APPENDIX E

Noise Impact Assessment (SLR, 2015b)

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Proposed Small Stock Abattoir Development & Continued Operation of the Blayney SeaLink Cold Store Complex Newbridge Road, Blayney NSW

Noise & Vibration Impact Assessment

Report Number 610.13744.00200-R1

16 February 2015

Metziya Pty Ltd

Newbridge Road

Blayney NSW 2799

Version: Revision 3

Proposed Small Stock Abattoir Development & Continued Operation of the Blayney SeaLink Cold Store Complex Newbridge Road, Blayney NSW Noise & Vibration Impact Assessment

PREPARED BY:

SLR Consulting Australia Pty Ltd
ABN 29 001 584 612
10 Kings Road
New Lambton NSW 2305 Australia
(PO Box 447 New Lambton NSW 2305 Australia)
T: +61 2 4037 3200 F: +61 2 4037 3201
newcastleau@slrconsulting.com www.slrconsulting.com

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Executive Summary

SLR Consulting Australia Pty Ltd (SLR) has been commissioned by Hornery & Associates Consulting Pty Ltd on behalf of Metziya Pty Limited (Metziya) to undertake a noise and vibration impact assessment (NVIA) for the development of a small stock abattoir and continued operations of the existing Blayney SeaLink Cold Store Complex (herein referred to as the Project), located approximately one kilometre east of the Blayney township in the Central West region of New South Wales (NSW).

Broadly, the objective of the NVIA was to conduct noise modelling of the existing and proposed construction and operations at the Project Site to identify the potential impacts of noise and vibration and to provide recommendations with regard to noise management strategies and mitigation measures where necessary, with the aim of achieving the project specific noise and vibration criteria.

Existing Acoustical Environment

An ambient noise monitoring program was conducted by SLR Consulting. Ambient noise levels were monitored at 3 separate locations (Palmer, Athol and Ewens), considered to be representative of the nearest potentially affected receivers to the site. The objective of this survey was to measure $L_{A90(15minute)}$ and $L_{Aeq(15minute)}$ noise levels at the nearest potentially affected residential locations during the day, evening and night-time periods to enable the determination of the intrusiveness and amenity criteria for the Project in accordance with the NSW Industrial Noise Policy (INP).

Operational Noise Assessment

Operational noise levels are predicted to meet the Project Specific Noise Criteria (PSNC) at all residential locations considered in the assessment.

Sleep Disturbance Assessment

The L_{Amax} noise levels are predicted to meet the project specific sleep disturbance noise goals for night-time period operation at the Project Site at all assessed receiver locations.

Road Traffic Noise Assessment

The calculated day and night-time road traffic noise level at the nearest roadside residential receivers meets the criteria detailed in the NSW Road Noise Policy under all prediction scenarios.

Construction Noise Assessment

The modelling results indicate that the predicted $L_{Aeq(15minute)}$ noise levels from proposed construction activities meet the 'Noise Affected' construction noise goals at all assessed sensitive receivers with the exception of R2 and R3. However, all residential receiver locations are well below the 'Highly Noise Affected' construction noise goal of 75 $L_{Aeq(15minute)}$.

The calculated day road traffic noise level at the nearest roadside residential receivers meets the criteria detailed in the NSW Road Noise Policy under all prediction scenarios.

Vibration Assessment

Given the separation distance to the nearest affected residential receptor, the level of vibration caused by construction activities is predicted to be below the level of human perception at any of the nearest receptors and therefore below the criteria for "minimal risk of cosmetic damage" at surrounding residential premises.

Executive Summary

Cumulative Assessment

Approval was granted by the then Department of Planning in January 2010 to Cadia Holdings Pty Ltd for the construction of the Cadia Valley Operations (CVO) Dewatering Facility on Lot 106 on DP 1161062, adjacent to the existing SeaLink Complex. Whilst construction has not yet commenced, given the facility is approved, the cumulative noise impact of both the Project and the CVO Dewatering Facility has been assessed.

Cumulative Operational Noise

The cumulative noise influence of both the Project and CVO Dewatering Facility operations are predicted to comply with the project specific Amenity Criteria.

Operational road traffic noise associated with the Blayney development and the CVO Dewatering Facility operations are predicted to comply with the RNP.

Cumulative Construction Noise

Noise predictions indicate that the cumulative construction noise predictions for the project would comply with construction 'Noise Affected' management levels for the daytime period at R1. However, the cumulative construction noise predictions exceed the 'Noise Affected' management levels at R2, R3 and R4. Notwithstanding this, the potential cumulative construction works at all residential receiver locations are below the 'highly noise affected' management noise level at all times.

Construction road traffic noise associated with the Project and the CVO Dewatering Facility operations are predicted to comply with the RNP.

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1 INTRODUCTION

SLR Consulting Australia Pty Ltd (SLR) has been commissioned by Hornery & Associates Consulting Pty Ltd on behalf of Metziya Pty Limited (Metziya) to undertake a noise and vibration impact assessment (NVIA) for the development of a small stock abattoir and continued operations of the existing Blayney SeaLink Cold Store Complex (herein referred to as the Project), located approximately one kilometre east of the Blayney township in the Central West region of New South Wales (NSW).

Broadly, the objective of the NVIA was to identify the potential impacts of noise and vibration from existing and proposed activities at the Project Site associated with both construction and operation of the facility and to provide recommendations with regard to noise management strategies and mitigation measures, where necessary, with the aim of achieving the project specific noise and vibration criteria.

The NVIA has been prepared with reference to Australian Standard AS 1055:1997 *Description and Measurement of Environmental Noise* Parts 1, 2 and 3 and in accordance with the *NSW Industrial Noise Policy* (INP) (EPA, 2000) and associated Application Notes (last updated July 2012). Where issues relating to noise are not addressed in the INP, such as sleep disturbance, reference has been made to the *NSW Road Noise Policy* (RNP) (DECCW, 2011).

Road traffic noise impacts have been assessed with reference to the RNP.

Construction noise impacts have been assessed with reference to the *NSW Interim Construction Noise Guideline* (ICNG) (DECC, 2009).

Vibration impacts have been assessed with reference to the EPA *Environmental Noise Management – Assessing Vibration: a technical guide (DEC 2006)*, DIN 4150 Part 3:1999 *Structural Vibration: effects of vibration on structures* and BS *6472-1:2008 guide to evaluation of human exposure to vibration in buildings - Vibration sources other than blasting, 2008.*

1.1 Acoustic Terminology

The following report uses specialist acoustic terminology. An explanation of common terms is provided in **Appendix A**.

2 STATUTORY REQUIREMENTS

The scope for the NVIA has been designed to address the Secretary's Environmental Assessment Requirements (SEARs), issued by the Department of Planning and Environment (DP&E) for the Project, with regard to the assessment of noise and vibration emissions. A summary of the SEARs is provided in **Table 1** together with the relevant sections of the NVIA addressing the particular SEAR.

Table 1 Secretary's Environmental Assessment Requirements and Government Agency Comments

Requirement	Relevant Section of NIA Report
Secretary Environment Assessment Requirements	
Noise and Vibration	
- Description of all potential noise and vibration sources such as construction, operational, on and off-site traffic noise;	Section 9, 10, 11 and 12
- A quantitative noise and vibration impact assessment including a cumulative noise impact assessment in accordance with relevant EPA guidelines; and	Whole report
- Details of noise and vibration mitigation, management and monitoring measures.	Section 14
Environment Protection Authority (EPA)	
Noise and Vibration The Proponent must carry out a Noise Impact Assessment in accordance with the NSW Interim (Final) Construction Noise Guideline (DECC 2009), the NSW Industrial Noise Policy (EPA 2000/2001), the Assessing Vibration: a technical guideline (DEC 2006) and the NSW Road Noise Policy (DECCW 2011) and that specifically addresses the following:	
(a) Construction noise: proposed construction hours, construction noise sources and levels, potential impacts and required noise mitigation measures;	Section 11 and 14
(b) Operational noise: proposed operating hours, operating noise sources and levels, potential impacts and required noise mitigation measures;	Section 9 and 14
(c) Vibration: potential vibration impacts and required vibration mitigation measures; and	
(d) Road Noise: number of truck movements per day, times of truck movements, vehicle noise sources and levels and required noise mitigation measures.	Section 10 and 14

3 PROJECT DESCRIPTION

3.1 Overview and Objectives

Metziya (the Applicant) is seeking a single new development consent under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) for the continued operation of the existing Blayney SeaLink Cold Store Complex, previously approved under Development Applications 59-01-02; 29-02-03; 60-2006; 66-2005; 9-2009; 155-2008 and 8-2009, and to develop a small stock abattoir within the site.

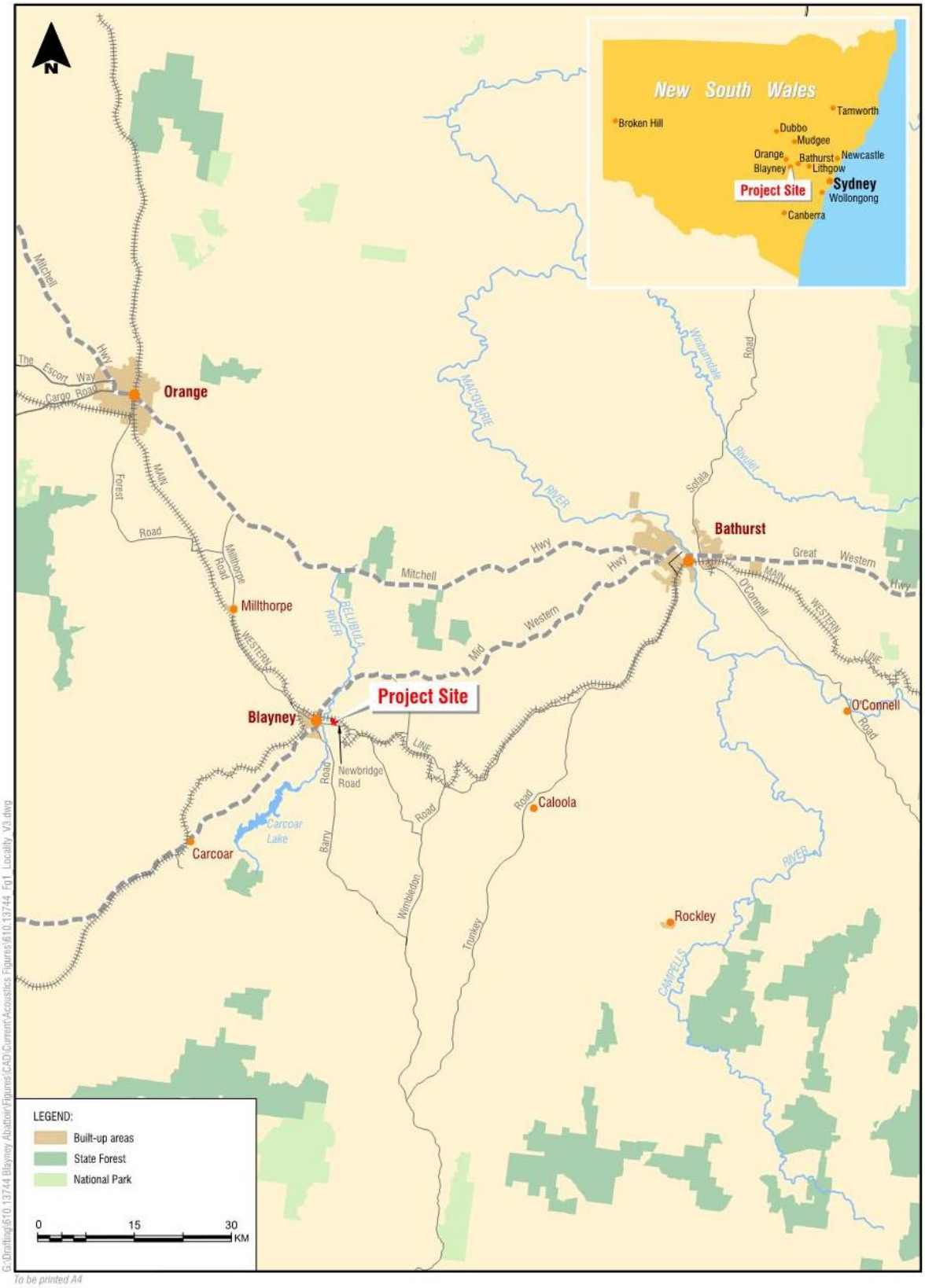
The proposed "Project Site" is located approximately one kilometre east of the Blayney township in the Central West region of NSW (see **Figure 1**). It is addressed to 137 Newbridge Road, Blayney NSW, and is identified as Lots 103 to 105 and 107 in Deposited Plan (DP) 1161062 in the Blayney Local Government Area (LGA). The combined titles comprise approximately 47 hectares. As evident on **Figure 2**, Lots 103 to 105 in DP 1161062 encompass the Applicant's existing cold storage facility known as Blayney SeaLink Cold Store Complex, while Lot 107 in DP 1161062 contains vacant land.

The Project involves the development of an abattoir (Blayney Export Meats) with the capacity to process up to 4,500 head per day, primarily rangeland goats and some lambs, along with the continuing operation and use of the existing Blayney SeaLink Cold Store Complex (owned and operated by Metziya) located within the Project Site.

Ancillary infrastructure that will support the abattoir and cold stores operations will include separate vehicular ingress and egress for livestock and product respectively from/to the adjoining Newbridge Road, heavy vehicle manoeuvring and turning areas, car parking and a waste water treatment system.

Figure 3 and **Figure 4** show the conceptual layout of the Project.

Figure 1 Site Locality



SLR

Regional Locality
FIGURE 1

Figure 2 Development Site

Figure 3 Conceptual Development Layout

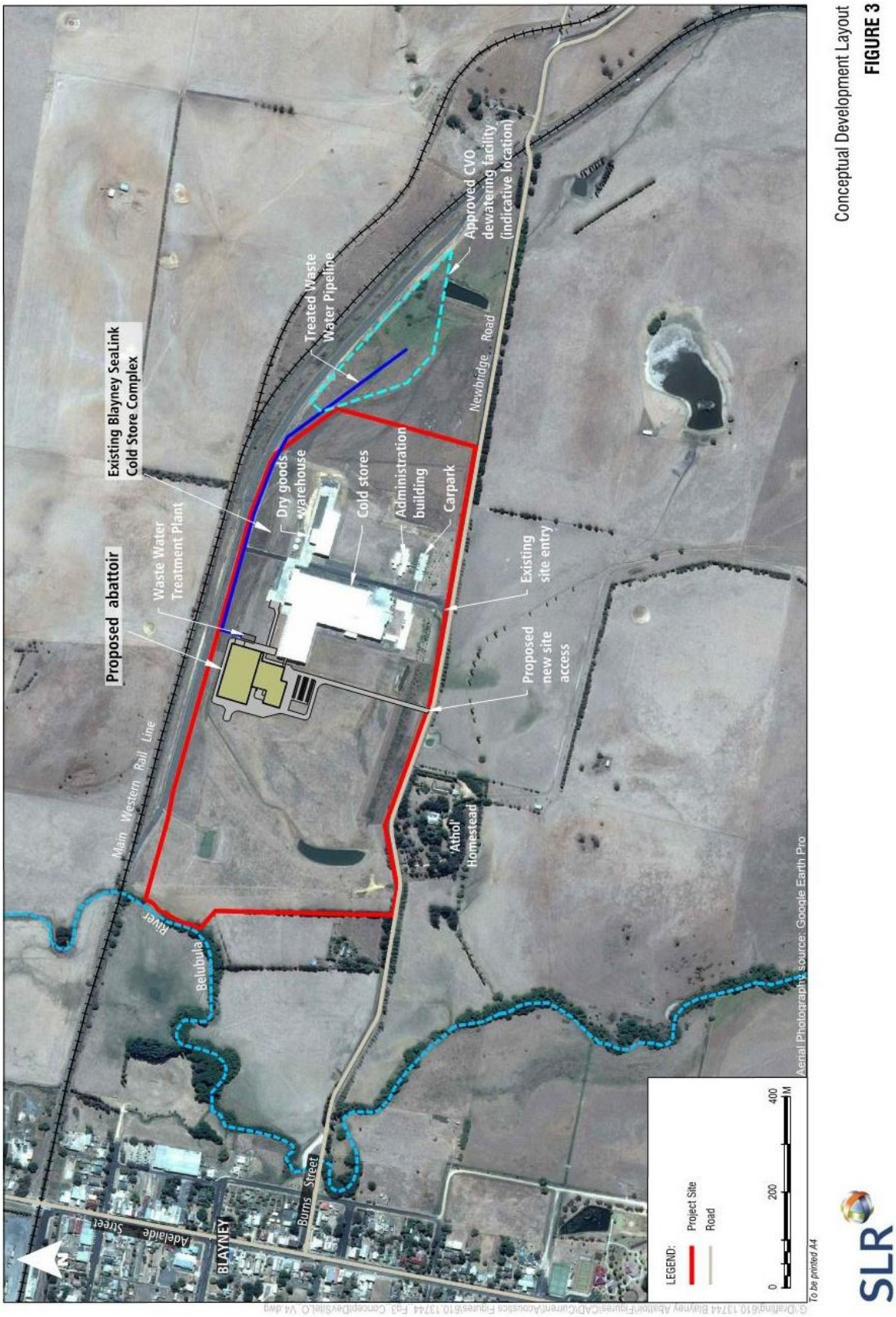
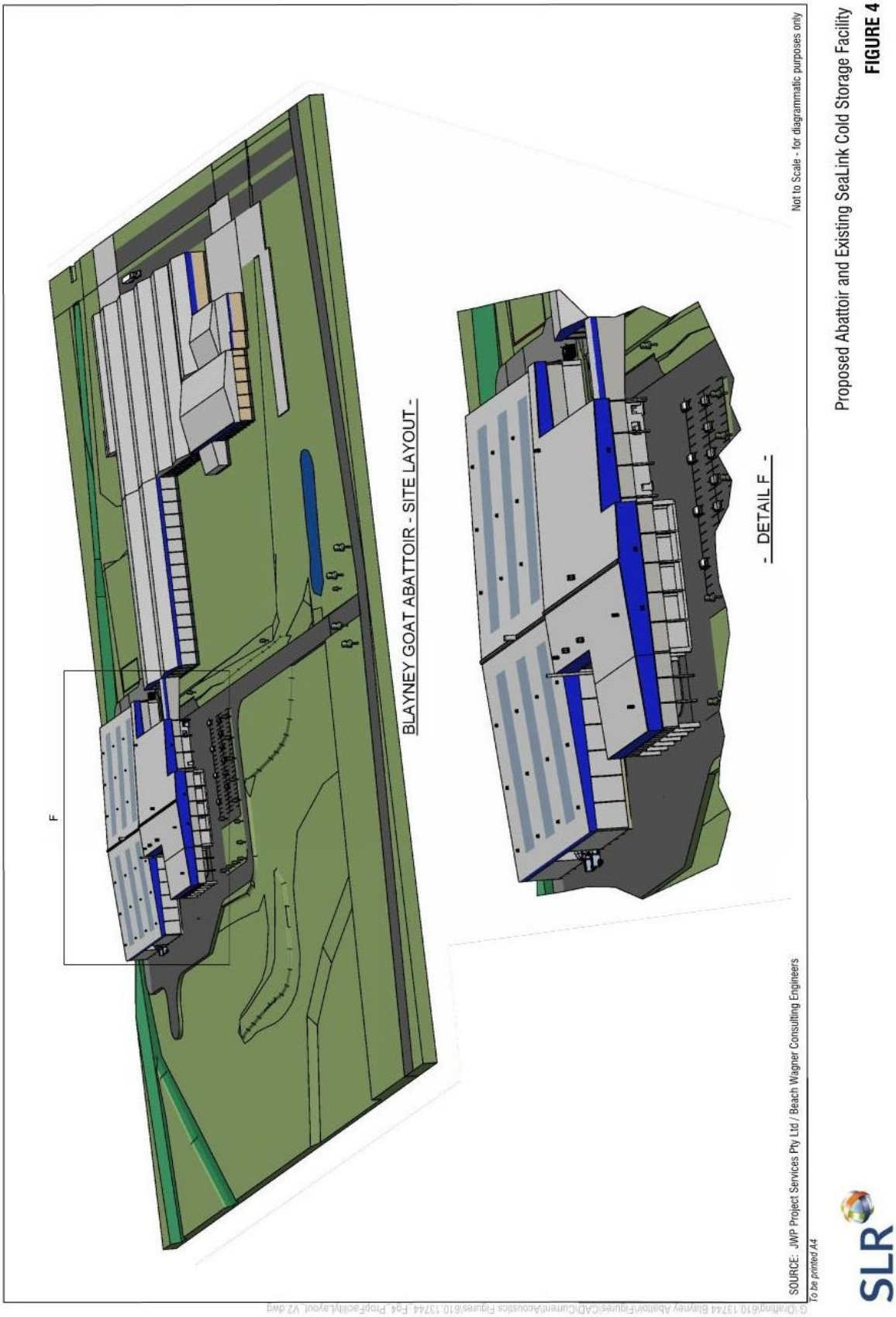


Figure 4 Proposed Blayney Export Meats Conceptual Engineering Design



3.2 Existing Blayney SeaLink Cold Store Complex

The existing Blayney Cold Store Warehouse complex comprises six freezer rooms each 90 metres long and 30 metres wide, capable of operating at temperatures to minus 30 degrees Celsius, two temperature controller loadout marshalling rooms with loading docks, a temperature controlled food packaging facility complete with automated cardboard recycling, internal offices and staff amenities. There is also a separate 2700 square metre (m^2) dry goods warehouse and an administration building, which incorporates a food services call centre. Development consent has been granted to increase the dry goods warehouse by 19,128 m^2 and construct a vehicle weighbridge.

