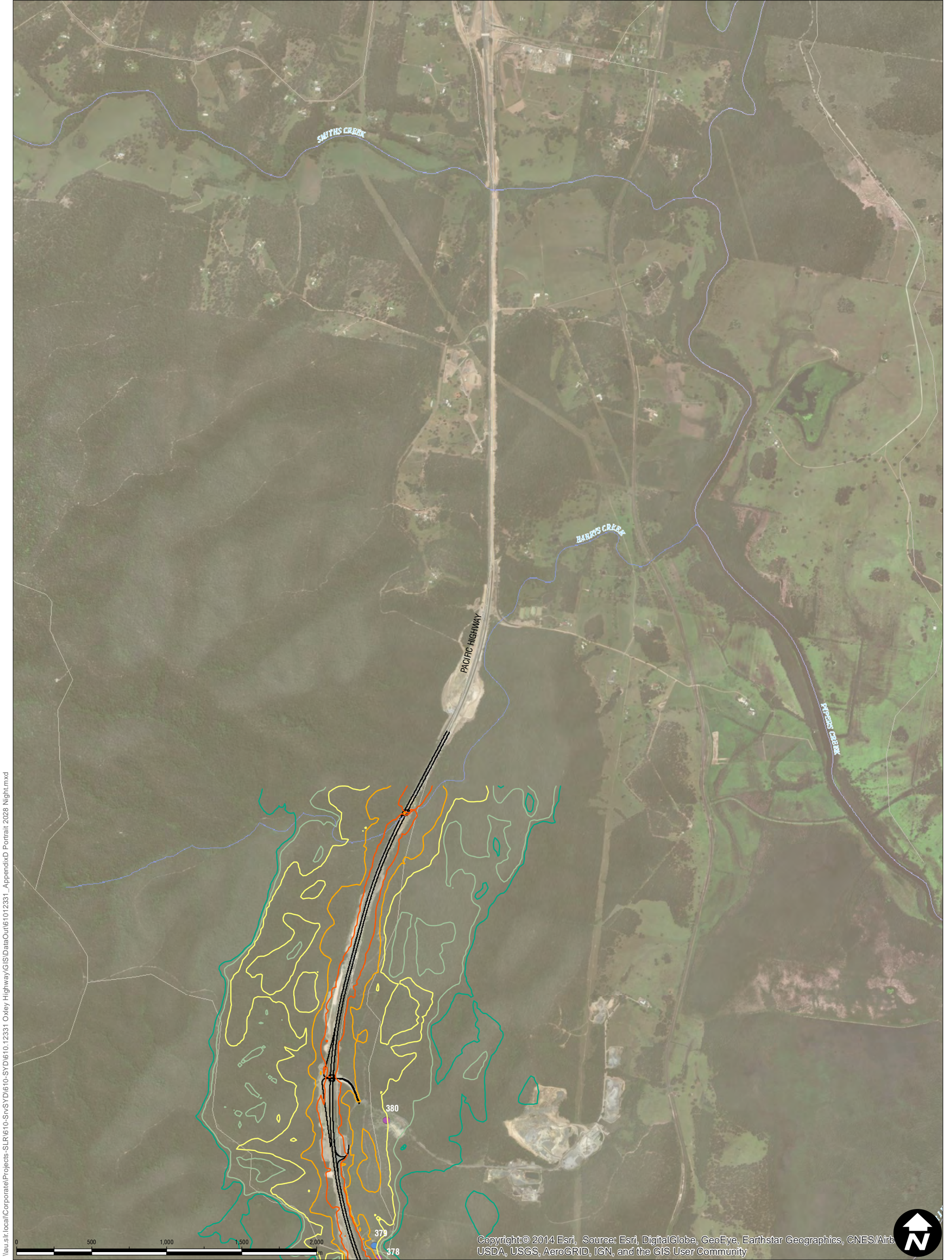


- Noise Sensitive Receivers (Residences)
- Non Noise Sensitive Receivers (Garages, sheds etc.)
- Noise Logging Locations
- Upgrade Alignment
- Day Noise Contours
 - 45 dBA
 - 50 dBA
 - 55 dBA
 - 60 dBA
 - 65 dBA

Oxley Highway to Kundaberg Post Construction Noise Report 2028 LAeq (9hr) Night Noise Contours

APPENDIX D

Page 4 of 5

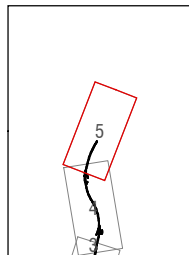


\\au.slr.local\Corporate\Projects-SLR\610-SvSYD\610-SYD\610.12331 Oxley Highway\GISData\Out61012331_AppendixD Portrait 2028 Night.mxd

Copyright © 2014 Esri, Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus, USDA, USGS, AeroGRID, IGN, and the GIS User Community



The content contained within this document may be based on third party data. SLR Consulting Australia Pty Ltd does not guarantee the accuracy of such information.