3.3 Proposed Blayney Export Meats Abattoir

The disturbance footprint for the proposed new abattoir will be relatively small at approximately 3.1 hectares, including the roofed building area, vehicle manoeuvring and parking areas and waste water treatment plant. The commercial activities associated with the abattoir will also be largely confined to this area.

The abattoir will have two different levels, with the primary areas or components on each level being:

- Ground level – undercover stock receipt and holding area, pelt sorting area, carton room and offal packing, along with staff amenities and offices; and
- Level 1 – raised stock pens, kill floor and boning room, and chillers along with staff amenities and lunch rooms.

The complex will produce three types of meat products as demanded by the serviced export markets – (i) whole bone-in carcass with skin on; (ii) whole bone-in carcass with skin off; and (iii) six way cut of carcass in cartons.

Importantly, there will be no on-site rendering of the raw animal waste products from the abattoir (offal, bone, blood, fat and trimmings) or any on-site skins processing.

3.4 Stock Holding Area

Livestock will be transported to the Project Site in semi-trailers and/or B-doubles and off-loaded at ground level within the abattoir building via an undercover unloading bay. Animals will be mustered into a series of level undercover holding pens split over the two levels of the abattoir building. Mesh fencing between pens will allow for adequate ventilation and observation and, whilst the holding pens will be enclosed to the south and east, the north and west sides will remain open for ventilation purposes.

3.5 Hours of Operation

The existing Blayney SeaLink Cold Store Complex will continue to operate 24 hours a day, seven days per week.

The abattoir is proposed to operate 24 hours a day, seven days per week. However, activities during the hours of 11pm-6am will generally be limited to stock delivery and operation of the waste water treatment plant.

3.6 Vehicular Access and Parking

It is proposed to provide separate heavy vehicular ingress for livestock and egress for product from/to the adjoining Newbridge Road. As shown on **Figure 3**, heavy vehicles will enter the site from Newbridge Road via a new access road to be constructed in front of the abattoir complex. Heavy vehicles loaded with product will exit the site via the existing access road and weighbridge constructed as part of the Blayney SeaLink Cold Store Complex.

A new car parking area will be constructed as part of the abattoir complex for use by abattoir employees and visitors. Staff and visitors to the Blayney SeaLink Cold Store Complex will continue to use the existing car park in front of the administration building and food packaging facility. While there will generally be no requirement for heavy vehicle parking, particularly for any length of time, adequate area will be available to ensure that heavy vehicle parking requirements can be met within the Project Site. At no time will it be necessary to park heavy vehicles on the adjoining Newbridge Road.

All new access roads and manoeuvring areas will be appropriately designed to carry the anticipated heavy vehicle movements and will be sealed.

3.7 Traffic Generation

The primary operational activities that will generate traffic to and from the Project Site will be:

- Delivery of livestock in semi-trailer and/or B-doubles;
- Delivery of livestock feed (as needed) in semi-trailers;
- Removal of meat products from the abattoir in refrigerated containers on semi-trailers to Port Botany;
- Removal of meat waste products (offal, bone, blood, fat and trimmings) in enclosed semi-trailers for off-site processing;
- Removal of skins in rigid trucks for off-site treatment;
- Continued delivery of goods to be chilled/frozen and stored at the existing Blayney SeaLink Cold Store Complex in refrigerated semi-trailers and/or B-doubles;
- Continued removal of other stored goods from the Blayney SeaLink Cold Store Complex in refrigerated semi-trailers and/or B-doubles;
- Continued delivery and removal of dry goods to and from the Blayney SeaLink facility in semi trailers and /or B-doubles.
- Removal of general garbage in rigid trucks;
- Servicing/tradesman visits in utes/vans; and
- Staff visits by cars.

3.8 Waste water Management

All operational waste water generated by the development will be treated on-site in a waste water treatment system designed specifically for the abattoir operation, which will involve gross solid separation through a series of screens followed by fat, oil and suspended solid removal through via Dissolved Air Floatation or similar process, followed by biological treatment and membrane filtration before final disinfection.

3.9 Landform and Topography

The topography of the site is relatively flat, ranging between approximately 866 and 875 metres Australian Height Datum (AHD). The Belubula River, which is part of the Lachlan catchment within the Murray-Darling Basin, adjoins part of the western boundary of the Project Site.

4 SENSITIVE RECEIVERS

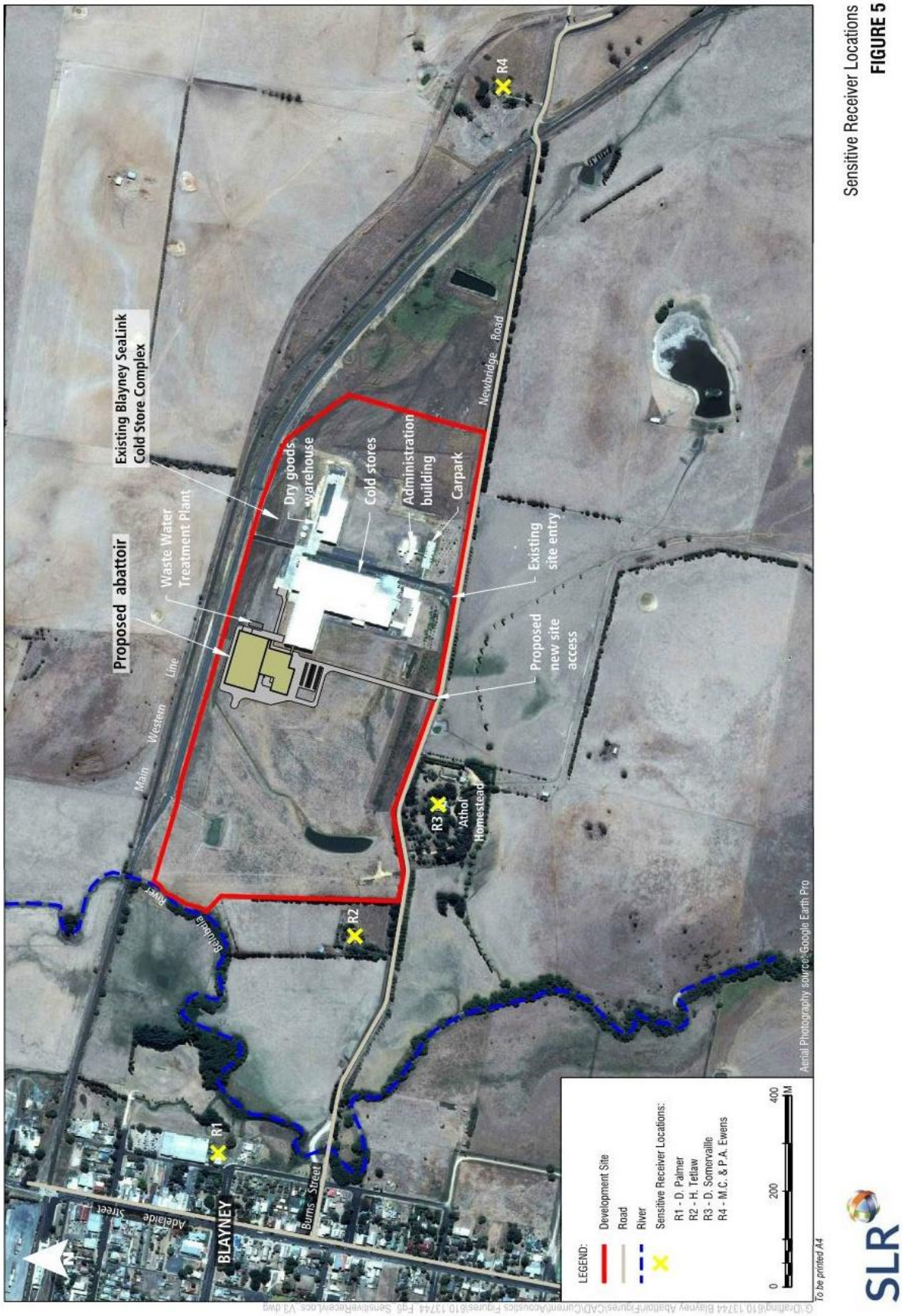
The Project Site sits to the east of Blayney, with a 400 to 500 metre separation distance between the site's western boundary and the edge of the Blayney township.

A number of sensitive receivers (residences) are located in the area surrounding the Project Site. The nearest residences and sensitive receivers have been identified to be considered as part of the NVIA, and are presented in **Table 2** and shown in **Figure 5**.

Table 2 Nearest Sensitive Receivers

Receiver ID*	Location	Location (m, UTM)		Elevation (m, AHD)
		Easting	Northing	
R1	Palmer	709604	6287610	868
R2	Tetlaw	710066	6287334	866
R3	Athol	710343	6287153	873
R4	Ewens	711833	6287031	896

Figure 5 Sensitive Receiver Locations



5 NOISE IMPACT ASSESSMENT PROCEDURES

5.1 General Objectives – NSW Industrial Noise Policy

Responsibility for the control of noise emission in NSW is vested in Local Government and the EPA. The INP was released in January 2000 and provides a framework and process for deriving noise criteria for consents and licences that will enable the relevant authority to regulate premises that are scheduled under the *Protection of the Environment Operations Act 1997 (POEO Act)*.

The specific policy objectives are:

- To establish noise criteria that would protect the community from excessive intrusive noise and preserve amenity for specific land uses.
- To use the criteria as the basis for deriving project specific noise levels.
- To promote uniform methods to estimate and measure noise impacts, including a procedure for evaluating meteorological effects.
- To outline a range of mitigation measures that could be used to minimise noise impacts.
- To provide a formal process to guide the determination of feasible and reasonable noise limits for consents or licences that reconcile noise impacts with the economic, social and environmental considerations of industrial development.
- To carry out functions relating to the prevention, minimisation and control of noise from premises scheduled under the POEO Act.

It is noted that the Project Site is not currently a scheduled premises~~;~~. However, as a result of having the capacity to produce more than 5,000 tonnes of animal products per year, the proposed abattoir will be a premises-based activity under Schedule 1 of the POEO Act and will be required to operate under an Environment Protection Licence administered by the EPA under Section 43(b) of the POEO Act.

The policy sets two separate noise criteria to meet environmental noise objectives; one to account for intrusive noise and the other to protect the amenity of particular land uses.

Assessing Intrusiveness

For assessing intrusiveness, the background noise level must be measured. The intrusiveness criterion essentially means that the equivalent continuous noise level (L_{Aeq}) of the source should not be more than five decibels above the measured background level (L_{A90}).

Assessing Amenity

The amenity assessment is based on noise criteria specific to land use and associated activities (**Table 3**). The criteria relate only to industrial-type noise and do not include road, rail or community noise. The existing noise level from industry is measured. If it approaches the criterion value, then noise levels from new industries need to be designed so that the cumulative effect does not produce noise levels that would significantly exceed the criterion (**Table 4**).

Table 3 Amenity Criteria Recommended L_{Aeq} Noise Levels from Industrial Noise Sources

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended $L_{Aeq(Period)}$ Noise Level (dBA)	
			Acceptable	Recommended Maximum
Residence	Rural	Day	50	55
		Evening	45	50
		Night	40	45
	Suburban	Day	55	60
		Evening	45	50
		Night	40	45
	Urban	Day	60	65
		Evening	50	55
		Night	45	50
	Urban/Industrial Interface (for existing situations only)	Day	65	70
		Evening	55	60
		Night	50	55
School classrooms - internal	All	Noisiest 1 hour period when in use	35	40
Hospital wards - internal - external	All	Noisiest 1 hour period	35 50	40 55
Place of worship - internal	All	When in use	40	45
Area specifically reserved for passive recreation (eg National Park)	All	When in use	50	55
Active recreation area (eg school playground, golf course)	All	When in use	55	60
Commercial premises	All	When in use	65	70
Industrial premises	All	When in use	70	75

Note: Monday - Saturday: Daytime 7.00 am to 6.00 pm; Evening 6.00 pm to 10.00 pm; Night-time 10.00 pm to 7.00 am. Sundays, Public Holidays: Daytime 8.00 am - 6.00 pm; Evening 6.00 pm - 10.00 pm; Night-time 10.00 pm - 8.00 am. The L_{Aeq} index corresponds to the level of noise equivalent to the energy average of noise levels occurring over a measurement period.

Table 4 Modification to Acceptable Noise Level (ANL)* to Account for Existing Levels of Industrial Noise

Total Existing L_{Aeq} Noise Level from Industrial Noise Sources	Maximum L_{Aeq} Noise Level for Noise from New Sources Alone, dBA
≥ Acceptable noise level plus 2 dBA	If existing noise level is *likely to decrease* in future acceptable noise level minus 10 dBA If existing noise level is *unlikely to decrease* in future existing noise level minus 10 dBA
Acceptable noise level plus 1 dBA	Acceptable noise level minus 8 dBA
Acceptable noise level	Acceptable noise level minus 8 dBA
Acceptable noise level minus 1 dBA	Acceptable noise level minus 6 dBA
Acceptable noise level minus 2 dBA	Acceptable noise level minus 4 dBA
Acceptable noise level minus 3 dBA	Acceptable noise level minus 3 dBA
Acceptable noise level minus 4 dBA	Acceptable noise level minus 2 dBA
Acceptable noise level minus 5 dBA	Acceptable noise level minus 2 dBA
Acceptable noise level minus 6 dBA	Acceptable noise level minus 1 dBA
< Acceptable noise level minus 6 dBA	Acceptable noise level

* ANL = recommended acceptable L_{Aeq} noise level for the specific receiver, area and time of day from **Table 3**

5.2 INP Noise Assessment Strategy

The INP PSNC are the more stringent of either the amenity or intrusive criteria. The INP states that these criteria have been selected to protect at least 90% of the population living in the vicinity of industrial noise sources from the adverse effects of noise for at least 90% of the time. Provided the criteria in the INP are achieved, it is unlikely that most people would consider the resultant noise levels excessive.

In those cases where the INP PSNC are not achieved, it does not automatically follow that all people exposed to the noise would find the noise unacceptable. In subjective terms, exceedances of the INP project specific assessment criteria can be generally described as follows:

- Negligible noise level increase <1 dBA (Not noticeable by all people)
- Marginal noise level increase 1 dBA to 2 dBA (Not noticeable by most people)
- Moderate noise level increase 3 dBA to 5 dBA (Not noticeable by some people but may be noticeable by others)
- Appreciable noise level increase >5 dBA (Noticeable by most people)

5.3 Assessing Sleep Disturbance

The potential for sleep arousal has been assessed using the guidance provided in the INP Application Notes and the RNP.

As per the INP Application Notes (last updated 12 July 2012), it is recognised that the current $L_{A1(1minute)}$ sleep disturbance criteria of 15 dBA above the prevailing $L_{A90(15minute)}$ level is not ideal. The assessment of potential sleep disturbance is complex and poorly understood and the EPA believes that there is insufficient information to determine a suitable alternative criteria.

The INP guideline suggests that the $L_{A1(1minute)}$ level of 15 dBA above the RBL is a suitable screening criteria for sleep disturbance for the night-time period.

Guidance regarding potential for sleep disturbance is also provided in the RNP. The RNP calls upon a number of studies that have been conducted into the effect of maximum noise levels on sleep. The RNP acknowledges that, at the current level of understanding, it is not possible to establish absolute noise level criteria that would correlate to an acceptable level of sleep disturbance. However, the RNP provides the following conclusions from the research on sleep disturbance:

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

It is generally accepted that internal noise levels in a dwelling, with the windows open, are 10 dBA lower than external noise levels. Based on a worst case minimum attenuation, with windows open, of 10 dBA, the first conclusion above suggests that short term external noises of 60 dBA to 65 dBA are unlikely to cause awakening reactions. The second conclusion suggests that one or two noise events per night with maximum external noise levels of 75 dBA to 80 dBA are not likely to affect health and wellbeing significantly.

5.4 Road Traffic Noise

The RNP sets out noise criteria applicable to particular types of projects, road categories and land uses for the purpose of defining traffic noise impacts.

Table 5 presents the most relevant RNP criteria for residential land uses affected by noise from a freeway, arterial, sub-arterial, or local road. Noise levels provided in **Table 5** are external noise levels and refer only to road traffic noise; they do not include ambient noise from other sources.

Table 5 Road Traffic Noise Assessment Criteria for Residential Land Uses

Road category	Type of project/land use	Assessment criteria – dBA	
		Day (7 am–10 pm)	**Night (10 pm–7 am)**
Freeway/ arterial/ sub-arterial roads	Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	LAeq, (15 hour) 60 (external)	LAeq, (9 hour) 55 (external)
Local roads	Existing residences affected by additional traffic on existing local roads generated by land use developments	LAeq, (1 hour) 55 (external)	LAeq, (1 hour) 50 (external)

Note: 1. Land use developers must meet internal noise goals in the Infrastructure SEPP (Department of Planning NSW 2007) for sensitive developments near busy roads (see **Appendix C10** of the RNP for details).

Note: 2. Sub-arterial roads previously designated as 'collector roads' in the Environmental criteria for road traffic noise.

5.5 Construction Noise

The ICNG sets out noise management levels for residential and other noise-sensitive receivers and how they are to be applied. The policy suggests restriction to the hours of construction that apply to activities that generate noise at residences above the 'highly affected' noise management level. A summary of the noise management levels is contained in **Table 6**.

Table 6 Construction Noise Management

Time of day	Management level LAeq(15minute)	How to apply
Recommended standard hours Monday to Friday 7am to 6pm Saturday 8am to 1pm No work Sundays or public holidays	Noise Affected RBL** + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured LAeq (15 min) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. • The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dBA	The highly noise affected level represents the point above which there may be strong community reaction to noise. • Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: 1. times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences 2. if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise Affected RBL** + 5 dB	A strong justification would typically be required for works outside the recommended standard hours. • The proponent should apply all feasible and reasonable work practices to meet the noise affected level. • Where all feasible and reasonable practices have been applied and noise is more than 5 dBA above the noise affected level, the proponent should negotiate with the community. • For guidance on negotiating agreements see section 7.2.2 of the ICNG.

*Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5m above ground level. If the property boundary is more than 30m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30m of the residence. Noise levels may be higher at upper floors of the noise-affected residence.
**RBL: Rating Background Level, as defined in the NSW Industrial Noise Policy (EPA, 2000).

5.6 Assessing Vibration

5.6.1 Human Response

The EPA released *Assessing Vibration: a technical guideline* (the Guideline) in February 2006. The Guideline presents preferred and maximum vibration values for use in assessing human responses to vibration and provides recommendations for measurement and evaluation techniques. The Guideline is based on British Standard BS 6472-1998 *Evaluation of human exposure to vibration in buildings (1-80Hz)* which is similar to Australian Standard AS-2670.2-1990 but includes additional guidelines in relation to intermittent vibration. The criteria presented in the Guideline are non-mandatory. Where all feasible and reasonable mitigation measures have been applied and vibration values are still beyond the maximum value, the operator would need to negotiate directly with the affected community.

Section 2.4 of the Guideline provides acceptable values for intermittent vibration in terms of vibration dose values (VDV) which requires the measurement of the overall weighted root mean square (rms) acceleration over the frequency range 1 Hz to 80 H. To calculate VDV the following formula is used:

$$VDV = \left[\int_0^T a^4(t)dt \right]^{0.25}$$

where VDV is the vibration dose value in $m/s^{1.75}$, *a(t)* is the frequency-weighted acceleration in m/s^2 and *T* is the total period of the day (in seconds) during which vibration may occur.

The acceptable VDV are reproduced here in **Table 7**.

Table 7 Acceptable Vibration Dose Values for Intermittent Vibration

Location	Daytime		Night-time	
	Preferred Value	Maximum Value	Preferred Value	Maximum Value
Residences	0.20 $m/s^{1.75}$	0.40 $m/s^{1.75}$	0.13 $m/s^{1.75}$	0.26 $m/s^{1.75}$

Note: Daytime is 7.00 am to 10.00 pm and night-time is 10:00pm to 7:00am

There is a low probability of adverse comment or disturbance to building occupants at vibration values below the preferred values. Adverse comment or complaints may be expected if vibration values approach the maximum values. The guideline states that activities should be designed to meet the preferred values where an area is not already exposed to vibration.

5.6.2 Human Perception

The human perception intermittent vibration dose levels at residences for the project are provided in **Table 8** from the *British Standard BS 6472:2008*.

Table 8 Human Perception Values for Intermittent Vibration

Vibration dose values ($m/s^{1.75}$) above which various degrees of adverse comment may be expected in residential buildings			
Place	**Low probability of adverse comment**	**Adverse comment possible**	**Adverse comment probable**
Residential building 16 hours day*	0.2 to 0.4[1]	0.4 to 0.8	0.8 to 1.6[2]
Residential building 8 hours night	0.13[1]	0.26	0.51[2]

Note: *Daytime is 7:00 am to 11:00 pm and Night-time 11:00pm to 7:00am

1. Below these ranges adverse comment is not expected.
2. Above these ranges adverse comment is very likely.

5.6.3 Building Response

British Standard 7385: Part 2-1993 "*Evaluation and measurement for vibration in buildings Part 2*" provides criteria against which the likelihood of building damage from ground vibration can be assessed.

Sources of vibration which are considered in the standard include blasting (carried out during mineral extractions or construction excavation), demolition, piling, ground treatments (compaction), construction equipment, tunnelling, road and rail traffic and industrial machinery.

The standard states that the guide values relate predominantly to transient vibration which does not give rise to resonant responses in structures, and to low-rise buildings. Where the dynamic loading caused by continuous vibration is such as to give rise to dynamic magnification due to resonance, especially at the lower frequencies where lower guide values apply, then the guide values may need to be reduced by up to 50%. Since the nearest buildings could potentially experience resonance effects, a conservative level of continuous "minimal risk of cosmetic damage" criterion has been adopted here and is shown in **Table 9**.

Table 9 Transient Vibration Guide Values – Minimal Risk of Cosmetic Damage

Type of Building	Peak Component Particle Velocity in Frequency Range of Predominant Pulse	
	4 Hz to 15 Hz	15 Hz and Above
Reinforced or framed structures - Industrial and heavy commercial buildings	25 mm/s at 4 Hz and above	
Unreinforced or light framed structures - Residential or light commercial type buildings	7.5 mm/s at 4 Hz increasing to 10 mm/s at 15 Hz	10 mm/s at 15 Hz increasing to 25 mm/s at 40 Hz and above

Note: Values referred to are at the base of the building being considered.

Furthermore, **Table 10** outlines the adopted structural damage vibration limits for residential dwellings from the German Standard *DIN 4150: Part 3-1999* for the proposed development.

Table 10 Adopted Long-term Structural Vibration Velocity Limits on Structures

Line	Type of Structure	Guideline values for velocity, v_i, in mm/s, of vibration in horizontal plane of highest floor, at all frequencies
1	Building used for commercial purposes, industrial buildings, and buildings of similar design	10
2	Dwellings and buildings of similar design and/or occupancy	5
3	Structures that, because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 and are great intrinsic value (e.g. listed buildings under preservation order)	2.5

6 EXISTING ACOUSTICAL AND METEOROLOGICAL ENVIRONMENT

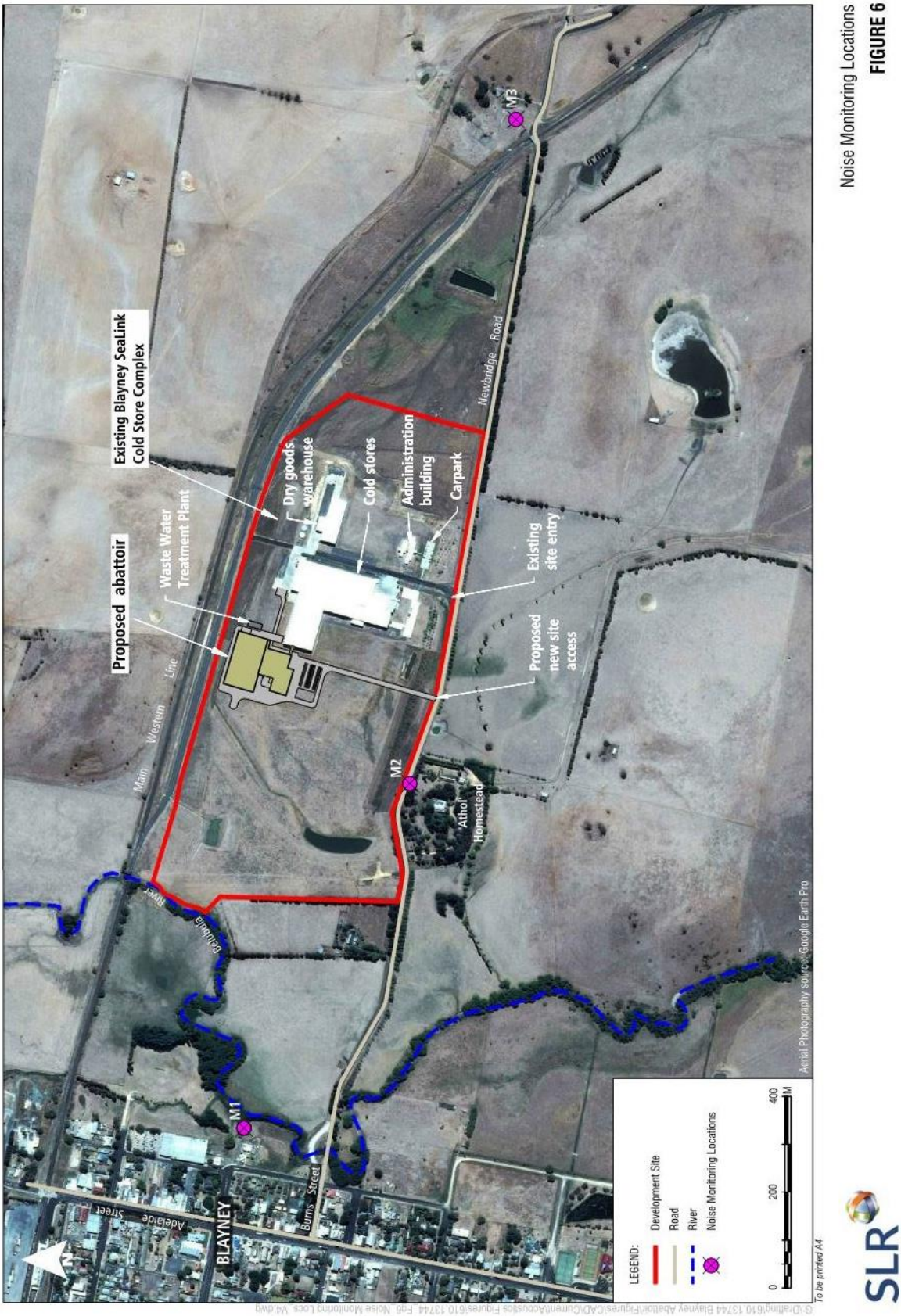
6.1 General Methodology

An ambient noise survey was conducted to characterise and quantify the existing acoustical environment in the area surrounding the Project Site. Noise monitoring was undertaken at three locations M1, M2 and M3 considered representative of the nearest potentially-affected noise-sensitive receivers to the Project Site. The noise monitoring locations are shown in **Figure 6**.

The ambient noise monitoring consisted of continuous, unattended noise logging and operator attended noise surveys. The operator attended noise surveys help to define noise sources and the character of noise in the area and are, therefore, used to qualify unattended noise logging results.

All acoustic instrumentation employed throughout the monitoring programme has been designed to comply with the requirements of AS IEC 61672 2004 "*Electroacoustics - Sound Level Meters*" (parts 1 and 2) and carries current NATA or manufacturer calibration certificates. Instrument calibration was checked before and after each measurement survey, with the variation in calibrated levels not exceeding ±0.5 dBA.

Figure 6 Noise Monitoring Locations



6.2 Operator-Attended Noise Monitoring

Operator attended noise measurements were conducted during the day, evening and night-time periods at the unattended noise monitoring locations (Location M1, M2 and M3). The purpose of these surveys was twofold; to qualify the unattended noise logging results and to determine the contribution of existing industrial noise sources (including those from the Project Site) to the total ambient noise environment.

Operator attended noise measurements were conducted during the day, evening and night-time on Wednesday 4 June 2014 using a B&K 2270 integrating sound level meter (S/N 3003729). Each operator attended noise survey was 15 minutes duration.

The results of the operator attended noise measurements are given in **Table 11**, **Table 12** and **Table 13.** Ambient noise levels given in the tables include all noise sources such as traffic, insects, birds, and any other industrial operations.

The tables provide the following information:

- Monitoring location.
- Date & start time.
- Wind velocity (m/s) and Temperature (ºC) at the measurement location.
- Typical maximum (L_{Amax}) and contributed noise levels.

Table 11 Operator Attended Noise Survey Results – Location M1 (Palmer)

Date/Start Time Weather	Primary Noise Descriptor (dBA re 20 µPa)					Description of Noise Emission and Typical Maximum Levels LAmax – dBA
	LAmax	LA1	LA10	LA90	LAeq	
Day 04/06/2014 3:15 pm W = 2.8m/s SSW Temp = 10.3°C	67	54	49	42	47	Road traffic (Mid Western Hwy) ~ 47 to 52 dBA (constant) Birds ~ 51 to 60 dBA Dog ~ 67 dBA IGA roof top mechanical plant fans (intermittent) LAmax 46, LAeq(15min) 37 dBA Existing Blayney SeaLink Cold Storage operations not audible
Evening 04/06/2014 6:45 pm W = 2.5 m/s SSW Temp = 8°C	68	55	47	39	46	Road traffic (Mid Western Hwy)~ 40 to 52 dBA (constant) Dog ~ 62 to 68 dBA Insects/frogs 33-35 dBA (constant) IGA roof top mechanical Plant Fans (Intermittent) LAmax 46, LAeq(15min) 37 dBA Existing Blayney SeaLink Cold Storage operations not audible
Night 04/06/2014 10:54 pm W = 1.3 m/s SSW Temp = 5.5°C	49	46	41	28	37	Road traffic (Mid Western Hwy)~ 43 to 49 dBA (constant) Dog ~ 29 to 32 dBA Insects/frogs 30-33 dBA (constant) IGA roof top mechanical plant fans (Intermittent) LAmax 33, LAeq(15min) <30 dBA Existing Blayney SeaLink Cold Storage operations not audible

Table 12 Operator Attended Noise Survey Results – Location M2 (Athol)

Date/Start Time Weather	Primary Noise Descriptor (dBA re 20 µPa)					Description of Noise Emission and Typical Maximum Levels LAmax – dBA
	LAmax	LA1	LA10	LA90	LAeq	
Day 04/06/2014 2:55 pm W = 2.5m/s SW Temp = 10.7°C	80	75	54	34	59	Local road traffic (Newbridge Rd) ~ 79 to 80 dBA (Intermittent) Distant road traffic (Mid Western Hwy)~ 36 to 51 dBA (constant) Birds ~ 37 to 51 dBA No industrial noise sources audible Existing Blayney SeaLink Cold Storage operations not audible
Evening 04/06/2014 6:21 pm W = 2.5 m/s SSW Temp = 8.5°C	81	64	51	34	55	Local road rraffic (Newbridge Rd) ~ 56 to 81 dBA (Intermittent) Distant road rraffic (Mid Western Hwy)~ 35 to 37 dBA (constant) Coal Train ~ 48 to 58 dBA Dog ~ 37 to 44 dBA Insects/frogs 30-32 dBA (constant) No industrial noise sources audible Existing Blayney SeaLink Cold Storage operations not audible
Night 04/06/2014 10:23 pm W = 1.3 m/s SSW Temp = 5.5°C	49	44	39	30	36	Distant road traffic (Mid Western Hwy)~ 36 to 48 dBA (constant) Aircraft flyover 38 to 49 dBA Insects/frogs 27 dBA (constant) Dog ~ 32 to 33 dBA Existing Blayney SeaLink Cold Storage operations audible 26 to 27 dBA (constant)

Table 13 Operator Attended Noise Survey Results – Location M3 (Ewens)

Date/Start Time Weather	Primary Noise Descriptor (dBA re 20 µPa)					Description of Noise Emission and Typical Maximum Levels LAmax – dBA
	LAmax	LA1	LA10	LA90	LAeq	
Day 04/06/2014 2:35 pm W = 2.5m/s SW Temp = 10.7°C	93	83	60	34	69	Local road traffic (Newbridge Rd) ~ 52 to 63 dBA (Intermittent) Coal Train ~ 55 to 93 dBA Birds ~ 35 to 42 dBA No industrial noise sources audible Existing Blayney SeaLink Cold Storage operations not audible
Evening 04/06/2014 6:00 pm W = 2.5 m/s SSW Temp = 8.5°C	70	60	49	32	47	Local road traffic (Newbridge Rd) ~ 49 to 62 dBA (Intermittent) Distant road traffic (Mid Western Hwy)~ 30 to 32 dBA (constant) Birds ~ 36 dBA Insects/frogs 33-34 dBA (constant) No industrial noise sources audible Existing Blayney SeaLink Cold Storage operations not audible
Night 04/06/2014 10:02 pm W = 1.3 m/s SSW Temp = 5.5°C	66	61	46	27	45	Local road traffic (Newbridge Rd) ~ 43 to 66 dBA (Intermittent) Aircraft flyover 53 to 55 dBA Distant road traffic (mid Western Hwy)~ 31 dBA (constant) Birds ~ 30 to 33 dBA Insects/frogs 28-30 dBA (constant) Existing Blayney SeaLink Cold Storage operations audible 26 dBA (constant)

Results of operator-attended noise surveys indicate that natural noise sources, local and distant road traffic are the main contributors to the ambient noise environment during all monitoring periods at logger location M1, M2 and M3.

6.3 Unattended Continuous Noise Monitoring

Background noise levels were monitored by SLR with the objective being to measure $L_{A90(period)}$ and $L_{Aeq(15minute)}$ noise levels at the nearest potentially affected residential locations during the day, evening and night-time periods to enable the determination of the intrusiveness and amenity criteria for the project.

Background noise levels were monitored from Wednesday 4 June 2014 to Wednesday 11 June 2014 inclusive at locations M1, M2 and M3. Details of the monitoring location are provided in **Table 14** and **Figure 6**.

Table 14 Ambient Noise Monitoring Locations

Logger Type/ Serial No.	Location	Location (m, UTM)		Elevation (m, AHD)
		Easting	Northing	
ARL EL316 16-203-509	Logger Location M1	709653.25	6287576.95	868
ARL EL316 16-203-531	Logger Location M2	710372.11	6287219.30	873
ARL EL316 16-301-473	Logger Location M3	711754.00	6286971.75	891

The noise logger was programmed to record statistical noise level indices continuously in 15 minute intervals, including L_{Amax}, L_{A1}, L_{A50}, L_{A90}, L_{A99}, L_{Amin} and L_{Aeq}. Precautions were taken to minimise influences from extraneous noise sources and reflections from adjacent buildings.

Weather data for the survey period was obtained from the Bureau of Meteorology (BOM) weather station located at Orange Airport (approximately 18.8 km north west of the Project Site). Noise data corresponding to periods of rainfall and/or wind speeds in excess of 5 m/s (approximately 9 knots) were discarded in accordance with INP data exclusion methodology. A summary of the results of the background survey is given in **Table 15**. Results are displayed graphically in **Appendix B**.

Table 15 Summary of Existing Ambient Noise Levels

Location	Period	Measured Background L_{A90} Noise Level	Adopted Rating Background Level	Estimated Existing Industrial Contribution L_{Aeq} (non project related)
M1 - Palmer	Daytime	35 dBA	35 dBA	37 dBA
	Evening	33 dBA	33 dBA	37 dBA
	Night-time	29 dBA	30 dBA *	<30 dBA
M2 - Athol	Daytime	31 dBA	31 dBA	Non discernable
	Evening	28 dBA	30 dBA*	Non discernable
	Night-time	27 dBA	30 dBA*	<30 dBA
M3 - Ewens	Daytime	30 dBA	30 dBA	Non discernable
	Evening	28 dBA	30 dBA *	Non discernable
	Night-time	27 dBA	30 dBA *	<30 dBA

Note: Daytime 7.00 am to 6.00 pm; Evening 6.00 pm to 10.00 pm; Night-time 10.00 pm to 7.00 am
On Sundays and Public Holidays, Daytime 8.00 am to 6.00 pm; Evening 6.00 pm to 10.00 pm; Night-time 10.00 pm to 8.00 am
The L_{A90} represents the level exceeded for 90% of the interval period and is referred to as the average minimum or background noise level
L_{Aeq} - The equivalent continuous noise level is defined as the level of noise equivalent to the energy average of noise levels occurring over a measurement period.

* The rating background was below 30 dBA and therefore has been adjusted to equal 30 dBA as stated in the NSW Industrial Noise Policy (INP).

The operator-attended noise measurements presented in **Table 11**, **Table 12** and **Table 13** show that the existing measured L_{A90} background noise levels presented in **Table 15** have not been affected by noise from the existing Project Site activities at R1 during all periods and during the day and evening at R2 and R3 and therefore are applicable levels to be used in the establishment of PSNC.

However, the operator-attended noise measurements presented in **Table 12** and **Table 13** show that the existing measured L_{A90} background noise levels presented in **Table 15** have been affected by noise from the existing Project Site activities during the night-time at R2 and R3 respectively. It is relevant to note that the measured L_{A90} background and the existing Project Site activities during this period were measured to be below the minimum background of 30 dBA. Therefore, the adopted rating background equals the minimum background of 30 dBA as stated in the NSW Industrial Noise Policy (INP) and therefore is applicable to be used in the establishment of PSNC.

7 EFFECTS OF METEOROLOGY ON NOISE LEVELS

7.1 Wind

Wind has the potential to increase noise at a receiver when it is light and stable and blows from the direction of the source of the noise. As the strength of the wind increases the noise produced by the wind will obscure noise from most industrial and transport sources.

Wind effects need to be considered when wind is a feature of the area under consideration (in accordance with the INP). Where wind blows from the source to the receiver at speeds up to 3 m/s for more than 30% of the time in any season, then wind is considered to be a feature of the area and noise level predictions must be made under these conditions.

The INP provides two methods to assess wind effects; analysis of relevant weather data to determine whether wind is a feature based on the frequency of occurrence and wind speed (*detailed approach*) or simply assume that wind is a feature of the area (*simple approach*). Wind speed and direction data, among other parameters, have been measured at the BOM automated weather station (AWS) at Orange Airport (Station Number 063303) for many years. Thus, a detailed approach has been utilised for the purpose of this assessment.

In order to determine the prevailing conditions for the Project Site, seven (7) years of weather data (2027, 2008, 2009, 2010, 2011, 2012, 2013) was obtained from the BOM AWS at Orange Airport (approximately 18.8 km north west of the Project Site).

In Accordance with the INP, this data was analysed to determine the frequency of occurrence of winds of speeds up to 3 m/s in each season during the day, evening and night time periods. The results of the wind analysis for daytime, evening, and night-time winds are presented in **Table 16**,

Table 17 and **Table 18** respectively. In each table, the wind directions and percentage occurrence are those dominant during each season.