- Noise Sensitive Receivers (Residences)
 - Non Noise Sensitive Receivers (Garages, sheds etc.)
 - Noise Logging Locations
 - Upgrade Alignment
- Day Noise Contours**
- 45 dBA
 - 50 dBA
 - 55 dBA
 - 60 dBA
 - 65 dBA

Oxley Highway to Kundaberg
Post Construction Noise Report
2028 LAeq (9hr) Night
Noise Contours

APPENDIX E

Updated ONMR ECRTN Assessment Year 2016 and Design Year 2026

NCA	Receiver ID	2016 Future Existing Noise Level ^{1,8}		Applicable ECRTN Criteria ²		Detailed Design Noise Level (dBA) ^{3,5}				2026 Future Design "Exceedance" at Most Affected Facade (dBA) ^{4,5}			
		Daytime LAeq(15hr)	Night-time LAeq(9hr)	Daytime LAeq(15hr)	Night-time LAeq(9hr)	2016 Future		2026 Future Design		Daytime LAeq(15hr)		Night-time LAeq(9hr)	
						Daytime LAeq(15hr)	Night-time LAeq(9hr)	Daytime LAeq(15hr)	Night-time LAeq(9hr)	Exceedance ⁴ (dBA)	Acute?	Exceedance ⁴ (dBA)	Acute?
11	360	49	48	60	55	52	50	53	51	-	-	-	-
11	361	61	60	63	62	65	63	66	64	2.8	YES	2.1	YES
11	362	60	59	60	61	63	61	64	62	4.4	-	2	YES
11	370	52	51	60	55	55	53	56	54	-	-	-	-
11	373	59	58	60	60	63	61	65	62	4.5	-	3	YES
11	377	57	56	60	58	60	58	61	59	0.9	-	1.3	-
11	654	57	56	60	58	62	59	63	60	2.5	-	2.8	YES
11	837	51	50	60	55	55	53	56	54	-	-	-	-
12	363	63	62	65	64	65	63	66	64	1.1	YES	0.4	YES
12	364	60	58	60	60	62	60	63	61	3.4	-	1.2	YES
12	365	58	57	60	59	60	58	61	59	1.3	-	0.4	-
12	367	55	53	60	55	58	55	59	57	-	-	1.7	-
12	374	65	64	67	66	68	66	69	67	2	YES	1.3	YES
12	375	64	63	66	65	67	65	68	66	2	YES	1.2	YES
12	378	54	53	60	55	58	56	59	57	-	-	2	-
12	380	54	53	60	55	57	55	58	56	-	-	0.8	-
13	315	58	56	58	57	67	63	67	65	9.1	YES	8.7	YES
13	322	55	54	55	54	53	49	53	52	-	-	-	-
13	323	61	60	61	60	55	52	56	54	-	-	-	-
13	330	52	51	55	51	50	47	51	49	-	-	-	-
13	332	50	49	55	50	49	46	50	48	-	-	-	-
13	340	51	50	55	50	50	47	51	49	-	-	-	-
13	345	51	50	55	50	50	47	51	49	-	-	-	-
13	346	51	50	55	50	50	47	51	49	-	-	-	-
13	840	62	61	63	61	55	52	56	54	-	-	-	-
14	259	48	47	55	50	56	54	56	56	0.8	-	5.8	-
14	341	52	51	55	51	55	53	56	54	1.1	-	3.3	-
14	647	54	53	55	54	58	55	59	57	3.8	-	3.4	-
14	2022	45	43	55	50	47	45	48	47	-	-	-	-
14	2023	47	46	55	50	51	48	51	50	-	-	-	-
14	2024	47	45	55	50	49	46	50	48	-	-	-	-
14	2025	48	47	55	50	51	48	52	50	-	-	-	-
15	204	40	39	55	50	56	53	56	56	1	-	5.6	-
15	205	46	45	55	50	50	47	50	49	-	-	-	-
15	209	53	52	55	52	48	46	48	48	-	-	-	-
15	266	40	39	55	50	54	52	54	54	-	-	4	-
15	270	48	47	55	50	48	47	49	49	-	-	-	-
15	271	50	48	55	50	48	47	49	49	-	-	-	-
15	311	48	47	55	50	59	56	59	58	3.9	-	8.4	-
15	632	43	42	55	50	56	54	56	56	1.1	-	5.8	-
16	176	69	68	70	68	44	41	44	44	-	-	-	-
16	229	69	68	69	68	44	42	44	44	-	-	-	-
16	230	72	71	73	71	45	43	45	45	-	-	-	-
16	231	58	57	59	58	45	43	45	45	-	-	-	-
16	247	59	57	59	58	46	44	47	46	-	-	-	-
16	251	51	50	55	50	46	44	47	46	-	-	-	-
16	252	58	57	59	57	47	44	47	47	-	-	-	-
16	255	48	47	55	50	47	45	48	47	-	-	-	-
16	256	48	47	55	50	47	45	48	48	-	-	-	-
16	272	57	55	57	56	46	44	47	47	-	-	-	-
16	273	55	54	55	54	46	44	47	46	-	-	-	-
16	277	50	49	55	50	46	44	47	46	-	-	-	-
16	278	54	53	55	53	46	44	46	46	-	-	-	-
16	279	56	54	56	55	46	44	47	46	-	-	-	-
16	281	58	57	59	57	46	44	47	46	-	-	-	-
16	610	48	47	55	50	47	45	48	48	-	-	-	-
16	2026	45	43	55	50	48	45	48	47	-	-	-	-
16	2027	44	43	55	50	47	45	47	47	-	-	-	-
17	116	48	47	55	50	49	45	48	48	-	-	-	-
17	117	51	50	55	50	47	44	47	46	-	-	-	-
17	119	47	46	55	50	49	46	49	49	-	-	-	-
17	123	44	42	55	50	50	47	50	50	-	-	-	-
17	125	42	40	55	50	52	49	52	51	-	-	1.2	-
17	126	42	40	55	50	53	50	53	52	-	-	2.5	-
17	128	40	39	55	50	55	52	55	54	-	-	4.3	-
17	129	42	41	55	50	53	50	52	52	-	-	2	-
17	130	43	42	55	50	52	49	51	51	-	-	1.1	-
17	131	42	41	55	50	51	48	51	50	-	-	-	-
17	135	44	43	55	50	50	47	50	49	-	-	-	-
17	138	51	50	55	50	46	43	46	45	-	-	-	-
17	139	67	66	67	66	45	42	45	45	-	-	-	-
17	142	66	65	67	66	46	43	46	45	-	-	-	-
17	148	66	65	66	65	46	42	45	45	-	-	-	-
17	149	69	68	70	68	46	43	46	46	-	-	-	-
17	157	67	65	67	66	44	41	44	44	-	-	-	-
17	159	66	65	67	65	45	42	44	44	-	-	-	-
17	163	68	67	69	67	44	41	44	43	-	-	-	-
17	583	43	41	55	50	50	47	50	49	-	-	-	-
17	846	46	45	55	50	50	47	50	50	-	-	-	-
17	2004	45	43	55	50	48	45	48	47	-	-	-	-
17	2005	43	42	55	50	50	47	49	49	-	-	-	-
18	850	43	42	55	50	49	46	49	48	-	-	-	-
19	74	50	49	55	50	53	51	54	52	-	-	2.4	-
19	75	50	48	55	50	53	52	54	53	-	-	2.9	-
19	76	52	51	55	52	61	59	62	60	6.6	-	8.7	YES
19	77	51	49	55	50	54	53	55	54	-	-	4.1	-
19	80	51	50	55	50	56	54	56	55	1.4	-	5.3	-
19	855	48	47	55	50	51	49	52	51	-	-	0.7	-
19	2020	46	44	55	50	48	46	49	47	-	-	-	-
19	2045	45	44	55	50	46	45	48	46	-	-	-	-
19	2063	49	48	55	50	52	50	52	48	-	-	-	-