Table 16 Seasonal Frequency of Occurrence of Wind Speed Intervals – Daytime

Period	Calm	Wind Direction	0.5 – 2 m/s	2 – 3 m/s	0.5 – 3 m/s
Summer	2.7%	NNW±45	2.5%	5.4%	8.0%
Autumn	7.2%	WSW±45	4.9%	7.1%	12.0%
Winter	6.8%	WSW±45	3.6%	5.6%	9.2%
Spring	3.2%	NW±45	2.6%	5.0%	7.7%

Table 17 Seasonal Frequency of Occurrence of Wind Speed Intervals – Evening

Period	Calm	Wind Direction	0.5 – 2 m/s	2 – 3 m/s	0.5 – 3 m/s
Summer	5.0%	ENE±45	2.3%	7.8%	10.1%
Autumn	11.6%	E±45	3.1%	12.5%	15.7%
Winter	11.1%	NE±45	2.6%	9.5%	12.1%
Spring	8.6%	NNE±45	3.3%	8.2%	11.5%

Table 18 Seasonal Frequency of Occurrence of Wind Speed Intervals – Night

Period	Calm	Wind Direction	0.5 – 2 m/s	2 – 3 m/s	0.5 – 3 m/s
Summer	20.6%	E±45	4.4%	10.0%	14.5%
Autumn	27.6%	SSE±45	7.2%	11.1%	18.4%
Winter	21.6%	S±45	5.1%	10.5%	15.6%
Spring	23.4%	S±45	6.3%	8.7%	15.0%

From the above weather data, significant wind (i.e. wind speed of up to 3 m/s) was not recorded more than the assessment threshold of 30% during the periods between 2007 and 2013 and therefore prevailing winds have not been considered in this assessment.

7.2 Temperature Inversion

Temperature inversions, when they occur, have the ability to increase noise levels by focusing sound waves. Temperature inversions occur predominantly at night during the winter months. For a temperature inversion to be a significant characteristic of the area it needs to occur for approximately 30% of the total night-time during winter, or about two nights per week.

Meteorological data was available from the AWS at Orange Airport to allow the determination of the percentage occurrence of temperature inversions during winter nights. The most current temperature inversion data was contained in the year 2013.

The INP states: '*Temperature inversions occur during E, F and G stability categories. These three categories are considered to represent weak, moderate and strong inversions respectively. For noise-assessment purposes, only moderate and strong inversions are considered significant enough to require assessment'*.

In dispersion modelling, stability class is used to categorise the rate at which a plume will disperse. In the Pasquill-Gifford stability class assignment scheme there are six stability classes, A through to F. Class A relates to unstable conditions, such as might be found on a sunny day with light winds. Class F relates to stable conditions, such as those that occur when the sky is clear, the winds are light and an inversion is present. The intermediate classes B, C, D and E relate to intermediate dispersion conditions. A seventh class, G, has also been defined to accommodate extremely stable conditions such as might be found in arid rural areas.

An analysis of the occurrence of each stability class has been conducted and is provided in **Table 19**.

Table 19 Seasonal Frequency of Occurrence of Temperature Inversion – Night

Stability Class	Winter
A	0.0%
B	0.0%
C	0.0%
D	47.7%
E	21.7%
F	14.2%
G	16.4%
F+G	**30.6%**

Results of the analysis is provided in **Table 19** indicate that temperature inversions occur in the area and have therefore been considered as part of this noise assessment.

7.2.1 Suitability of Meteorological Data

It is noted that the dataset utilised for the purpose of the NVIA may differ to that utilised in other environmental impact assessments including, but not limited to, air quality. Whilst the starting point for each assessment may be similar, the requirements for meteorological data vary, as stated in guidance documentation from the appropriate regulatory authorities.

The factors considered in selecting the meteorological data for use in an air quality impact assessment can be considerably different to those that need to be considered when compiling data for a noise impact assessment.

Worst case noise impacts tend to occur under conditions of low wind speeds when there is little atmospheric turbulence to dissipate the noise emissions. Impacts resulting from particulate emissions tend to be greatest under moderate to strong wind speeds, when wind-blown dust is generated and particulate matter can be carried significant distances before settling out of the air.

Dust impacts are also assessed based on longer term averages (24-hour and annual averages), whereas noise and odour nuisance impacts are more likely to be associated with peak events.

Furthermore, the weather dataset as a whole is required to contain different meteorological parameters to assess the noise impacts or air quality impacts. For example, for air quality impacts, the mixing heights in the dataset are required to assess the vertical dispersion of pollutants which can have a significant impact on the resultant ground level concentration at the discrete receptors. Whereas for noise impacts, the mixing heights do not directly influence the noise levels experienced.

For these reasons, the meteorological data used in this assessment differs from that used in the assessment of air quality impacts from the Project.

Appendix C provides further discussion with regard to the requirements for weather data and how it is analysed for the purpose of the NVIA.

8 PROJECT SPECIFIC NOISE CRITERIA

8.1 Operational Noise Design Criteria

The noise emission design criteria for the Project have been established with reference to the INP outlined in **Section 5** of this report.

The INP defines three types of acoustical environments; rural, suburban or urban. Based on the definitions of these environments in the INP, the acoustical environment around the Project Site typifies a suburban environment, which is defined as; "*an area that has local traffic with characteristically intermittent traffic flows or with some limited commerce or industry"* (INP, 2000). Therefore, the residences in the general area have been assessed as "suburban" receiver types.

The amenity criteria have been established using the results of ambient noise measurements. Existing industrial L_{Aeq} noise levels in the vicinity are more than 6 dBA below the Acceptable Noise Levels described in **Table 3** for all proposed operational periods. Therefore, the project specific amenity criteria is equal to the Acceptable Noise Level (refer **Table 3**).

In accordance with the INP, the PSNC reflect the most stringent noise level requirements from the noise levels derived for both the intrusive and amenity criteria. Applying the most stringent requirement as the PSNC ensures that both intrusive noise is limited and amenity is protected.

The operational PSNC for residences R1 (see **Figure 5**) is based on L_{A90} and L_{Aeq} noise levels measured at Logger Location M1 (see **Figure 6**).

The operational PSNC for residences R2 and R3 (see **Figure 5**) is based on L_{A90} and L_{Aeq} noise levels measured at Logger Location M2 (see **Figure 6**).

The operational PSNC for residences R4 (see **Figure 5**) is based on L_{A90} and L_{Aeq} noise levels measured at Logger Location M3 (see **Figure 6**).

The operational PSNC for the project are shown in **Table 20**. As can be seen in **Table 21**, the PSNC adopted for all sensitive receivers is the intrusiveness criteria, being the most stringent criteria.

Table 20 Operational PSNC

Location	Period	Measured Background Noise Level (LA90)	Adopted RBL L_{A90}	Intrusiveness Criteria $L_{Aeq(15minute)}$ (RBL +5dB)	Amenity Criteria $L_{Aeq(Period)}$	PSNC $L_{Aeq(15min)}$
R1 – Palmer	Day	35 dBA	35 dBA	40 dBA	55 dBA	**40 dBA**
	Evening	33 dBA	33 dBA	38 dBA	45 dBA	**38 dBA**
	Night	29 dBA	30 dBA *	35 dBA	40 dBA	**35 dBA**
R2 & R3 – Tetlaw and Athol	Day	31 dBA	31 dBA	36 dBA	55 dBA	**36 dBA**
	Evening	28 dBA	30 dBA *	35 dBA	45 dBA	**35 dBA**
	Night	27 dBA	30 dBA *	35 dBA	40 dBA	**35 dBA**
R4 - Ewens	Day	30 dBA	30 dBA	35 dBA	55 dBA	**35 dBA**
	Evening	28 dBA	30 dBA *	35 dBA	45 dBA	**35 dBA**
	Night	27 dBA	30 dBA *	35 dBA	40 dBA	**35 dBA**

Note: Daytime 7.00 am to 6.00 pm; Evening 6.00 pm to 10.00 pm; Night-time 10.00 pm to 7.00 am
On Sundays and Public Holidays, Daytime 8.00 am to 6.00 pm; Evening 6.00 pm to 10.00 pm; Night-time 10.00 pm to 8.00 am

*The rating background was below 30 dBA and therefore has been adjusted to equal 30 dBA as stated in the NSW Industrial Noise Policy (INP).

8.2 Sleep Disturbance Noise Goals

The relevant sleep disturbance noise goals for each residential area are provided in **Table 21**.

Table 21 Sleep Disturbance Noise Goals

Location	Period	Measured Background Noise Level (L_{A90})	Adopted RBL* L_{A90}	Sleep Disturbance Noise Goal (External)
R1, R2, R3 & R4	Night	<30 dBA	30 dBA[1]	**45 dBA**

* For the purposes of determining the relevant sleep disturbance noise goal the adopted RBL has been calculated such that the background noise level excludes the existing contribution from the Project Site.

1. The rating background was below 30dBA and therefore has been adjusted to equal 30dBA as stated in the NSW Industrial Noise Policy (INP)

8.3 Road Traffic Noise Goals

Table 5 provides the relevant project specific operational and construction road traffic noise goals that are applicable for the Project.

Table 22 Project Specific Road Traffic Noise Assessment Criteria for Residential Land Uses

Road	Assessment criteria – dBA	
	Day (7 am–10 pm)	**Night (10 pm–7 am)**
Mid western Highway Millthorpe Road/Orange Road/Church street	LAeq, (15 hour) 60 (external)	LAeq, (9 hour) 55 (external)
Newbridge Road	LAeq, (1 hour) 55 (external)	LAeq, (1 hour) 50 (external)

8.4 Construction Noise Goals

Similar to the intrusive PSNC, the adopted project specific noise goal for construction activities is background (refer to **Table 15**) plus 10 dBA (L_{A90} + 10 dBA) for standard hours. **Table 23** presents the noise goals for construction activities at the Project Site.

The resulting construction PSNC for residences R1 (see **Figure 5**) is based on L_{A90} and L_{Aeq} noise levels measured at Logger Location M1 (see **Figure 6**).

The resulting construction PSNC for residences R2 and R3 (see **Figure 5**) is based on L_{A90} and L_{Aeq} noise levels measured at Logger Location M2 (see **Figure 6**).

The resulting construction PSNC for residences R4 (see **Figure 5**) is based on L_{A90} and L_{Aeq} noise levels measured at Logger Location M3 (see **Figure 6**).

Table 23 Construction Noise Goals

Residential Location	Period	Noise Goal (LAeq,15minute) (dBA)	
		Noise Affected	**Highly Noise Affected**
R1 – Palmer	Recommended Standard Hours	45 dBA	75 dBA
R2 – Tetlaw		41 dBA	
R3 – Athol		41 dBA	
R4 - Ewens		40 dBA	

Note: Recommended standard hours for construction are between the hours of 7.00 am and 6.00 pm Monday to Friday and Saturday 8am to 1pm. No work Sundays or public holidays.

8.5 Operational and Construction Vibration Goals

Table 7 and **Table 10** provide the relevant project specific operational vibration goals that are applicable for the Project

9 OPERATIONAL NOISE IMPACT ASSESSMENT

9.1 Acoustically Significant Sources

Sound power levels for acoustically significant items of plant and equipment operating at the Project Site have been obtained from onsite measurements where possible. Where this was not possible data was obtained from an SLR noise source database of similar equipment. The L_{Aeq} sound power levels of relevant plant and equipment utilised for the purpose of predicting noise emission levels are given in **Table 24**.

Table 24 Equipment Sound Power Levels

Plant and Equipment	Data Source	Typical Sound Power Level LA_{eq} (dBA)
Existing Operations		
Semi-trailer and/or B-double entering or leaving	SLR Database	84 dBA
Semi-trailer and/or B-double manoeuvring including reversing beeper	SLR Database	94 dBA
Semi-trailer and/or B-double Taking off	SLR Database	90 dBA
Semi-trailer and/or B-double Braking and Slowing down	SLR Database	92 dBA
Outside compressor room including condensers SPL @ 20m	Onsite measurements	43 dBA
Forklifts (6)	Onsite measurements	97 dBA per forklift
Refrigeration Unit	Onsite measurements	92 dBA
Carpark	SLR Database	63 dBA
Proposed Operations		
Semi-trailer and/or B-double entering or leaving	SLR Database	84 dBA
Semi-trailer and/or B-double manoeuvring including reversing beeper	SLR Database	94 dBA
Semi-trailer and/or B-double Taking off	SLR Database	90 dBA
Semi-trailer and/or B-double Braking and Slowing down	SLR Database	92 dBA
Semi-trailer and/or B-double unloading Goats	SLR Database	103 dBA
Water treatment plant	SLR Database	90 dBA
Goat Bleating	SLR Database	88 dBA[1]
Roof top ventilation fans (10)	SLR Database	88 dBA per fan
Carpark	SLR Database	63 dBA
Boiler (2)	SLR Database	93 dBA
Extraction Fan (2)	Manufacture Data	91 dBA

Note: 1. Noise level presented for a goat bleating have been obtained from measurements of actual goat noise levels from a goat stud farm located on the Central Coast NSW.

9.1.1 Traffic generation

Table 25 summarises the anticipated traffic volumes to be generated over a typical year.

The following points should be noted in terms of the volume of traffic to be generated:

- It is estimated that close to 80 percent of the total traffic will be generated by light vehicles (car/ute/van). During the seasonal packing of hampers during the two months leading up to Christmas, this percentage will increase to approximately 86 percent;
- With the exception of livestock delivery, all heavy vehicle activities should occur between 6:30am and 7pm; and
- Heavy vehicle activities will be relatively evenly spread (i.e. no peak periods).

Therefore from the operational data provided by the applicant the peak hour traffic generation from the site will be on completion of the abattoir;

- 120 vtph in the AM peak (117 inbound and 3 outbound) between 6 am and 7 am.
- 166 vtph in the PM peak (158 outbound and 8 inbound) between 3 pm and 4 pm.

Table 25 Estimated Traffic Volumes

Activity	Vehicle Type	Daily Vehicles (Two Way Vehicle Trips)
	Heavy Vehicles	
Delivery of livestock	Semi-trailer and/or B-double	12
Delivery of consumables	Semi-trailer	2
Delivery of goods to Blayney SeaLink Cold Store Complex	Semi-trailer and/or B-double	12
Removal of meat products from the abattoir	Semi-trailer and/or B-double	6
Removal of other stored goods from the Blayney SeaLink Cold Store Complex	Semi-trailer and/or B-double	12
Removal of meat waste products	Rigid truck	4
Removal of skins	Rigid truck	4
Removal of general garbage	Rigid truck	4
Maintenance	Rigid truck	2
Heavy Vehicle Sub-Total		**58**
	Light Vehicles	
Staff Blayney SeaLink	Car	60
Staff Abattoir	Car	200
Tradesman	Ute / Van	2
Hamper King packout	Car (2 months)	120
Light Vehicle Sub-Total		**382**
TOTAL		**440**

9.2 Operational Noise Modelling

9.2.1 Operational Noise Modelling Parameters

The Conservation of Clean Air and Water Europe (CONCAWE) prediction methodology was utilised within SoundPLAN 3D modelling software (Version 7.3), developed by Braunstein and Berndt Gmbh in Germany, to predict noise emissions from operation of the Project Site. A three-dimensional digital terrain map giving all relevant topographic information was used in the modelling process. The model used this map, together with noise source data, ground cover, shielding by barriers and/or adjacent buildings and atmospheric information to predict noise levels at the nearest sensitive receivers.

Prediction of noise emission levels was carried out under calm atmospheric conditions. Atmospheric parameters under which noise predictions were made are given in **Table 26**.

Table 26 Meteorological Parameters Considered for Noise Predictions

	Temperature	Humidity	Wind Speed	Wind Direction (degrees from north)	Temperature Inversion
Day (calm)	16^{o}C	64%	n/a	n/a	n/a
Evening (calm)	14 ^{o}C	70%	n/a	n/a	n/a
Night (calm)	10 ^{o}C	84%	n/a	n/a	n/a
Temperature Inversion (night)	10 ^{o}C	84%	n/a	n/a	Pasquill Stability Category 6 (CONCAWE)[1]

Note: 1. The basis of this correction is the meteorological category of the atmosphere which is assessed in accordance with Pasquill and Turner Stability Categories contain within the CONCAWE algorithm. The 6 categories are shown in **Table 27** with the effect on attenuation.

Table 27 Pasquill Stability Category

Meteorological Category	Pasquill Stability Category		
	A, B	C, D, E	F, G
1	V< -3.0	-	-
2	-3.0 < V < -0.5	V < - 3.0	-
3	-0.5 < V < +0.5	-3.0 < V < -0.5	V < -3.0
4	+0.5 < V < +3	-0.5 < V < 0.5	-3.0 < V < -0.5
5	V > 3	0.5 < V < +3	-0.5 < V < +0.5
6	-	V> +3	+0.5 < V < +3

Assumptions made in modelling noise emissions from the Project Site include the following:

- All acoustically significant plant and equipment operates simultaneously.
- Mobile noise sources, such delivery vehicles, were modelled at typical locations and assumed to operate in repetitive cycles.

9.2.2 Operational Scenario – Noise Model Summary

The operational scenario modelled during each period is summarised in **Table 28**. A tick (✓) indicates that the equipment is in operation during the relevant period. A cross (×) indicates that the equipment is not in operation during the relevant period. It should be noted that the operational scenarios modelled are likely to represent an acoustically worst-case scenario.

Table 28 Operational Scenarios Considered in Noise Model

Plant and Equipment	Day	Evening	Night
Existing Operation			
Semi-trailer and/or B-double entering or leaving	✓	✓	✓
Semi-trailer and/or B-double manoeuvring including reversing beeper	✓	✓	✓
Semi-trailer and/or B-double Taking off	✓	✓	✓
Semi-trailer and/or B-double Braking and Slowing down	✓	✓	✓
Outside compressor room including condensers SPL @ 20m	✓	✓	✓
Forklifts (6)	✓	✓	✓
Refrigeration Unit	✓	✓	✓
Carpark	✓	✓	✓
Proposed Operations			
Semi-trailer and/or B-double entering or leaving	✓	✓	✓
Semi-trailer and/or B-double manoeuvring including reversing beeper	✓	✓	✓
Semi-trailer and/or B-double Taking off	✓	✓	✓
Semi-trailer and/or B-double Braking and Slowing down	✓	✓	✓
Semi-trailer and/or B-double unloading Goats	✓	✓	✓
Water treatment plant	✓	✓	✓
Goat holding pens (10,000 goats)	✓	✓	✓
Roof top ventilation fans (10)	✓	✓	✓
Carpark	✓	✓	✓
Boiler (2)	✓	✓	✓
Extraction Fan (2)	✓	✓	✓

It is relevant to note that goats by nature are placid animals and only make significant noise (bleating) during mating and when under stress. All possible, mitigation has been implemented to reduce the stress on the goats and the livestock will be managed and treated in accordance with animal welfare standards as per Agriculture NSW requirements, as well as the requirements of the Department of Agriculture, Fisheries and Forestry and the NSW Food Authority. As a conservative approach, the noise model has assumed that only 5% of the 10,000 goats in the holding pens would be bleating during any 15 minute period.

9.2.3 Operational Noise Modelling Results and Discussion

Noise emission levels were predicted from the Project Site for the typical operational scenarios described in **Table 28**.

Noise from all sources that contribute to the total noise from the site have been examined to identify characteristics that may cause greater annoyance (for example tonality, impulsiveness etc). The appropriate modifying factors, as outlined in the INP, have been applied where these characteristics are considered to be present. Noise levels predicted for the Project (including existing and proposed operations) at the nearest sensitive receiver locations are provided in **Table 29**.

Table 29 Operational Predicted Noise Level Results

Location	Period	Predicted Noise Level $L_{Aeq(15minute)}$ (dBA)						PSNC $L_{Aeq(15minute)}$ (dBA)
		Existing operation		Proposed operation		Total		
		Calm	Temperature Inversion	Calm	Temperature Inversion	Calm	Temperature Inversion	
R1 - Palmer	Day	<30	N/A	<30	N/A	<30	N/A	40
	Evening	<30	N/A	<30	N/A	<30	N/A	38
	Night	<30	<30	<30	<30	<30	<30	35
R2 - Tetlaw	Day	<30	N/A	<30	N/A	<30	N/A	36
	Evening	<30	N/A	<30	N/A	<30	N/A	35
	Night	<30	<30	<30	31	<30	32	35
R3 - Athol	Day	<30	N/A	31	N/A	32	N/A	36
	Evening	<30	N/A	31	N/A	32	N/A	35
	Night	<30	<30	31	33	33	34	35
R4 - Ewens	Day	<30	N/A	<30	N/A	<30	N/A	35
	Evening	<30	N/A	<30	N/A	<30	N/A	35
	Night	<30	<30	<30	<30	<30	<30	35

Note: Daytime 7.00 am to 6.00 pm; Evening 6.00 pm to 10.00 pm; Night-time 10.00 pm to 7.00 am
On Sundays and Public Holidays, Daytime 8.00 am to 6.00 pm; Evening 6.00 pm to 10.00 pm; Night-time 10.00 pm to 8.00 am

Results presented in **Table 29** indicate that operational noise levels are predicted to meet the PSNC at all residential locations considered in the assessment.

9.3 Sleep Disturbance Analysis

In assessing sleep disturbance, typical L_{Amax} noise levels of acoustically significantly plant and equipment used at the Project Site (refer to **Table 30**) were used as input to the noise model. L_{Amax} noise level predictions were made at the nearest residential locations surrounding the Project Site under worst-case weather condition at night and the results are presented in **Table 31**. The use of the L_{Amax} noise level provides a worst-case prediction since the $L_{A1(1minute)}$ noise level of a particular event is likely to be less than the L_{Amax}.

Table 30 L_{Amax} Sound Power Levels

Plant and Equipment	Data Source	Sound Power Level dBA
Existing Operations		
Semi-trailer and/or B-double entering or leaving	SLR Database	103 dBA
Semi-trailer and/or B-double manoeuvring including reversing beeper	SLR Database	103 dBA
Semi-trailer and/or B-double Taking off	SLR Database	103 dBA
Semi-trailer and/or B-double Braking and Slowing down	SLR Database	103 dBA
Outside compressor room including condensers SPL @ 20m	Onsite measurements	43 dBA
Forklifts (6)	Onsite measurements	106 dBA per forklift
Refrigeration Unit	Onsite measurements	94 dBA
Carpark	SLR Database	98 dBA
Proposed Operations		
Semi-trailer and/or B-double entering or leaving	SLR Database	103 dBA
Semi-trailer and/or B-double manoeuvring including reversing beeper	SLR Database	103 dBA
Semi-trailer and/or B-double Taking off	SLR Database	103 dBA
Semi-trailer and/or B-double Braking and Slowing down	SLR Database	103 dBA
Semi-trailer and/or B-double unloading Goats	SLR Database	115 dBA
Water treatment plant	SLR Database	90 dBA
Goat Bleating	SLR Database	98 dBA [1]
Roof top ventilation fans (10)	SLR Database	88 dBA per fan
Carpark	SLR Database	98 dBA
Boiler (2)	SLR Database	100 dBA
Extraction Fan (2)	Manufacture Data	91 dBA

Note: 1. Noise level presented for a goat bleating have been obtained from measurements of actual goat noise levels from a goat stud farm located on the Central Coast NSW.

Table 31 Predicted Sleep Disturbance Noise Levels

Location	Period	Predicted Sleep Disturbance Noise Level L_{max} (dBA)	Project Specific Sleep Disturbance Noise Goal ($L_{A1\ (1minute)}$)
R1 – Palmer	Night-time	32	**45 dBA**
R2 – Tetlaw		39	
R3 - Athol		44	
R4 – Ewens		32	

The L_{Amax} noise levels are predicted to meet the project specific sleep disturbance noise goals specified in **Table 21** for night-time period operation at the Project Site at all assessed receiver locations.

10 ROAD TRAFFIC NOISE IMPACT ASSESSMENT

10.1 Methodology and Assumptions

Road traffic noise levels from the Project have been predicted using with the Federal Highway Administration Model (FHWA). The modelling allows for traffic volume and mix, vehicle speed, reflections off building surfaces, ground absorption and shielding from ground topography and physical noise barriers.

All reported noise levels are “facade-corrected”, that is, predicted noise levels have been adjusted upwards to include a notional 2.5 dBA reflection within the noise model computation.

The predicted levels are for receiver points 1.5 m above the external ground level.

Two scenarios were modelled for the purposes of this traffic noise impact assessment:

- Scenario 1 - assumes existing traffic volumes with the SeaLink Cold Storage Complex.
- Scenario 2 - assumes existing traffic volumes with the SeaLink Cold Storage Complex and the proposed abattoir in operation.

10.2 Operational Road Traffic Parameters

Existing and additional employee traffic to and from the Project Site associated with operation of the Project will use the following roads:

Burns Street/Newbridge Road

Burns Street connecting to Newbrìdge Road functions as a local urban and rural collector road under a functional road hierarchy. It collects and distributes traffic from the rural areas east of Blayney to Newbridge. It is under the care and control of Blayney Shire Council and in the vicinity of the site has a two way two lane sealed carriageway approximately 7 metres wide Within the Blayney town area, Burns Street has a carriageway width of approximately 20 metres providing parking lanes on both sides of the street. Burns Street is speed zoned 50 km/h while Newbridge Road is speed zoned 80 km/h in the vicinity of the site.

Mid-Western Highway

The Mid-Western Highway (State Highway 6 – A41) is a major arterial road and transportation route in the central west area connecting the Great Western Highway at Bathurst to the Newell Highway and south to Hay. As a major arterial road it is under the care and control of the Roads and Maritime Services (RMS). Through Blayney the Mid-Western Highway is locally known as Adelaide Street and is the main street of the town. Within the town centre it is an urban road 20 metres wide between kerbs providing two lane two way travel lanes with adjacent angled rear to kerb parking areas while north and south of Blayney it is a two way two lane sealed rural wide with 3.5 metre wide travel lines and wide sealed shoulders. Adelaide Street is speed zoned 50 km/h while 100 km/h speed zoning exists north and south of Blayney on the Highway.

Church Street / Orange Road

Church Street, which connects to Orange Road, is a sub-arterial road connecting Blayney to the regional centre of Orange. It is a classified main road (MR 245) under the care and control of Blayney Shire Council. Typically within Blayney it is a two way two lane urban road of varying width with parking lanes provided within the town centre area while to the south of Blayney it is a two way two lane sealed rural road with 3.5 metre travel lane widths. It is speed zoned 50 km/h within Blayney and generally between 70 km/h and 100 km/h through the rural areas to Orange.

Road traffic volume information was provided by Intersect Traffic and reference has been made to the following:

- *Traffic Impact Assessment – Small Stock Abattoir – Lots 103 to 105 & 107 DP 1161062, 137 Newbridge Road, Blayney* dated September 2014

Details of parameters utilised in the noise model are provided in **Table 32**.

Table 32 Road Traffic Volumes Utilised in Noise Model

Scenario	Road Description	Road Traffic Speed km/h	AADT [1]	Day (15 hour) Traffic Flow 7am to 10pm	Night (9 hour) Traffic Flow 10pm to 7am	Heavy Vehicle %	
						Day 7am to 10pm	Night 10pm to 7am
Scenario 1 Existing traffic volumes with the SeaLink Cold Storage Complex	Burns Street/Newbridge Road	50km 80km	452	425	27	10	10
	Mid-Western Highway	50km 100km	4346	4085	261	12	12
	Church Street / Orange Road	50km 80km 100km	2873	2701	172	10	10
Scenario 2 existing traffic volumes with the SeaLink Cold Storage Complex and the proposed Abattoir in operation	Burns Street/Newbridge Road	50km 80km	688	647	41	10	10
	Mid-Western Highway	50km 100km	4582	4307	275	12	12
	Church Street / Orange Road	50km 70km 100km	3109	2992	187	10	10

1 – Annual Average Daily Traffic

10.3 Road Traffic Noise Prediction Results

Table 33 provides the prediction results for the operational road traffic noise levels associated with the Project.

Table 33 Operational Road Traffic Noise Prediction Results (Residential)

Scenario	Road Description	Road Traffic Speed km/h	Prediction Results (dBA) @ 10m		Criteria	
			Day (15 hour) 7am to 10pm	Night (9 hour) 10pm to 7am	Day (15 hour) 7am to 10pm	Night (9 hour) 10pm to 7am
Scenario 1 Existing traffic volumes with the Sealink Cold Storage Complex	Burns Street/ Newbridge Road	50km	44.9	35.2	60	55
		80km	47.8	38.1		
	Mid-Western Highway	50km	56.6	46.9		
		100km	59.1	49.4		
	Church Street / Orange Road	50km	53.0	43.2		
		70km	56.4	46.7		
		100km	57.3	47.6		
Scenario 2 Existing traffic volumes with the Sealink Cold Storage Complex and the proposed Abattoir in operation	Burns Street/ Newbridge Road	50km	46.8	37.0	60	55
		80km	49.6	39.9		
	Mid-Western Highway	50km	56.9	47.1		
		100km	59.3	49.6		
	Church Street / Orange Road	50km	53.3	43.6		
		70km	56.7	47.0		
		100km	57.6	47.9		

Based upon the expected peak road traffic movements presented in **Table 32**, the calculated daytime $L_{Aeq(15hour)}$ and night-time $L_{Aeq(9hour)}$ noise level at the nearest roadside residential receivers (assumed to be approximately 10m from the edge of the road) meets the criteria detailed in the RNP under all prediction scenarios. It is noted that in relation to the identified sensitive receivers near the Project Site, these results are conservative given that all residences are located further than 10m from the edge of the road.

11 CONSTRUCTION NOISE IMPACT ASSESSMENT

11.1 Construction Equipment Sound Power Levels

To assess the worst case construction noise scenario, this NVIA has assumed all construction activities proposed to occur on site will occur simultaneously. The sound power levels of the major noise generating plant that has been assumed for the construction of the infrastructure as part of the Project are given in **Table 34**. Sound power levels for equipment used in the assessment have been obtained from a SLR database of similar equipment.

Table 34 Acoustically Significant Equipment Sound Power Levels

Plant Equipment	Quantity	Sound Power Level (dBA)
Cat 12 grader	1	109 dBA
Cat 621 scraper	1	111 dBA
Cat D8 dozer	1	107 dBA
Cat 320 excavator	1	110 dBA
Tip truck	2	110 dBA
Cat backhoe	1	100 dBA
Concrete trucks	2	107 dBA
Concrete pump	1	108 dBA
General cargo trucks	3	89 dBA
Mobile crane	1	102 dBA

11.2 Construction Noise Modelling Results

Noise levels generated from the proposed construction activities were predicted at the nearest sensitive receiver locations surrounding the Project Site (see **Figure 5**). A summary of the results of these predictions are contained within **Table 35**.

Table 35 Predicted Construction Noise Levels at Residential Receivers

Residential Receiver Location	Predicted $L_{Aeq(15minute)}$ Noise Level (dBA)	Construction Design Goal $L_{Aeq(15minute)}$ (dBA)	
		Noise Affected	Highly Noise Affected
R1 – Palmer	38	45 dBA	75 dBA
R2 – Tetlaw	**45**	41 dBA	
R3 - Athol	**49**	41 dBA	
R4 – Ewens	34	40 dBA	

Note: Construction may only occur between the hours of 7.00 am and 6.00 pm Monday to Friday, and 8.00 am to 1.00 pm Saturdays. No construction work is to take place on Sundays or Public Holidays

The modelling results in **Table 35** indicate that the predicted $L_{Aeq(15minute)}$ noise levels from proposed construction activities meet the 'Noise Affected' construction noise goals at all assessed sensitive receivers with the exception of R2 and R3. However, all residential receiver locations are well below the 'Highly Noise Affected' construction noise goal of 75 $L_{Aeq(15minute)}$.

11.3 Construction Traffic

The construction of the abattoir will result in additional traffic entering and exiting the site. It is estimated that during the peak construction periods up to 30 construction employees will be on-site at any one time. If a car occupancy rate of 1.1 is assumed for employee traffic this would result in an am and pm peak traffic flow to the site of in the order of 28 vehicle trips per hour (VTHP). This will also increase the peak parking demand at the site by a similar number during construction.

Material deliveries will add to this traffic with peak materials delivery traffic expected during the pouring of concrete slabs early on in the construction period. With a large pour and a fleet of concrete trucks sourced from nearby it is likely that a further 10 vtph could occur during the am peak period as a result of this construction activity. In addition, during construction of the new access road and foundation for the car park internal roads and concrete slab there will be 4 vtph additional truck movements over a 30 day period hauling road base. Therefore overall it is estimated that the peak construction traffic generation resulting from the construction of the abattoir will be in the order of 42 vtph during the am peak.

11.3.1 Construction Road Traffic Noise Prediction Results

Table 33 provides the modelling results for the construction road traffic noise levels associated with the Project.

Table 36 Construction Road Traffic Noise Prediction Results (Residential)

Scenario	Road Description	Road Traffic Speed km/h	Prediction Results (dBA) @ 10m	Criteria
			Day (15 hour) 7am to 10pm	Day (15 hour) 7am to 10pm
Scenario 1 Construction operation with Existing traffic volumes with the SeaLink Cold Storage Complex	Burns Street/Newbridge Road	50km	49.5	60
		80km	51.9	
	Mid-Western Highway	50km	57.4	
		100km	59.7	
	Church Street / Orange Road	50km	54.0	
		70km	57.4	
		100km	58.2	

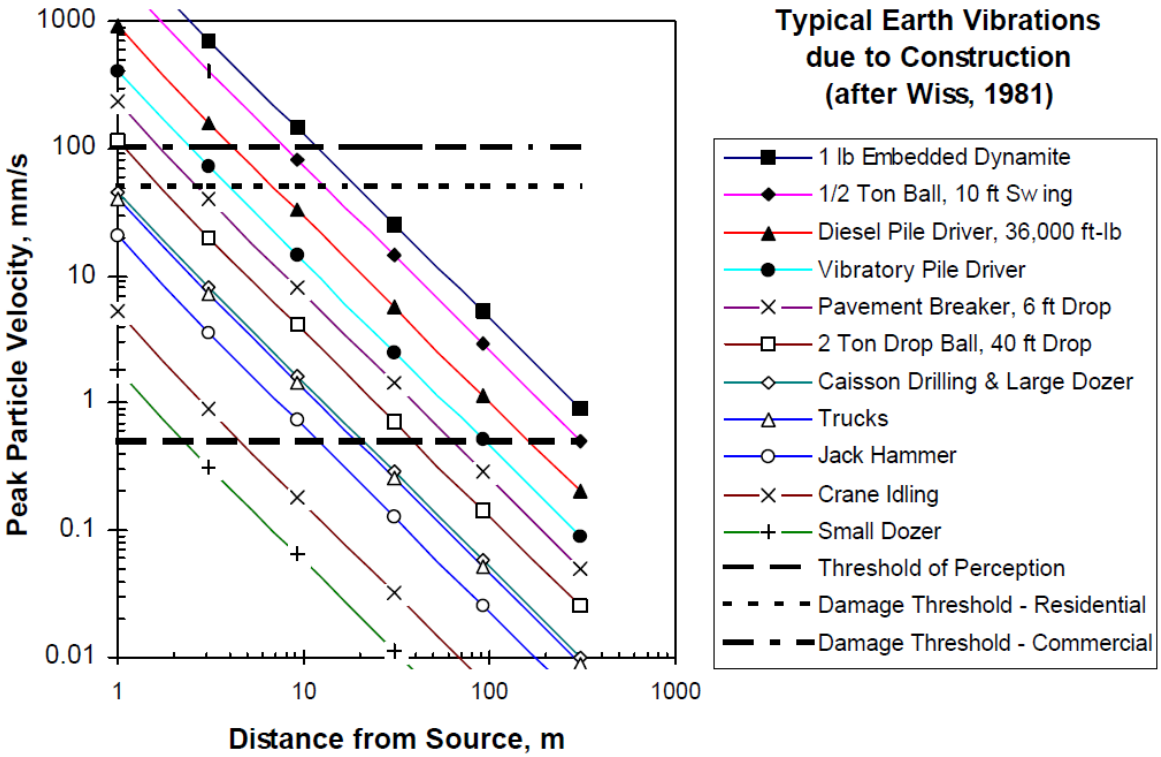
Based upon the expected peak road traffic movements presented in **Table 32**, the calculated daytime $L_{Aeq(15hour)}$ noise level at the nearest roadside residential receivers (assumed to be approximately 10m from the edge of the road) meets the criteria detailed in the RNP for the construction of the proposed abattoir.

12 VIBRATION ASSESSMENT

The main vibration generating equipment to be used at the site will include trucks and dozers during both construction and operation of the Project.

The amplitude of vibrations from construction equipment diminishes with distance from the source. This attenuation of vibration is due to both geometrical spreading and dissipation of energy within the ground. *Construction Vibrations and Their Impact on Vibration-Sensitive Facilities* (Amick & Gendreau, ASCE, 2000) provides a common generic model of vibrations as a function of distance developed by Wiss (1981), as shown in **Figure 7**.

Figure 7 Construction vibrations as a function of distance, after Wiss (1981)



Source: *Construction Vibrations and Their Impact on Vibration-Sensitive Facilities* (Amick & Gendreau, ASCE, 2000)

Given the separation distance between the Project site and the nearest potentially affected residential locations (greater than 200 m between the proposed infrastructure and the nearest residence) vibration levels from activities at the Project site are predicted to be negligible and below levels of human perception at the nearest residences. Consequently, vibration generated at the Project site will be significantly below the criteria for “minimal risk of cosmetic damage” at the nearest residences.

13 ASSESSMENT OF CUMULATIVE IMPACTS

13.1 Cadia Valley Operation (CVO) Dewatering Facility

Approval was granted by the then Department of Planning in January 2010 to Cadia Holdings Pty Ltd for the construction of the Cadia Valley Operations (CVO) Dewatering Facility on Lot 106 on DP 1161062, adjacent to the existing SeaLink Complex. This facility will be similar to the existing Blayney Dewatering Facility, and will consist of a filter press for dewatering concentrate, a front-end loader (FEL) for placement of dewatered concentrate into shipping containers and a forklift for placement of filled shipping containers onto trains on the rail siding. Whilst construction has not yet commenced, given the facility is approved the cumulative noise impact of both the Project and the CVO Dewatering Facility has been assessed.

13.2 Cumulative Operational Noise

The potential for the simultaneous operation of the Project and other approved and proposed developments can be assessed on a worst case scenario basis by adding the predicted noise levels from the proposed and approved operations together. The cumulative intrusive level is then adjusted (by -3 dBA) to the equivalent amenity level for comparison with the relevant amenity criteria for each location.

It should be noted that, for each of the developments assessed, the likelihood of the existing, future approved and proposed developments as well as the Project emitting simultaneous maximum noise emissions is remote due to the range of development locations and differences in the noise enhancing weather effects. This cumulative assessment is therefore considered to be conservative.

The results presented in **Table 37**, **Table 38** and **Table 39** provide the daytime, evening and night-time predicted cumulative noise levels assuming the predicted impacts from the Project and the CVO Dewatering Facility are indicative of continuous operation during a 24 hour period.

It is relevant to note that predicted noise levels from the Wilkinson Murray Report '*Cadia East Project – Noise and Blasting Impact Assessment',* dated April 2009 have been referenced.

Table 37 Potential Cumulative Daytime Operational Noise Impacts

Residential Receiver	Predicted Day Time Noise LAeq dBA				Amenity Criteria $L_{Aeq(Period)}$
	Blayney Export Meats & SeaLink	CVO Dewatering facility	Cumulative Intrusive Level	Cumulative Amenity (intrusive sum minus 3 dBA)	
R1 – Palmer	<30	<30	<30	<30	55 dBA
R2 – Tetlaw	<30	31	34	31	
R3 - Athol	32	35	37	34	
R4 – Ewens	<30	50	50	47	

Table 38 Potential Cumulative Evening Operational Noise Impacts

Residential Receiver	Predicted Evening Noise LAeq dBA				Amenity Criteria $L_{Aeq(Period)}$
	Blayney Export Meats & SeaLink	CVO Dewatering facility	Cumulative Intrusive Level	Cumulative Amenity (intrusive sum minus 3 dBA)	
R1 – Palmer	<30	<30	<30	<30	45 dBA
R2 – Tetlaw	<30	<30	32	<30	
R3 - Athol	32	32	35	32	
R4 – Ewens	<30	42	42	39	

Table 39 Potential Cumulative Night Time Operational Noise Impacts

Residential Receiver	Predicted Night time Noise LAeq dBA				Amenity Criteria $L_{Aeq(Period)}$
	Blayney Export Meats & SeaLink	CVO Dewatering facility	Cumulative Intrusive Level	Cumulative Amenity (intrusive sum minus 3 dBA)	
R1 – Palmer	<30	<30	<30	<30	40 dBA
R2 – Tetlaw	32	<30	33	30	
R3 - Athol	34	32	36	33	
R4 – Ewens	<30	42	42	39	

It is relevant to note that no site specific meteorological data was available, in accordance with the INP, at the time of the noise prediction for the CVO Dewatering Facility conducted by Wilkinson Murray (refer to Report '*Cadia East Project – Noise and Blasting Impact Assessment',* dated April 2009). Consequently, noise levels presented in **Table 37**, **Table 38** and **Table 39** for the CVO Dewatering Facility were predicted using one set of 'adverse' meteorological conditions which were:

- Daytime/Evening (construction and operation): Vector winds speeds blowing from source to receiver of 3 m/s (at a height of 10m).
- Night-time (operations only): Vector winds blowing from source to receiver of 1.5m/s (at a height of 10m) (for sensitive receivers located downslope of the CVO Dewatering Facility only [Palmer, Tetlaw and Athol]); and a temperature inversion strength 3^{o}per 100m (INP default).