20	83	57	55	57	56	60	59	61	60	4.4	-	4.8	YES
20	84	58	56	58	57	60	58	60	59	2.3	-	2.7	-
20	85	54	52	55	53	57	56	58	57	3.1	-	4	-
20	88	54	53	55	53	52	50	53	51	-	-	-	-
20	91	55	54	56	54	52	50	53	51	-	-	-	-
20	93	56	54	56	55	52	51	53	52	-	-	-	-
20	96	51	50	55	50	62	60	62	61	7.1	-	10.8	YES
20	98	53	52	55	52	51	49	52	51	-	-	-	-
20	99	51	50	55	50	49	47	50	49	-	-	-	-
20	100	52	50	55	51	50	48	51	49	-	-	-	-
20	102	56	55	57	55	55	51	55	53	-	-	-	-
20	103	55	53	55	54	53	50	54	52	-	-	-	-
20	107	53	51	55	52	55	51	55	54	-	-	1.7	-
20	567	53	52	55	53	52	50	52	51	-	-	-	-
20	802	53	51	60	55	54	51	55	53	-	-	-	-
20	860	55	54	60	55	58	55	58	57	-	-	1.7	-
20	2015	49	48	55	50	47	46	49	48	-	-	-	-
20	2028	49	48	55	50	46	46	48	47	-	-	-	-
20	2029	50	48	55	50	48	46	49	47	-	-	-	-
20	2030	49	47	55	50	46	45	48	46	-	-	-	-
20	2031	50	48	55	50	48	46	49	47	-	-	-	-
20	2032	49	47	55	50	47	45	48	46	-	-	-	-
20	2033	46	45	55	50	45	43	46	44	-	-	-	-
20	2034	34	32	55	50	47	45	48	46	-	-	-	-
20	2035	47	46	55	50	45	43	46	45	-	-	-	-
20	2036	45	43	55	50	43	41	44	43	-	-	-	-
20	2037	47	46	55	50	45	43	46	44	-	-	-	-
20	2038	47	46	55	50	44	43	46	44	-	-	-	-
20	2065	53	52	55	53	56	54	56	55	1.4	-	2.9	-
20	2066	53	52	55	52	53	50	53	52	-	-	-	-
21	12	56	56	60	58	60	58	61	60	0.8	-	2	-
21	20	55	54	60	55	58	57	59	58	-	-	2.9	-
21	39	47	46	60	55	50	49	51	50	-	-	-	-
21	43	47	47	55	50	52	50	52	51	-	-	1	-
21	61	47	46	55	50	53	52	52	53	-	-	2.6	-
21	63	53	52	60	55	57	56	57	57	-	-	1.7	-
21	68	46	45	55	50	52	51	50	51	-	-	1.1	-
21	529	54	54	60	55	59	57	60	58	-	-	3.4	-
21	866	56	55	60	55	59	58	60	59	-	-	3.8	-
21	2060	44	43	60	55	49	47	48	48	-	-	-	-
22	31	54	53	60	55	57	56	58	57	-	-	2	-
22	64	51	50	60	55	55	53	55	54	-	-	-	-
22	863	48	47	60	55	52	50	52	50	-	-	-	-
22	865	56	55	60	55	59	58	60	59	-	-	3.8	-
22	867	55	55	60	55	59	58	60	59	-	-	4.2	-
22	2008	47	46	60	55	49	48	49	48	-	-	-	-
22	2049	50	49	60	55	54	52	55	53	-	-	-	-

Note 1	The 2016 Future Existing is the "baseline" scenario and is used to determine the existing road traffic noise level in the absence of the project, predicted at the year of opening. This scenario makes use of the existing alignment geometry.												
Note 2	The ECRTN criteria is determined from guidance in ECRTN/ENMM with the category based on SWTC Appendix 4 Tables 4.1 and 4.2.												
	Where the existing noise level is already above the ECRTN base criteria then the applicable criteria becomes the existing noise level plus the relevant allowance factor.												
Note 3	The 2016 Future and 2026 Future Design noise levels are based on the IFC Design of the highway with all noise controls included in the modelling.												
Note 4	Highest exceedance around the façades of the dwelling over and above the Applicable ECRTN criteria.												
Note 5	Predicted noise levels are shown rounded to an integer, whereas the increases in future traffic noise are presented to one decimal place.												