Furthermore, the predicted noise level from Blayney Export Meats presented in **Table 37**, **Table 38** and **Table 39** were conducted under the following meteorological conditions:

- Daytime/Evening (construction and operation): Calm weather conditions

- Night-time (operations only): Temperature Inversion.

Based on the predicted noise levels present in **Table 37, Table 38** and **Table 39** the cumulative noise influence of both the Blayney Export Meats and CVO Dewatering Facility operations are predicted to comply with the project specific Amenity Criteria.

13.3 Cumulative Construction Noise

The Blayney Export Meats and CVO Dewatering Facility operations have the potential for simultaneous works to occur during construction. These projects have both been assessed using the ICNG. An assessment of the cumulative noise from concurrent construction is provided in **Table 40**.

Table 40 Cumulative Construction Noise Predictions

Location	Predicted Noise Level $L_{Aeq(15minute)}$		Cumulative Noise Level $L_{Aeq(15minute)}$	Construction Noise Management Level $L_{Aeq(15minute)}$	
				Noise Affected	Highly Noise Affected
	Blayney Export Meats	CVO Dewatering facility			
R1 – Palmer	38	31	36	45 dBA	75 dBA
R2 – Tetlaw	45	34	**49**	41 dBA	75 dBA
R3 - Athol	49	39	**46**	41 dBA	75 dBA
R4 – Ewens	34	54	**54**	40 dBA	75 dBA

Note: Construction may only occur between the hours of 7.00 am and 6.00 pm Monday to Friday, and 8.00 am to 1.00 pm Saturdays. No construction work is to take place on Sundays or Public Holidays

Noise predictions, summarised in **Table 40**, indicate that the cumulative construction noise predictions for the project would comply with construction 'Noise Affected' management levels for the daytime period at R1. However, the cumulative construction noise predictions exceed the 'Noise Affected' management levels at R2, R3 and R4. Notwithstanding this, the potential cumulative construction works at all residential receiver locations are below the 'highly noise affected' management noise level at all times.

13.4 Potential Cumulative Road Traffic Noise Impacts

13.4.1 Operational

The maximum road traffic movements associated with the Project is approximately 440 movements per day, when the Christmas hamper packing operation is being undertaken, whilst the road traffic associated with CVO Dewatering Facility operations would be only 18 movements per day. The Project operational road traffic noise level predictions presented in **Table 33** shows compliance with the RNP. The additional traffic from the CVO Dewatering Facility is negligible and hence the potential cumulative traffic impact of the two operations will also comply

13.4.2 Construction

Road traffic associated with construction of the Project is significantly less than the operational road traffic. The construction of the CVO Dewatering Facility would involve up to approximately 66 traffic movements (including 16 heavy vehicles) per day. Given that both construction activities would be undertaken during the day, road traffic noise would not be expected to cause nuisance at nearby receivers and are predicted to comply with the RNP.

13.5 Potential Cumulative Ground Vibration Impacts

Consistent with the Wilkinson Murray report, based on the separation distance to nearest receivers, potential vibration impacts for both projects would be below the level of human perception and of minimal risk to cause cosmetic damage.

14 NOISE MITIGATION AND MANAGEMENT RECOMMENDATIONS

14.1 Operational Noise and Vibration Mitigation and Management

Operational noise levels are predicted to be below the relevant guidelines at the closest residential receivers and therefore additional noise mitigation is not required. The Project has been designed to ensure that noise levels are minimised by the following:

- Fully enclosed holding yards;
- All livestock processing operations will occur in enclosed areas;
- Livestock deliveries will be undertaken inside the covered holding yards;
- Livestock will not be held in outdoor holding yards.
- Livestock will be managed in a manner to reduce animals under stress.
- The waste water treatment plant will be shielded by the abattoir and the existing building complex.
- Roller door to the holding yard building will be closed when not in use.

However, it is recommended that the Applicant monitors noise from the operational activities at the nearest affected residential receiver locations identified in **Table 2** after the construction is completed and the Project Site is fully operational. The results of this monitoring will determine whether compliance is being achieved, and whether noise mitigation is warranted for the site. If mitigation is found to be warranted the following general noise mitigation procedures would be considered.

14.1.1 General Noise Mitigation Options for Industrial Sources

Additional mitigation options that would be considered if required for noise control are:

- Control noise at the source.
- Best Management Practice (BMP).
- Best Available Technology Economically Achievable (BATEA).
- Control the transmission of noise.
- Use barriers and land-use controls to attenuate noise by increasing the distance between source and receiver.

These options are described further below.

Best Management Practice

Best Management Practice (BMP) may be adopted for particular operational procedures that minimise noise while retaining productive efficiency.

When an appropriate mitigation strategy that incorporates expensive engineering solutions is being considered, the extent to which cheaper, non-engineering-oriented BMP can contribute to the required reduction of noise will be taken into account.

Examples of BMP that could be considered if deemed necessary based on noise monitoring results are:

- Siting noisy equipment behind structures that act as barriers, or at the greatest distance from the noise-sensitive area; or orienting the equipment so that noise emissions are directed away from any sensitive areas, to achieve the maximum attenuation of noise.
- Keeping equipment well maintained.
- Restricting truck speed on the site to reduce noise from the transport operation.
- Reduce truck compression braking.
- Employing “quiet” practices when operating equipment (eg positioning and unloading of trucks in appropriate areas).
- Running staff-education programmes on the effects of noise and the use of quiet work practices.

Best Available Technology Economically Achievable (BATEA)

Equipment, plant and machinery that produce noise will incorporate advanced and affordable technology to minimise noise output.

Where BMP fails to achieve the required noise reduction by itself, the BATEA approach will be considered. Examples of BATEA include:

- Using a non-acoustic warning method to warn of a vehicles reversing or if this method does not prove satisfactory for safety reasons, adjusting the reversing alarm volume on heavy equipment to make them “smarter”, by limiting acoustic range to immediate danger area.
- Using pieces of equipment with efficient muffler design.

14.1.2 Controlling Noise in Transmission

Barriers

Barriers are more effective if they are near the source or the receiver. Their effectiveness is also determined by their height, the materials used (absorptive or reflective) and their density. The relationship of these design features to attenuation is well documented.

Barriers can take a number of forms - including free-standing walls, grass or earth mounds or bunds, and trenches or cuttings within which noise sources are sited. They are employed when source and receiver control is either impractical or too costly.

14.2 General Best Practice Noise Management

Operational noise levels are predicted to be below the relevant guidelines at the closest residential receivers and therefore noise mitigation is not required. Notwithstanding this, it is recommended that the following best practice noise mitigation and management measures should be considered for existing and proposed operations:

- Preparation of a formal noise management plan including noise monitoring program for inclusion in the Projects Operation Manual.
- Respond to community concerns with noise monitoring on site to determine mitigation measures to ameliorate the noise source.
- Refinement of warning alarms and sirens to minimise offsite impacts without compromising safety requirements.
- Keep plant and equipment well maintained, regular inspection and maintenance of equipment to ensure it is good working order.
- Incorporate clear signage at the site including relevant contact numbers for community enquiries.
- Prompt response to any community issues of concern.

14.3 Construction Noise Mitigation

Construction noise levels are predicted to exceed the 'Noise Affected' relevant guidelines at the closest residential receivers during construction. However, all residential receiver locations are well below the 'Highly Noise Affected' construction noise goal of 75 $L_{Aeq(15minute)}$. The following measures should be considered to reduce the construction noise impact:

- Site induction of contractors to include awareness of noise on neighbouring properties.
- Site noisy equipment behind structures that act as barriers or at the greatest distance from the noise-sensitive area or orient the equipment so that noise emissions are directed away from any sensitive areas.
- Keep equipment well maintained.
- Employ "quiet" practices when operating equipment (eg positioning and unloading of trucks in appropriate areas).
- A Construction Noise Management Plan should be prepared and implemented prior to commencement of construction works at the site. This should include the following:
    - Construction noise goals.
    - Recommendations regarding specific physical and managerial measures for controlling noise, noise and vibration monitoring programs and reporting procedures.
    - Measures for dealing with exceedances and mechanisms to provide ongoing community liaison.

With regard to potentially offensive noise events associated with construction activities AS 2436-1981 *Guide to noise control on construction, maintenance and demolition sites* states the following:

"If noisy operations must be carried out, then a responsible person should maintain liaison between the neighbouring community and the contractor. This person should inform the public at what time to expect noisy operations and also inform the contractor of any special needs of the public. Consultation and cooperation between the contractor and his neighbours and the removal of uncertainty and rumour can help to reduce the adverse reaction to noise."

15 CONCLUSION

SLR has undertaken a noise and vibration impact assessment (NVIA) for the continued operation of the Blayney SeaLink Cold Store Complex and the development of a small stock abattoir located approximately one kilometre east of the Blayney township in the Central West region of NSW.

Broadly, the objective of the NVIA was to identify the potential impacts of noise and vibration from existing and proposed activities at the Project Site associated with both construction and operation of the facility and to provide recommendations with regard to noise management strategies and mitigation measures, where necessary, with the aim of achieving the project specific noise and vibration criteria.

15.1 Existing Acoustical Environment

An ambient noise monitoring program was conducted by SLR. Ambient noise levels were monitored at three (3) separate locations (Palmer, Athol and Ewens), considered to be representative of the nearest potentially affected receivers to the site. The objective of this survey was to measure $L_{A90(15minute)}$ and $L_{Aeq(15minute)}$ noise levels at the nearest potentially affected residential locations during the day, evening and night-time periods to enable the determination of the intrusiveness and amenity criteria for the proposed development in accordance with the INP.

15.2 Operational Noise Assessment

Results presented in **Table 29** indicate that operational noise levels are predicted to meet the PSNC at all residential locations considered in the assessment.

Sleep Disturbance Assessment

The L_{Amax} noise levels are predicted to meet the project specific sleep disturbance noise goals specified in **Table 21** for night-time period operation at the Project Site at all assessed receiver locations.

15.3 Road Traffic Noise Assessment

The calculated day and night-time road traffic noise level at the nearest roadside residential receivers meets the criteria detailed in the RNP under all prediction scenarios.

15.4 Construction Noise Assessment

The modelling results indicate that the predicted $L_{Aeq(15minute)}$ noise levels from proposed construction activities meet the 'Noise Affected' construction noise goals at all assessed sensitive receivers with the exception of R2 and R3. However, all residential receiver locations are well below the 'Highly Noise Affected' construction noise goal of 75 $L_{Aeq(15minute)}$.

15.5 Construction Road Traffic Noise Assessment

The calculated day road traffic noise level at the nearest roadside residential receivers meets the criteria detailed in the NSW Road Noise Policy under all prediction scenarios

15.6 Vibration Assessment

Given the separation distance to the nearest affected residential receptor, the level of vibration caused by construction activities is predicted to be below the level of human perception at any of the nearest receptors and therefore below the criteria for "minimal risk of cosmetic damage" at surrounding residential premises.

15.7 Cumulative Assessment

15.7.1 Cumulative Operational Noise

The cumulative noise influence of both the Project and CVO Dewatering Facility operations are predicted to comply with the project specific Amenity Criteria.

Operational road traffic noise associated with the Project and the CVO Dewatering Facility operations are predicted to comply with the RNP.

15.7.2 Cumulative Construction Noise

Noise predictions indicate that the cumulative construction noise predictions for the project would comply with construction 'Noise Affected' management levels for the daytime period at R1. However, the cumulative construction noise predictions exceed the 'Noise Affected' management levels at R2, R3 and R4. Notwithstanding this, the potential cumulative construction works at all residential receiver locations are below the 'highly noise affected' management noise level at all times.

Construction road traffic noise associated with the Project and the CVO Dewatering Facility operations are predicted to comply with the RNP.

15.8 Noise Mitigation and Management Recommendations

While operational and construction noise levels are predicted to be below the relevant project specific noise levels at all the nearest residential receiver locations, best practice noise mitigation and management measures have been recommended for consideration (refer to **Section 14**).

Acoustic Terminology

1 Sound Level or Noise Level

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

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

The symbols SPL, L or L_P are commonly used to represent Sound Pressure Level. The symbol L_A represents A-weighted Sound Pressure Level. The standard reference unit for Sound Pressure Levels expressed in decibels is 2E-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
120 110	Heavy rock concert Grinding on steel	Extremely noisy
100 90	Loud car horn at 3 m Construction site with pneumatic hammering	Very noisy
80 70	Kerbside of busy street Loud radio or television	Loud
60 50	Department store General Office	Moderate to quiet
40 30	Inside private office Inside bedroom	Quiet to very quiet
20	Unoccupied 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.

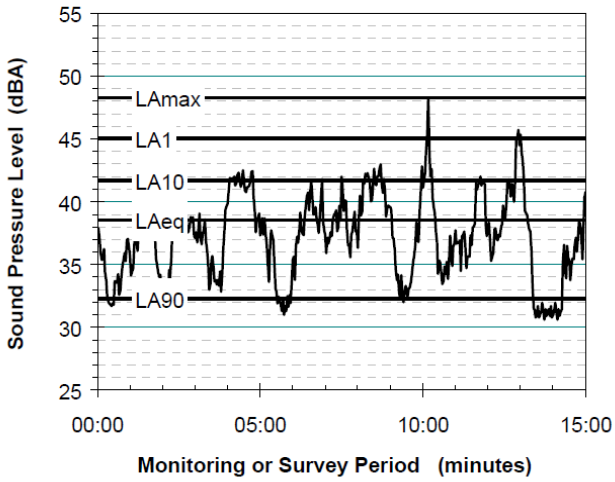
3 Sound Power Level

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 1E-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 exceed for 10% of the 15 minute interval. This is commonly referred to as the average maximum noise level.

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

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

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

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

5 Tonality

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

6 Impulsiveness

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

7 Frequency Analysis

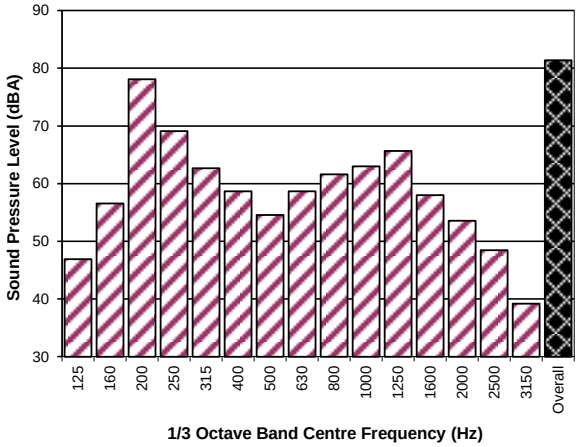
Frequency analysis is the process used to examine the tones (or frequency components) which make up the overall noise or vibration signal. This analysis was traditionally carried out using analogue electronic filters, but is now normally carried out using Fast Fourier Transform (FFT) analysers.

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

Frequency analysis can be in:

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

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



8 Vibration

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

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

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

The common units for velocity are millimetres per second (mm/s). As with noise, decibel units can also be used, in which case the reference level should always be stated. A vibration level V, expressed in mm/s can be converted to decibels by the formula $20 \log (V/V_o)$, where V_o is the reference level (1E-6 mm/s). Care is required in this regard, as other reference levels are 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

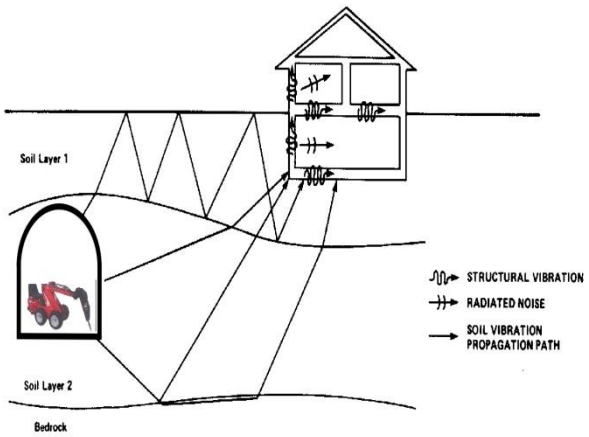
The term "over-pressure" is used to describe the air pressure pulse emitted during blasting or similar events. The peak level of an event is normally measured using a microphone in the same manner as linear noise (ie unweighted), at frequencies both in and below the audible range.

11 Regenerated Noise

Noise that propagates through a structure as vibration and is radiated by vibrating wall and floor surfaces is termed "regenerated noise", "structure-borne noise", or sometimes "ground-borne noise". Regenerated 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 regenerated noise include tunnelling works, underground railways, excavation plant (eg rockbreakers), and building services plant (eg fans, compressors and generators).

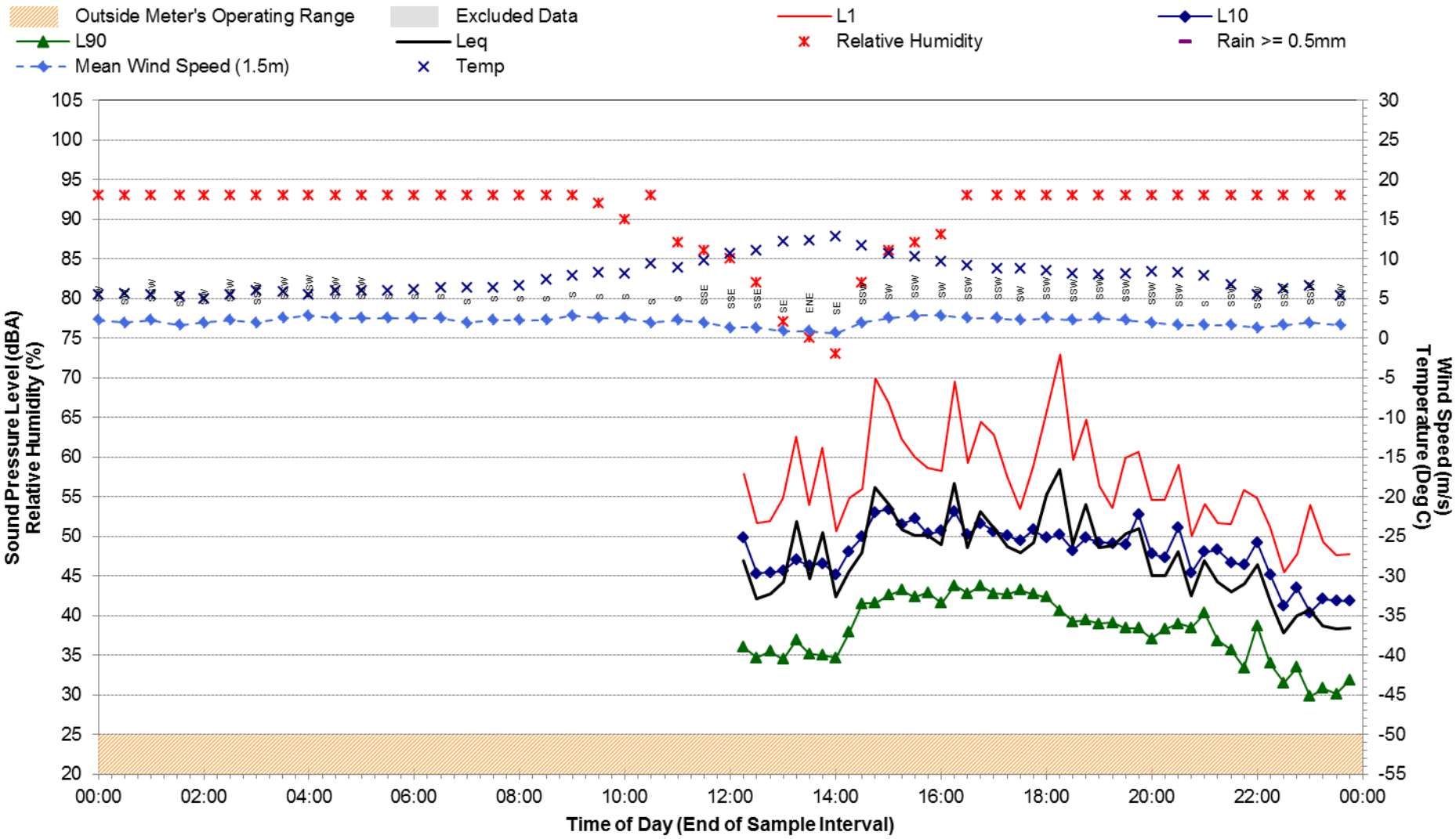
The following figure presents the various paths by which vibration and regenerated noise may be transmitted between a source and receiver for construction activities occurring within a tunnel.