APPENDIX F

As Built ECRTN Assessment
Year of Opening 2018 and Design Year 2028

APPENDIX F
As Built ECRTN Assessment
Year of Opening 2018 and Design Year 2028

NCA	Receiver ID	2016 Future Existing Noise Level ^{1,8}		Applicable ECRTN Criteria ²		Detailed Design Noise Level (dBA) ^{3,5}				2028 Future Design "Exceedance" at Most Affected Facade (dBA) ^{4,5}			
		Daytime LAeq(15hr)	Night-time LAeq(9hr)	Daytime LAeq(15hr)	Night-time LAeq(9hr)	2018 Year of Opening		2028 Design Year		Daytime LAeq(15hr)		Night-time LAeq(9hr)	
						Daytime LAeq(15hr)	Night-time LAeq(9hr)	Daytime LAeq(15hr)	Night-time LAeq(9hr)	Exceedance ⁴ (dBA)	Acute?	Exceedance ⁴ (dBA)	Acute?
11	360	49	48	60	55	51	49	53	51	-	-	-	-
11	361	61	60	63	62	64	62	65	64	2.3	-	2	YES
11	362	60	59	60	61	62	61	64	62	4	-	1.9	YES
11	370	52	51	60	55	54	52	56	54	-	-	-	-
11	373	59	58	60	60	62	61	64	62	3.9	-	2.8	YES
11	377	57	56	60	58	58	57	60	59	-	-	0.7	-
11	654	57	56	60	58	60	59	62	61	2	-	2.8	YES
11	837	51	50	60	55	54	52	55	54	-	-	-	-
12	363	63	62	65	64	63	62	65	64	-	-	-0.4	YES
12	364	60	58	60	60	60	58	62	60	1.7	-	-	-
12	365	58	57	60	59	59	58	61	60	1	-	0.7	-
12	367	55	53	60	55	56	55	58	57	-	-	1.5	-
12	374	65	64	67	66	67	66	69	67	1.5	YES	1.2	YES
12	375	64	63	66	65	66	65	68	66	1.5	YES	1.1	YES
12	378	54	53	60	55	57	55	59	57	-	-	1.9	-
12	380	54	53	60	55	55	54	57	56	-	-	0.5	-
13	315	58	56	58	57	65	65	67	66	8.6	YES	9.7	YES
13	322	55	54	55	54	51	51	52	52	-	-	-	-
13	323	61	60	61	60	54	53	55	55	-	-	-	-
13	330	52	51	55	51	48	48	50	50	-	-	-	-
13	332	50	49	55	50	47	47	49	49	-	-	-	-
13	340	51	50	55	50	49	48	50	50	-	-	-	-
13	345	51	50	55	50	48	48	50	50	-	-	-	-
13	346	51	50	55	50	49	48	50	50	-	-	-	-
13	840	62	61	63	61	54	53	55	54	-	-	-	-
14	259	48	47	55	50	53	55	55	56	-	-	6.4	-
14	341	52	51	55	51	54	53	55	55	-	-	3.6	-
14	647	54	53	55	54	57	56	58	57	3.3	-	3.8	-
14	2022	45	43	55	50	46	46	47	47	-	-	-	-
14	2023	47	46	55	50	49	48	51	50	-	-	-	-
14	2024	47	45	55	50	48	47	49	49	-	-	-	-
14	2025	48	47	55	50	50	49	51	51	-	-	0.9	-
15	204	40	39	55	50	54	55	55	56	-	-	6.3	-
15	205	46	45	55	50	47	48	49	50	-	-	-	-
15	209	53	52	55	52	46	47	47	49	-	-	-	-
15	266	40	39	55	50	52	53	53	55	-	-	4.8	-
15	270	48	47	55	50	47	48	48	50	-	-	-	-
15	271	50	48	55	50	47	48	48	50	-	-	-	-
15	311	48	47	55	50	57	57	58	59	3	-	9	-
15	632	43	42	55	50	53	55	55	57	-	-	6.7	-
16	176	69	68	70	68	42	42	43	44	-	-	-	-
16	229	69	68	69	68	42	43	43	45	-	-	-	-
16	230	72	71	73	71	43	44	45	46	-	-	-	-
16	231	58	57	59	58	43	44	44	46	-	-	-	-
16	247	59	57	59	58	44	45	46	47	-	-	-	-
16	251	51	50	55	50	44	45	46	47	-	-	-	-
16	252	58	57	59	57	45	46	46	47	-	-	-	-
16	255	48	47	55	50	45	46	47	48	-	-	-	-
16	256	48	47	55	50	45	47	47	48	-	-	-	-
16	272	57	55	57	56	44	45	46	47	-	-	-	-
16	273	55	54	55	54	44	45	46	47	-	-	-	-
16	277	50	49	55	50	44	45	46	47	-	-	-	-
16	278	54	53	55	53	44	45	46	47	-	-	-	-
16	279	56	54	56	55	44	45	46	47	-	-	-	-
16	281	58	57	59	57	44	45	46	47	-	-	-	-
16	610	48	47	55	50	46	47	47	48	-	-	-	-
16	2026	45	43	55	50	45	46	47	48	-	-	-	-
16	2027	44	43	55	50	45	46	46	48	-	-	-	-
17	116	48	47	55	50	46	47	48	49	-	-	-	-
17	117	51	50	55	50	45	45	46	47	-	-	-	-
17	119	47	46	55	50	47	48	48	49	-	-	-	-
17	123	44	42	55	50	47	48	49	50	-	-	-	-
17	125	42	40	55	50	48	49	50	51	-	-	0.8	-
17	126	42	40	55	50	49	50	51	52	-	-	1.6	-
17	128	40	39	55	50	51	52	53	54	-	-	3.7	-
17	129	42	41	55	50	49	50	51	52	-	-	2	-
17	130	43	42	55	50	49	49	50	51	-	-	1.1	-
17	131	42	41	55	50	48	49	50	51	-	-	0.9	-
17	135	44	43	55	50	47	48	49	50	-	-	-	-
17	138	51	50	55	50	44	44	45	46	-	-	-	-
17	139	67	66	67	66	43	44	45	45	-	-	-	-
17	142	66	65	67	66	44	44	45	46	-	-	-	-
17	148	66	65	66	65	43	44	45	46	-	-	-	-
17	149	69	68	70	68	44	45	46	46	-	-	-	-
17	157	67	65	67	66	42	43	43	44	-	-	-	-
17	159	66	65	67	65	42	43	44	45	-	-	-	-
17	163	68	67	69	67	42	42	43	44	-	-	-	-
17	583	43	41	55	50	48	48	49	50	-	-	-	-
17	846	46	45	55	50	48	48	49	50	-	-	-	-
17	2004	45	43	55	50	45	46	47	48	-	-	-	-
17	2005	43	42	55	50	47	48	49	50	-	-	-	-
18	850	43	42	55	50	47	47	48	49	-	-	-	-
19	74	50	49	55	50	51	51	53	53	-	-	2.5	-
19	75	50	48	55	50	51	51	53	53	-	-	2.9	-
19	76	52	51	55	52	58	58	60	59	4.6	-	7.8	-
19	77	51	49	55	50	53	52	54	54	-	-	4	-
19	80	51	50	55	50	53	53	55	55	-	-	5.1	-
19	855	48	47	55	50	50	49	52	51	-	-	1	-
19	2020	46	44	55	50	46	46	49	48	-	-	-	-
19	2045	45	44	55	50	45	45	48	47	-	-	-	-
19	2063	49	48	55	50	50	49	52	51	-	-	1.2	-

APPENDIX F
As Built ECRTN Assessment
Year of Opening 2018 and Design Year 2028

20	82	56	55	57	55	60	60	62	62	5.2	-	6.6	YES
20	83	57	55	57	56	59	59	60	60	3.3	-	4.7	-
20	84	58	56	58	57	57	58	59	59	1.4	-	2.7	-
20	85	54	52	55	53	55	55	57	57	1.5	-	3.6	-
20	88	54	53	55	53	50	50	52	52	-	-	-	-
20	91	55	54	56	54	51	50	52	52	-	-	-	-
20	93	56	54	56	55	51	50	53	52	-	-	-	-
20	96	51	50	55	50	61	60	62	62	7.3	-	11.5	YES
20	98	53	52	55	52	51	49	52	51	-	-	-	-
20	99	51	50	55	50	48	47	50	49	-	-	-	-
20	100	52	50	55	51	49	48	51	50	-	-	-	-
20	102	56	55	57	55	54	52	55	54	-	-	-	-
20	103	55	53	55	54	53	51	54	53	-	-	-	-
20	107	53	51	55	52	54	53	55	55	-	-	3.1	-
20	567	53	52	55	53	50	49	52	51	-	-	-	-
20	802	53	51	60	55	53	53	55	54	-	-	-	-
20	860	55	54	60	55	56	55	58	57	-	-	2.2	-
20	2015	49	48	55	50	47	46	49	48	-	-	-	-
20	2028	49	48	55	50	46	46	48	47	-	-	-	-
20	2029	50	48	55	50	47	46	48	48	-	-	-	-
20	2030	49	47	55	50	46	45	47	46	-	-	-	-
20	2031	50	48	55	50	47	46	48	47	-	-	-	-
20	2032	49	47	55	50	46	45	48	47	-	-	-	-
20	2033	46	45	55	50	44	43	46	45	-	-	-	-
20	2034	34	32	55	50	46	45	47	47	-	-	-	-
20	2035	47	46	55	50	44	43	46	45	-	-	-	-
20	2036	45	43	55	50	43	42	44	43	-	-	-	-
20	2037	47	46	55	50	44	43	46	45	-	-	-	-
20	2038	47	46	55	50	44	43	45	44	-	-	-	-
20	2065	53	52	55	53	54	54	56	56	0.9	-	3.1	-
20	2066	53	52	55	52	52	51	54	52	-	-	-	-
21	12	56	56	60	58	60	59	61	59	1.2	-	1.1	-
21	20	55	54	60	55	58	57	60	57	-	-	2.1	-
21	39	47	46	60	55	50	49	52	50	-	-	-	-
21	43	47	47	55	50	51	49	52	51	-	-	0.8	-
21	61	47	46	55	50	51	48	52	50	-	-	-	-
21	63	53	52	60	55	55	54	57	55	-	-	-	-
21	68	46	45	55	50	50	47	51	49	-	-	-	-
21	529	54	54	60	55	59	58	60	58	-	-	2.7	-
21	866	56	55	60	55	59	58	60	58	-	-	3	-
21	2060	44	43	60	55	48	46	49	47	-	-	-	-
22	31	54	53	60	55	57	56	59	57	-	-	1.6	-
22	64	51	50	60	55	53	52	55	53	-	-	-	-
22	863	48	47	60	55	51	49	52	51	-	-	-	-
22	865	56	55	60	55	59	57	60	58	-	-	3.2	-
22	867	55	55	60	55	59	58	61	59	0.8	-	3.7	-
22	2008	47	46	60	55	47	46	49	48	-	-	-	-
22	2049	50	49	60	55	53	52	55	53	-	-	-	-
Note 1	The 2016 Future Existing is the "baseline" scenario and is used to determine the existing road traffic noise level in the absence of the project, predicted at the year of opening. This scenario makes use of the existing alignment geometry. The ECRTN criteria is determined from guidance in ECRTN/ENMM with the category based on SWTC Appendix 4 Tables 4.1 and 4.2.												
Note 2	Where the existing noise level is already above the ECRTN base criteria then the applicable criteria becomes the existing noise level plus the relevant allowance factor.												
Note 3	The 2018 Opening Yearand 2028 Design noise levels are based on the As Built Design of the highway with all noise controls included in the modelling.												
Note 4	Highest exceedance around the façades of the dwelling over and above the Applicable ECRTN criteria.												
Note 5	Predicted noise levels are shown rounded to an integer, whereas the increases in future traffic noise are presented to one decimal place.												