The term "regenerated noise" is also used to describe other types of noise that are emitted from the primary source as a different form of energy. One example would be a fan with a silencer, where the fan is the energy source and primary noise source. The silencer may effectively reduce the fan noise, but some additional noise may be created by the aerodynamic effect of the silencer in the airstream. This "secondary" noise may be referred to as regenerated noise.

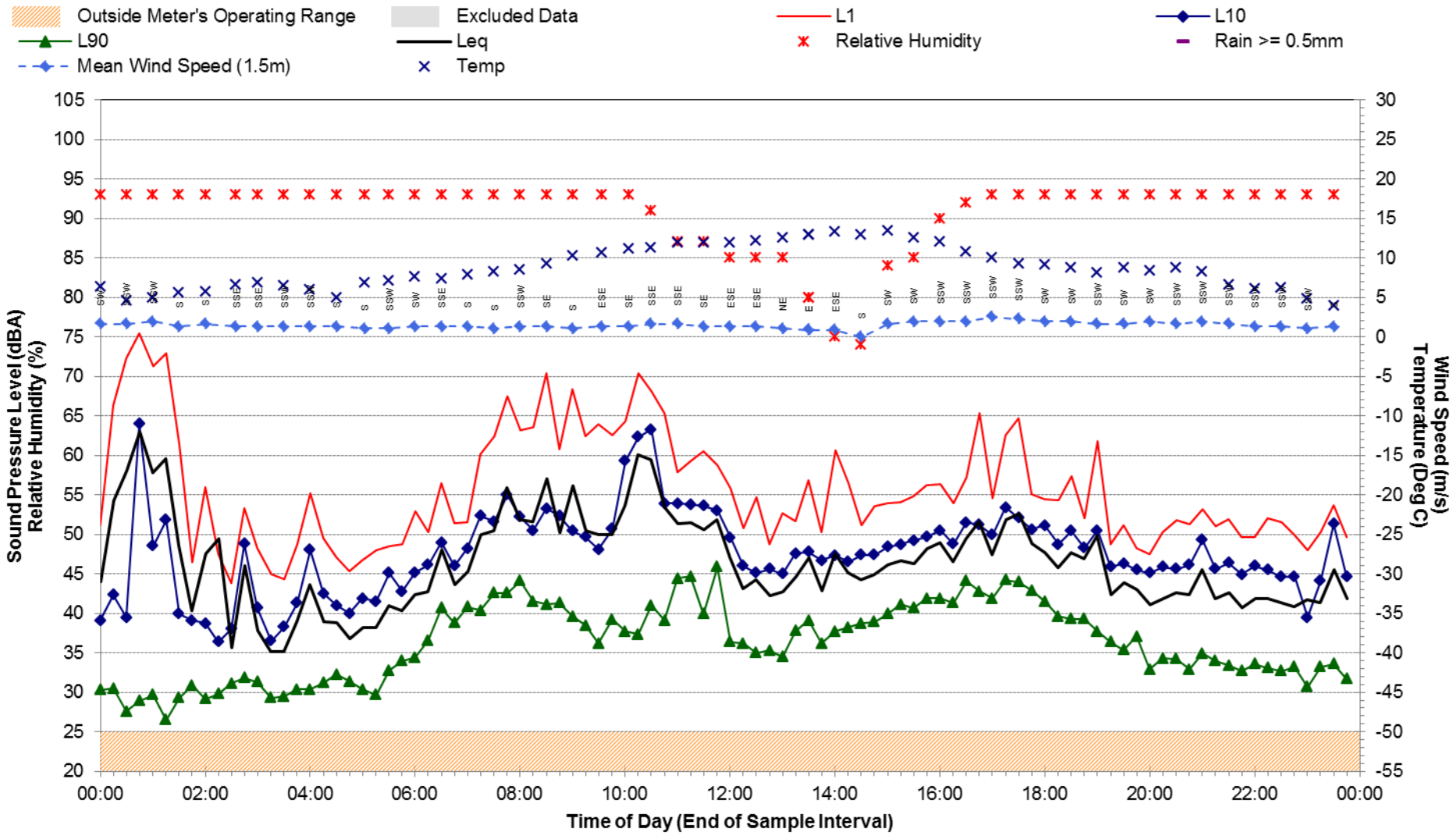
Statistical Ambient Noise Levels

M1 Monitoring Location - Wednesday, 4 June 2014



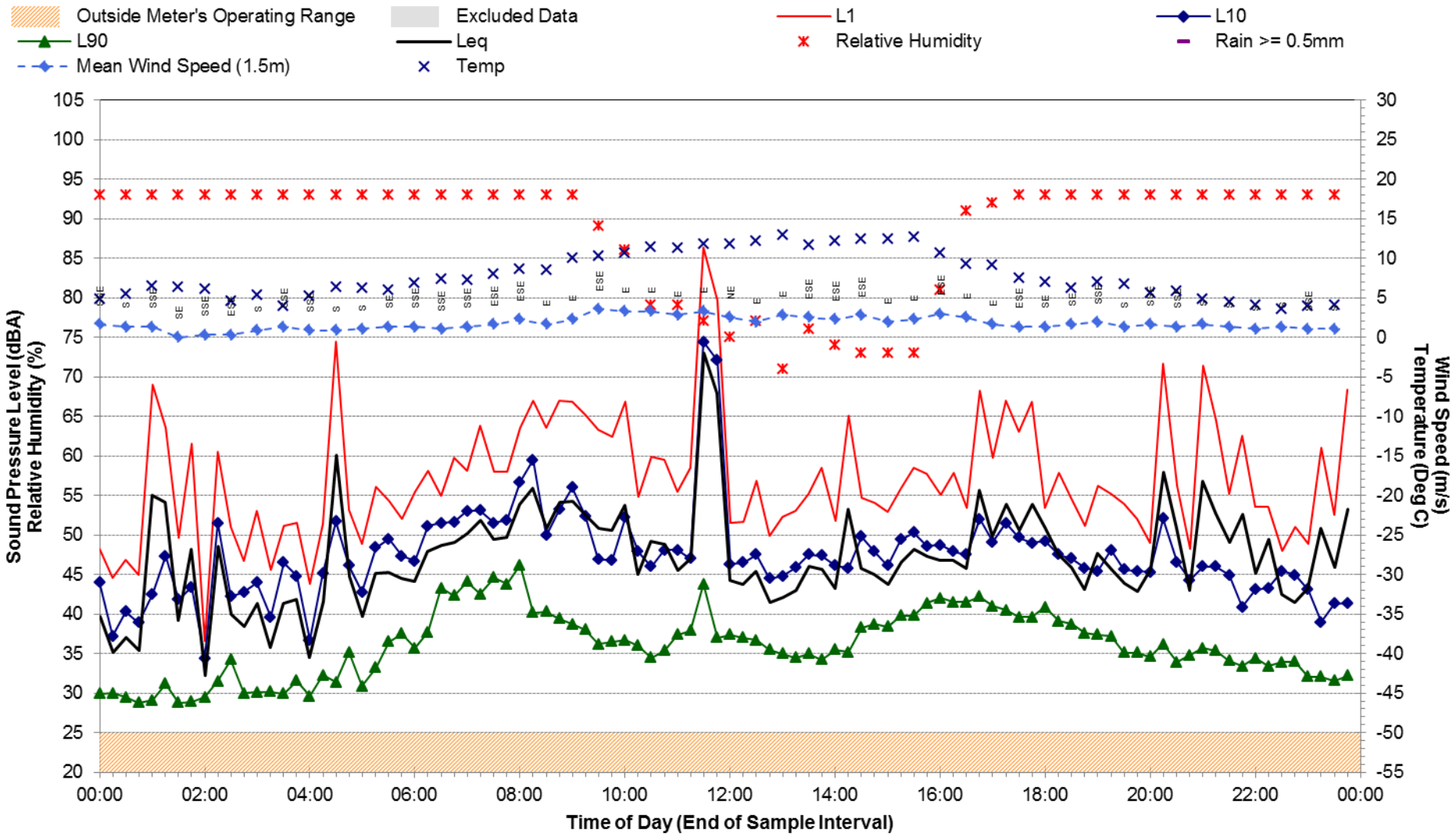
Statistical Ambient Noise Levels

M1 Monitoring Location - Thursday, 5 June 2014



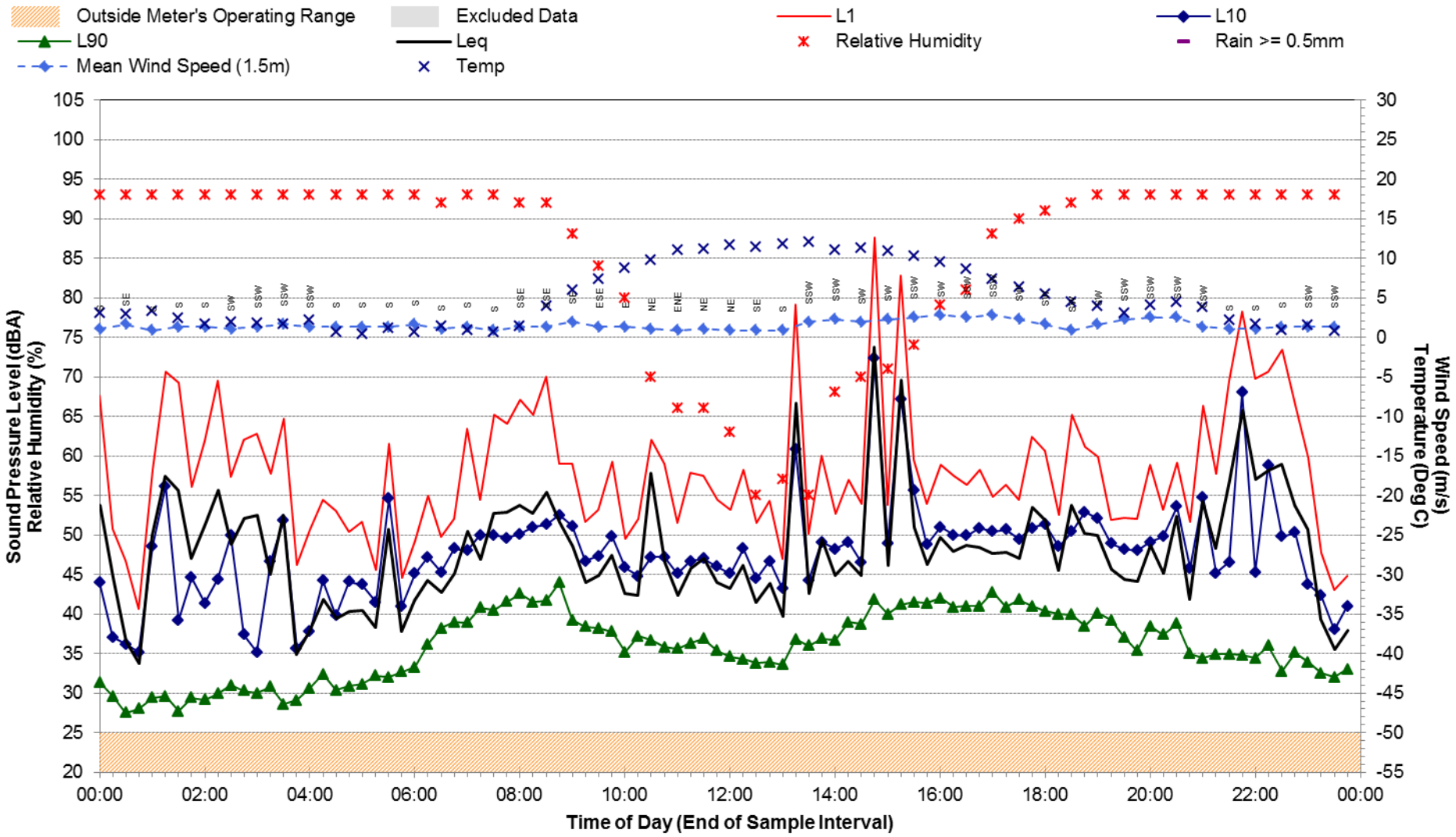
Statistical Ambient Noise Levels

M1 Monitoring Location - Friday, 6 June 2014



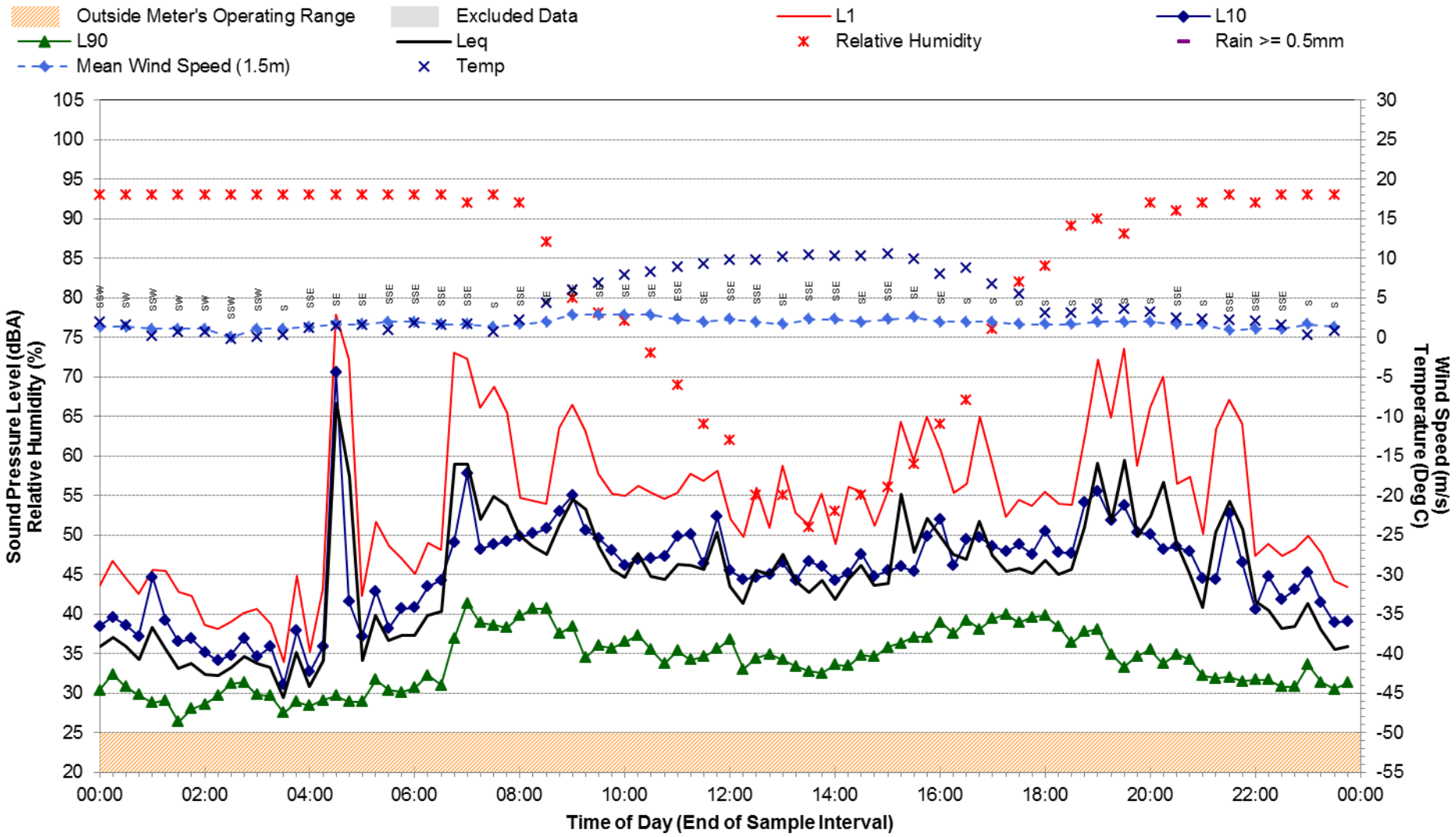