APPENDIX G

ONMR Year 2016 and 'As-Built' Year of Opening 2018 Comparison and
ONMR Design Year 2026 and 'As-Built' Design Year 2028 Comparison

APPENDIX G
ONMR Year 2016 and 'As-Built' Year of Opening 2018 Comparison and
ONMR Design Year 2026 and 'As-Built' Design Year 2028 Comparison

NCA	Receiver ID	ONMR and 'As-Built' Noise Level (dBA)						ONMR and 'As-Built' Noise Level (dBA)					
		Daytime LAeq(15hr)			Night-time LAeq(9hr)			Daytime LAeq(15hr)			Night-time LAeq(9hr)		
		Year 2016	Year 2018	2018-2016 Difference	Year 2016	Year 2018	2018-2016 Difference	Future Year 2026	Future Year 2028	2028-2026 Difference	Future Year 2026	Future Year 2028	2028-2026 Difference
11	360	52	51	-1.1	50	49	-0.8	53	53	-0.5	51	51	-0.2
11	361	65	64	-1.1	63	62	-0.8	66	65	-0.5	64	64	-0.1
11	362	63	62	-1.1	61	61	-0.8	64	64	-0.4	62	62	-0.1
11	370	55	54	-1.2	53	52	-0.8	56	56	-0.6	54	54	-0.1
11	373	63	62	-1.2	61	61	-0.9	65	64	-0.6	62	62	-0.2
11	377	60	58	-1.5	58	57	-1.1	61	60	-0.9	59	59	-0.6
11	654	62	60	-1.3	59	59	-0.8	63	62	-0.5	60	61	0.0
11	837	55	54	-1.1	53	52	-0.9	56	55	-0.5	54	54	-0.1
12	363	65	63	-2.0	63	62	-1.6	66	65	-1.3	64	64	-0.8
12	364	62	60	-2.4	60	58	-2.1	63	62	-1.7	61	60	-1.3
12	365	60	59	-1.0	58	58	-0.5	61	61	-0.3	59	60	0.3
12	367	58	56	-1.4	55	55	-0.8	59	58	-0.6	57	57	-0.2
12	374	68	67	-1.2	66	66	-0.9	69	69	-0.5	67	67	-0.1
12	375	67	66	-1.2	65	65	-0.8	68	68	-0.5	66	66	-0.1
12	378	58	57	-1.0	56	55	-0.8	59	59	-0.4	57	57	-0.1
12	380	57	55	-1.3	55	54	-0.8	58	57	-0.6	56	56	-0.3
13	315	67	65	-1.4	63	65	1.9	67	67	-0.5	65	66	1.0
13	322	53	51	-1.7	49	51	1.3	53	52	-0.6	52	52	0.7
13	323	55	54	-0.8	52	53	0.7	56	55	-0.6	54	55	0.4
13	330	50	48	-1.4	47	48	0.9	51	50	-0.7	49	50	0.5
13	332	49	47	-1.7	46	47	1.2	50	49	-0.7	48	49	0.6
13	340	50	49	-1.5	47	48	1.0	51	50	-0.7	49	50	0.6
13	345	50	48	-1.3	47	48	0.9	51	50	-0.7	49	50	0.6
13	346	50	49	-1.4	47	48	1.0	51	50	-0.7	49	50	0.6
13	840	55	54	-1.1	52	53	0.2	56	55	-0.8	54	54	0.2
14	259	56	53	-2.9	54	55	0.9	56	55	-1.3	56	56	0.6
14	341	55	54	-1.4	53	53	0.2	56	55	-0.8	54	55	0.3
14	647	58	57	-1.3	55	56	0.1	59	58	-0.5	57	57	0.4
14	2022	47	46	-1.5	45	46	0.8	48	47	-0.9	47	47	0.5
14	2023	51	49	-1.5	48	48	0.5	51	51	-0.6	50	50	0.5
14	2024	49	48	-1.5	46	47	0.9	50	49	-0.7	48	49	0.6
14	2025	51	50	-1.4	48	49	0.8	52	51	-0.6	50	51	0.7
15	204	56	54	-2.7	53	55	1.1	56	55	-1.0	56	56	0.7
15	205	50	47	-2.5	47	48	1.2	50	49	-1.0	49	50	0.7
15	209	48	46	-2.4	46	47	1.2	48	47	-1.0	48	49	0.6
15	266	54	52	-2.4	52	53	0.9	54	53	-1.2	54	55	0.8
15	270	48	47	-1.2	47	48	1.1	49	48	-0.9	49	50	0.7
15	271	48	47	-1.6	47	48	1.1	49	48	-1.1	49	50	0.7
15	311	59	57	-2.4	56	57	1.1	59	58	-0.9	58	59	0.6
15	632	56	53	-2.7	54	55	0.9	56	55	-1.3	56	57	0.9
16	176	44	42	-2.6	41	42	1.2	44	43	-0.7	44	44	0.4
16	229	44	42	-1.8	42	43	1.1	44	43	-1.0	44	45	0.7
16	230	45	43	-2.0	43	44	1.2	45	45	-0.9	45	46	0.7
16	231	45	43	-1.9	43	44	1.2	45	44	-1.0	45	46	0.6
16	247	46	44	-2.0	44	45	1.2	47	46	-1.0	46	47	0.6
16	251	46	44	-1.9	44	45	1.1	47	46	-0.9	46	47	0.7
16	252	47	45	-1.9	44	46	1.2	47	46	-1.0	47	47	0.7
16	255	47	45	-1.3	45	46	1.2	48	47	-0.9	47	48	0.7
16	256	47	45	-1.4	45	47	1.1	48	47	-1.0	48	48	0.7
16	272	46	44	-2.1	44	45	1.1	47	46	-0.9	47	47	0.7
16	273	46	44	-1.9	44	45	1.1	47	46	-0.9	46	47	0.7
16	277	46	44	-1.9	44	45	1.1	47	46	-1.0	46	47	0.7
16	278	46	44	-2.0	44	45	1.2	46	46	-0.9	46	47	0.7
16	279	46	44	-2.0	44	45	1.2	47	46	-0.9	46	47	0.7
16	281	46	44	-2.1	44	45	1.1	47	46	-0.9	46	47	0.7
16	610	47	46	-1.4	45	47	1.1	48	47	-1.0	48	48	0.7
16	2026	48	45	-2.6	45	46	1.2	48	47	-1.0	47	48	0.6
16	2027	47	45	-2.6	45	46	1.2	47	46	-1.0	47	48	0.6
17	116	49	46	-2.4	45	47	1.4	48	48	-0.5	48	49	0.7
17	117	47	45	-2.4	44	45	1.4	47	46	-0.6	46	47	0.7
17	119	49	47	-2.5	46	48	1.4	49	48	-0.6	49	49	0.7
17	123	50	47	-3.0	47	48	0.7	50	49	-1.1	50	50	0.1
17	125	52	48	-3.6	49	49	0.2	52	50	-1.6	51	51	-0.4
17	126	53	49	-4.1	50	50	-0.3	53	51	-2.1	52	52	-0.9
17	128	55	51	-3.9	52	52	0.0	55	53	-1.9	54	54	-0.6
17	129	53	49	-3.3	50	50	0.6	52	51	-1.2	52	52	0.0
17	130	52	49	-3.2	49	49	0.6	51	50	-1.2	51	51	0.0
17	131	51	48	-2.6	48	49	1.2	51	50	-0.6	50	51	0.6
17	135	50	47	-2.5	47	48	1.3	50	49	-0.6	49	50	0.6
17	138	46	44	-2.5	43	44	1.3	46	45	-0.6	45	46	0.7
17	139	45	43	-2.4	42	44	1.4	45	45	-0.5	45	45	0.7
17	142	46	44	-2.4	43	44	1.4	46	45	-0.5	45	46	0.7
17	148	46	43	-2.5	42	44	1.4	45	45	-0.6	45	46	0.7
17	149	46	44	-2.5	43	45	1.3	46	46	-0.6	46	46	0.6
17	157	44	42	-2.5	41	43	1.3	44	43	-0.6	44	44	0.7
17	159	45	42	-2.6	42	43	1.2	44	44	-0.6	44	45	0.7
17	163	44	42	-2.4	41	42	1.3	44	43	-0.6	43	44	0.7
17	583	50	48	-2.5	47	48	1.3	50	49	-0.6	49	50	0.6
17	846	50	48	-2.6	47	48	1.2	50	49	-0.7	50	50	0.4
17	2004	48	45	-2.5	45	46	1.2	48	47	-0.6	47	48	0.7
17	2005	50	47	-2.4	47	48	1.3	49	49	-0.5	49	50	0.7
18	850	49	47	-2.3	46	47	1.4	49	48	-0.5	48	49	0.7
19	74	53	51	-1.7	51	51	-0.5	54	53	-0.6	52	53	0.1
19	75	53	51	-1.8	52	51	-0.6	54	53	-0.7	53	53	0.0
19	76	61	58	-3.2	59	58	-1.5	62	60	-2.0	60	59	-0.9
19	77	54	53	-1.8	53	52	-0.7	55	54	-0.8	54	54	-0.1
19	80	56	53	-2.1	54	53	-0.8	56	55	-1.0	55	55	-0.2
19	855	51	50	-1.2	49	49	-0.2	52	52	-0.3	51	51	0.3
19	2020	48	46	-1.1	46	46	-0.3	49	49	-0.2	47	48	0.3
19	2045	46	45	-1.1	45	45	-0.3	48	48	-0.1	46	47	0.3
19	2063	52	50	-1.2	50	49	-0.2	52	52	-0.2	48	51	3.0

ONMR Year 2016 and 'As-Built' Year of Opening 2018 Comparison and
ONMR Design Year 2026 and 'As-Built' Design Year 2028 Comparison

20	82	62	60	-1.9	61	60	-0.7	63	62	-1.1	62	62	-0.1
20	83	60	59	-1.9	59	59	-0.7	61	60	-1.1	60	60	-0.1
20	84	60	57	-2.1	58	58	-0.7	60	59	-0.9	59	59	0.0
20	85	57	55	-2.3	56	55	-1.1	58	57	-1.6	57	57	-0.4
20	88	52	50	-1.9	50	50	-0.4	53	52	-0.3	51	52	0.1
20	91	52	51	-1.0	50	50	-0.1	53	52	-0.4	51	52	0.2
20	93	52	51	-1.3	51	50	-0.2	53	53	-0.3	52	52	0.3
20	96	62	61	-1.0	60	60	0.2	62	62	0.2	61	62	0.7
20	98	51	51	-0.8	49	49	0.2	52	52	-0.1	51	51	0.3
20	99	49	48	-0.9	47	47	0.0	50	50	-0.1	49	49	0.3
20	100	50	49	-0.8	48	48	0.1	51	51	-0.2	49	50	0.3
20	102	55	54	-0.5	51	52	0.8	55	55	0.3	53	54	0.2
20	103	53	53	-0.5	50	51	0.7	54	54	0.2	52	53	0.3
20	107	55	54	-1.2	51	53	2.0	55	55	0.2	54	55	1.4
20	567	52	50	-1.6	50	49	-0.3	52	52	-0.5	51	51	0.1
20	802	54	53	-1.2	51	53	1.7	55	55	0.1	53	54	1.1
20	860	58	56	-1.6	55	55	0.0	58	58	0.5	57	57	0.5
20	2015	47	47	0.3	46	46	0.1	49	49	0.1	48	48	0.3
20	2028	46	46	0.0	46	46	0.0	48	48	0.1	47	47	0.3
20	2029	48	47	-0.8	46	46	0.1	49	48	-0.2	47	48	0.3
20	2030	46	46	-0.8	45	45	0.0	48	47	-0.3	46	46	0.2
20	2031	48	47	-0.8	46	46	0.1	49	48	-0.2	47	47	0.3
20	2032	47	46	-0.9	45	45	0.0	48	48	-0.2	46	47	0.2
20	2033	45	44	-0.9	43	43	0.2	46	46	0.0	44	45	0.4
20	2034	47	46	-0.8	45	45	0.1	48	47	-0.2	46	47	0.3
20	2035	45	44	-0.9	43	43	-0.2	46	46	-0.4	45	45	0.2
20	2036	43	43	-0.8	41	42	0.2	44	44	-0.1	43	43	0.4
20	2037	45	44	-0.7	43	43	-0.1	46	46	-0.4	44	45	0.2
20	2038	44	44	-0.8	43	43	-0.2	46	45	-0.5	44	44	0.1
20	2065	56	54	-1.5	54	54	-0.4	56	56	-0.5	55	56	0.2
20	2066	53	52	-0.7	50	51	0.5	53	54	0.2	52	52	0.4
21	12	60	60	0.2	58	59	0.2	61	61	0.4	60	59	-0.9
21	20	58	58	0.1	57	57	0.2	59	60	0.4	58	57	-0.8
21	39	50	50	-0.1	49	49	-0.5	51	52	0.5	50	50	-0.6
21	43	52	51	-1.1	50	49	-1.4	52	52	0.7	51	51	-0.2
21	61	53	51	-2.4	52	48	-3.6	52	52	0.7	53	50	-2.5
21	63	57	55	-1.8	56	54	-2.0	57	57	0.1	57	55	-1.3
21	68	52	50	-1.9	51	47	-3.2	50	51	1.2	51	49	-2.1
21	529	59	59	0.2	57	58	0.3	60	60	0.5	58	58	-0.7
21	866	59	59	0.2	58	58	0.2	60	60	0.4	59	58	-0.8
21	2060	49	48	-1.0	47	46	-1.3	48	49	1.0	48	47	-0.5
22	31	57	57	0.1	56	56	0.1	58	59	0.4	57	57	-0.4
22	64	55	53	-1.6	53	52	-1.7	55	55	0.2	54	53	-0.2
22	863	52	51	-0.9	50	49	-1.2	52	52	0.2	50	51	0.0
22	865	59	59	-0.4	58	57	-0.3	60	60	0.0	59	58	-0.6
22	867	59	59	0.0	58	58	0.2	60	61	0.4	59	59	-0.5
22	2008	49	47	-1.8	48	46	-1.5	49	49	0.1	48	48	0.1
22	2049	54	53	-0.3	52	52	-0.2	55	55	0.2	53	53	-0.2



pacifichighway.nsw.gov.au



1800 653 092



Customer feedback
Roads and Maritime
PO Box 576
Grafton NSW 2460

October 2019

RMS 19.1421

ISBN: 978-1-922338-04-4