Statistical Ambient Noise Levels

M1 Monitoring Location - Saturday, 7 June 2014



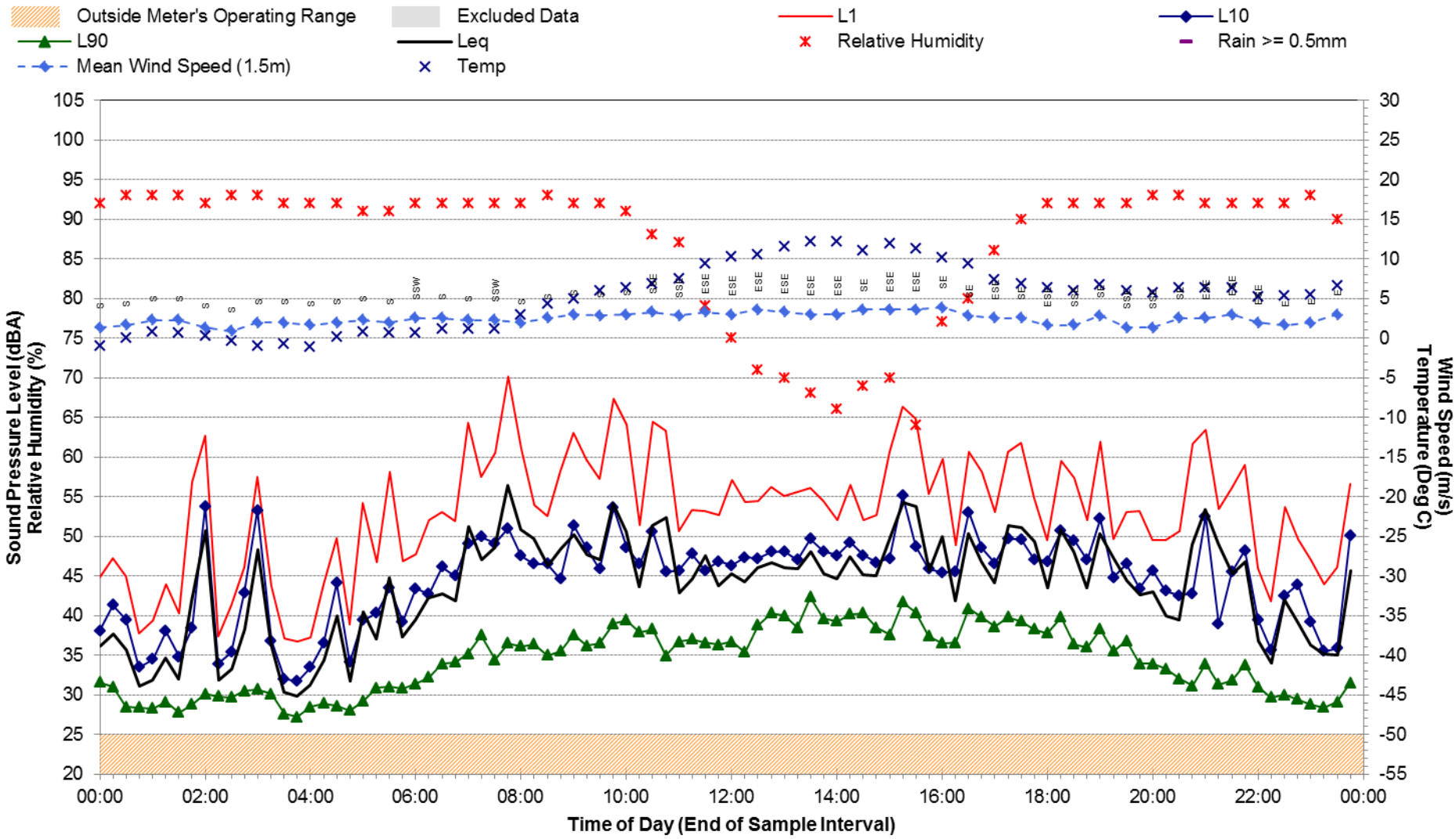
Statistical Ambient Noise Levels

M1 Monitoring Location - Sunday, 8 June 2014



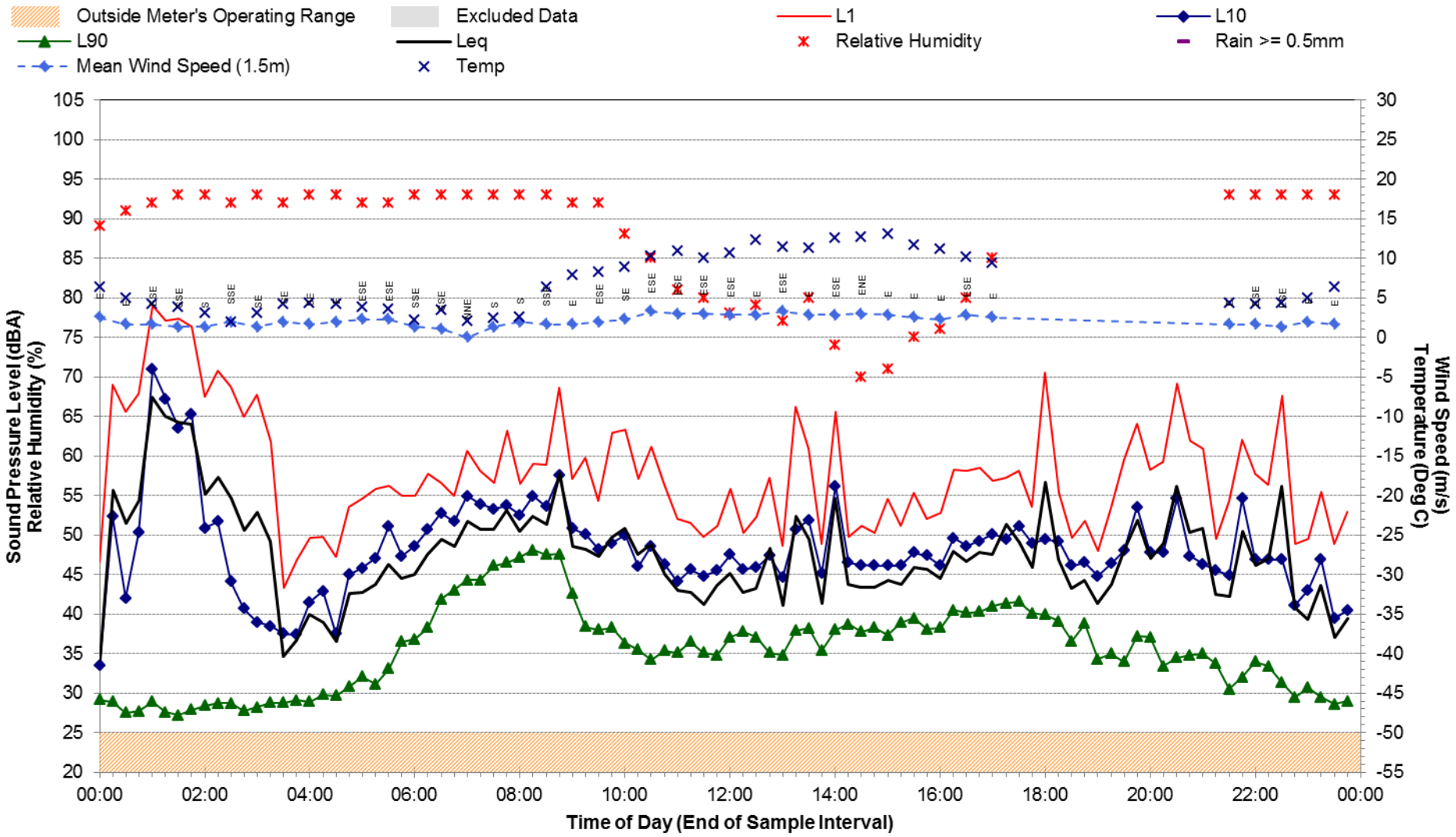
Statistical Ambient Noise Levels

M1 Monitoring Location - Monday, 9 June 2014



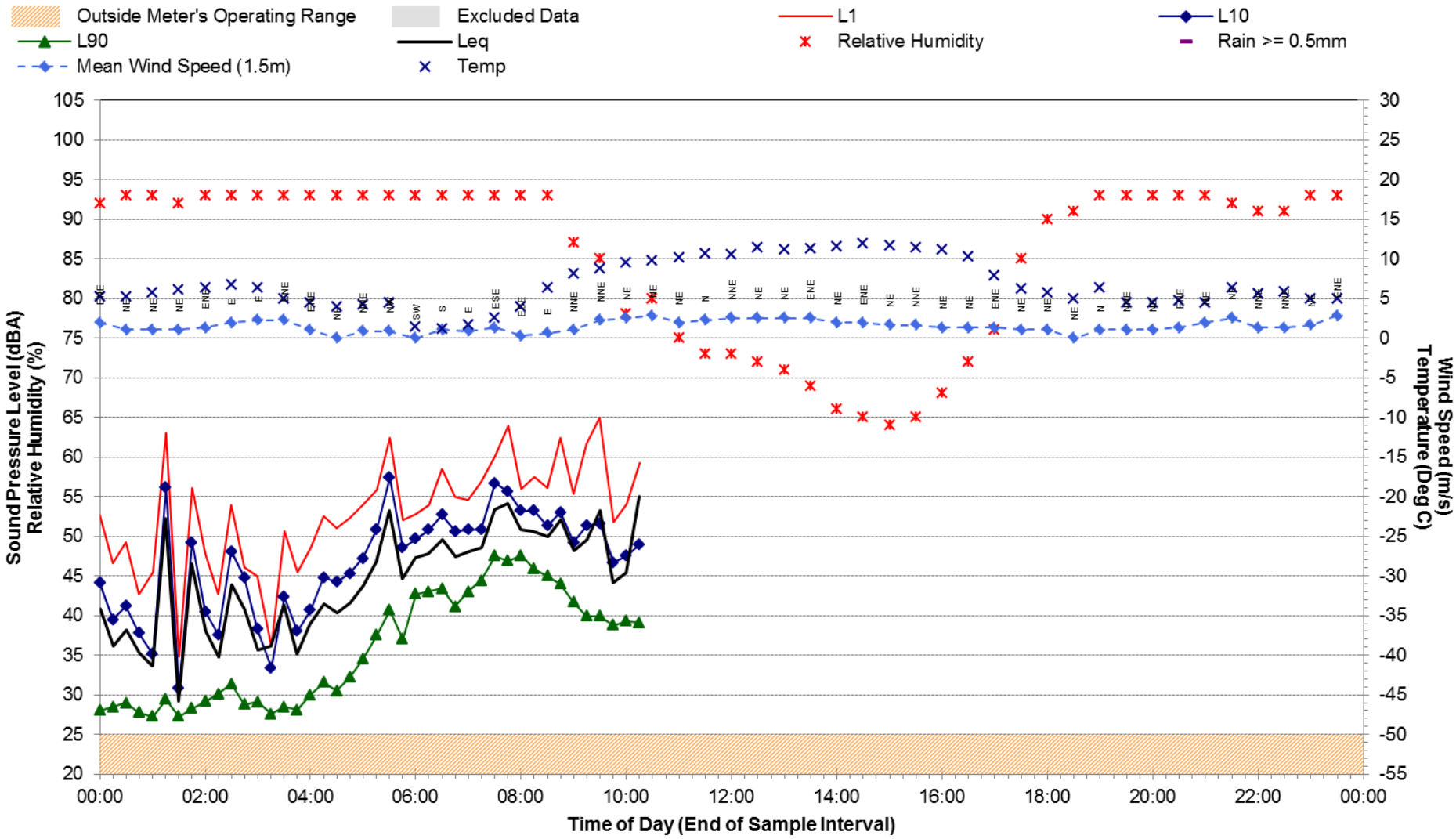
Statistical Ambient Noise Levels

M1 Monitoring Location - Tuesday, 10 June 2014



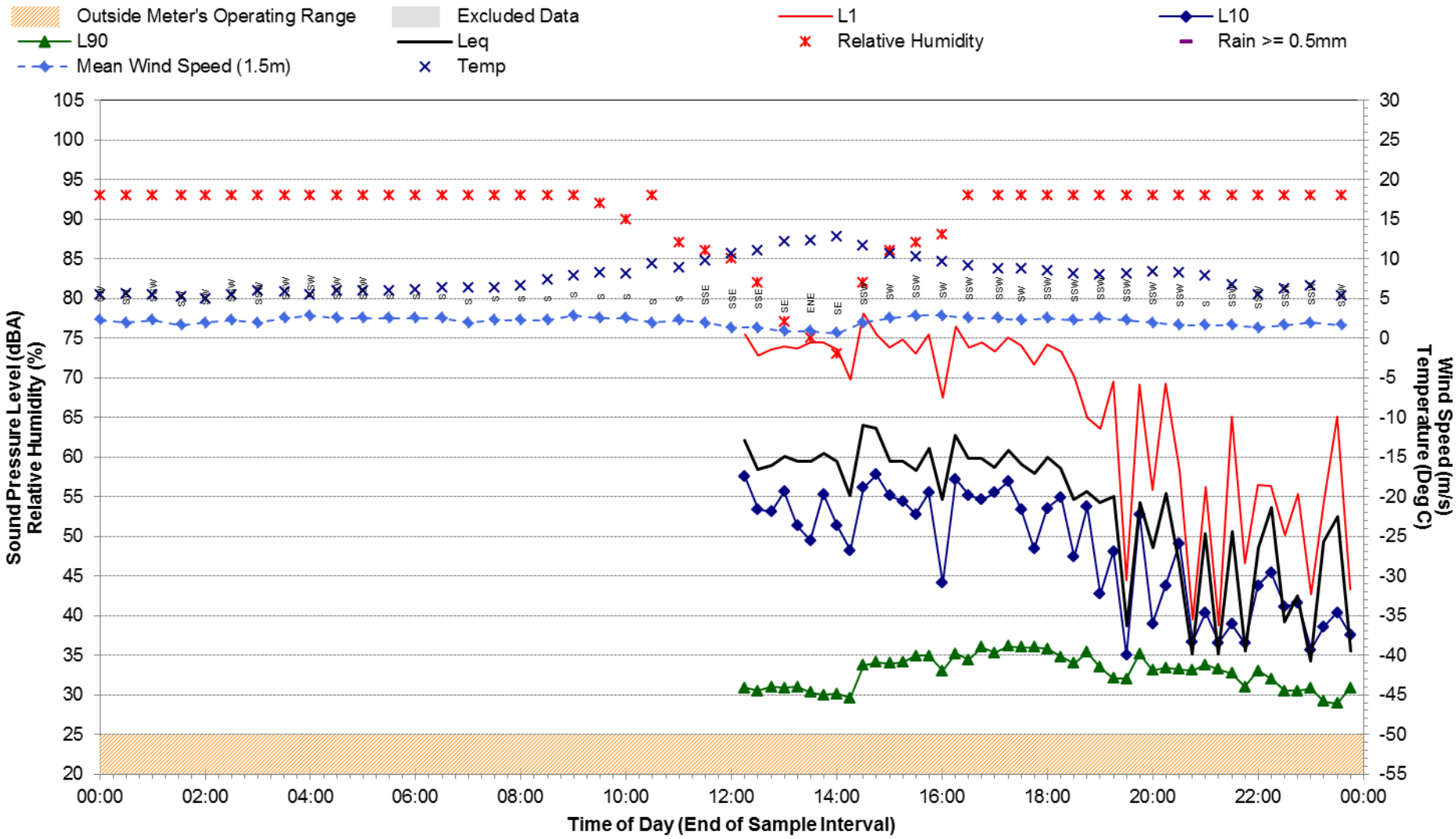
Statistical Ambient Noise Levels

M1 Monitoring Location - Wednesday, 11 June 2014



Statistical Ambient Noise Levels

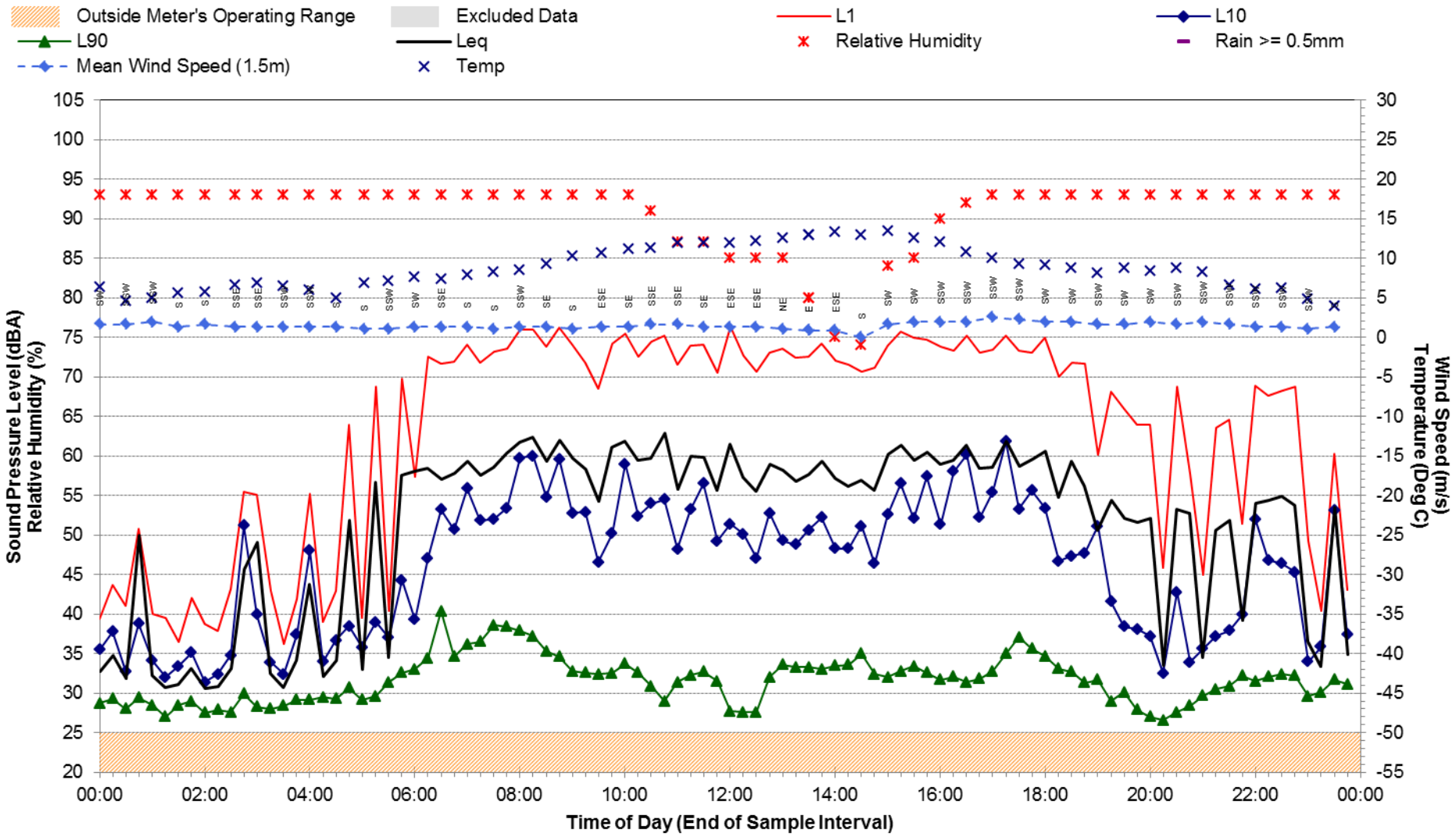
M2 Monitoring Location - Wednesday, 4 June 2014



Statistical Ambient Noise Levels

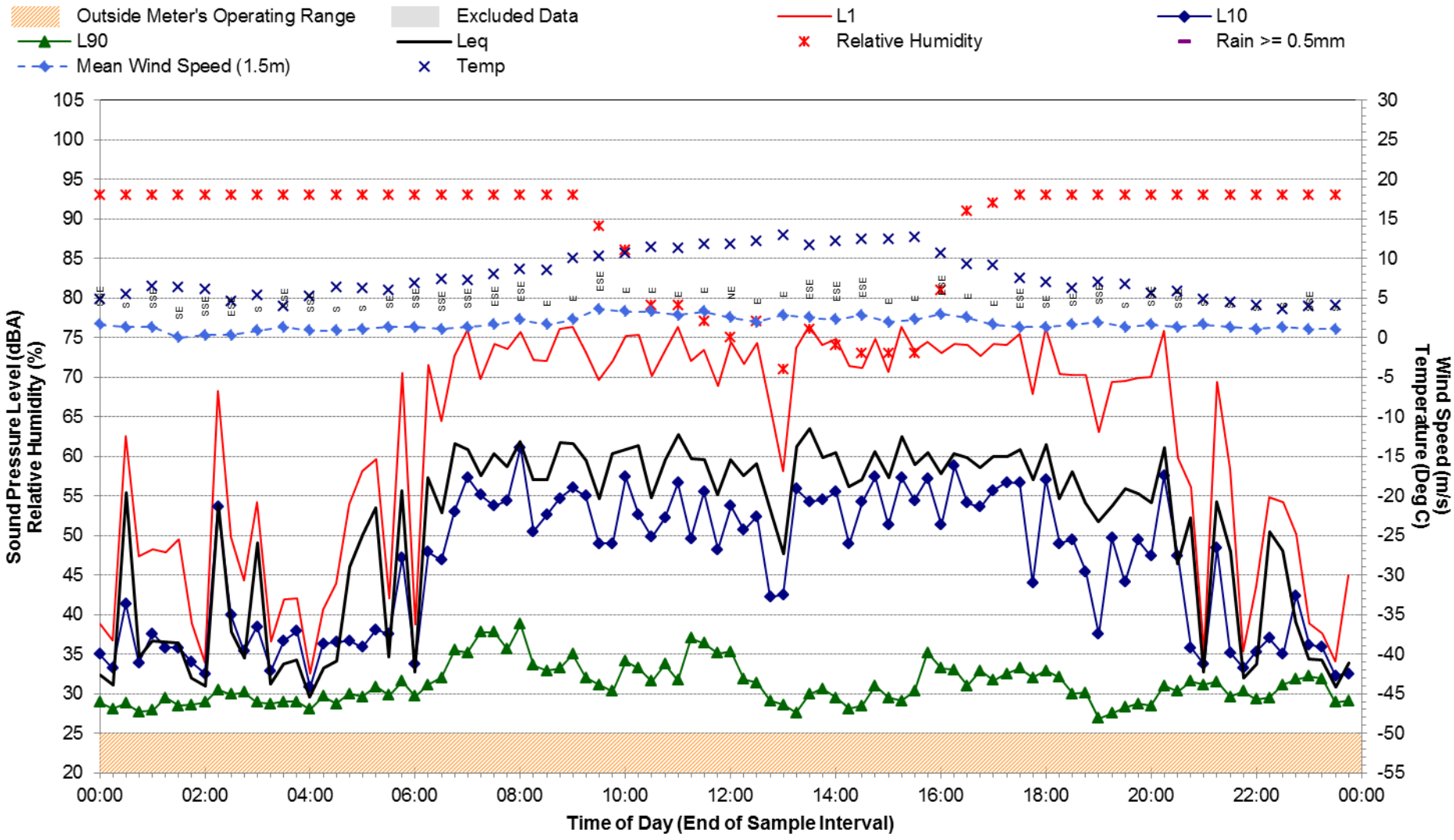
Statistical Ambient Noise Levels

M2 Monitoring Location - Thursday, 5 June 2014



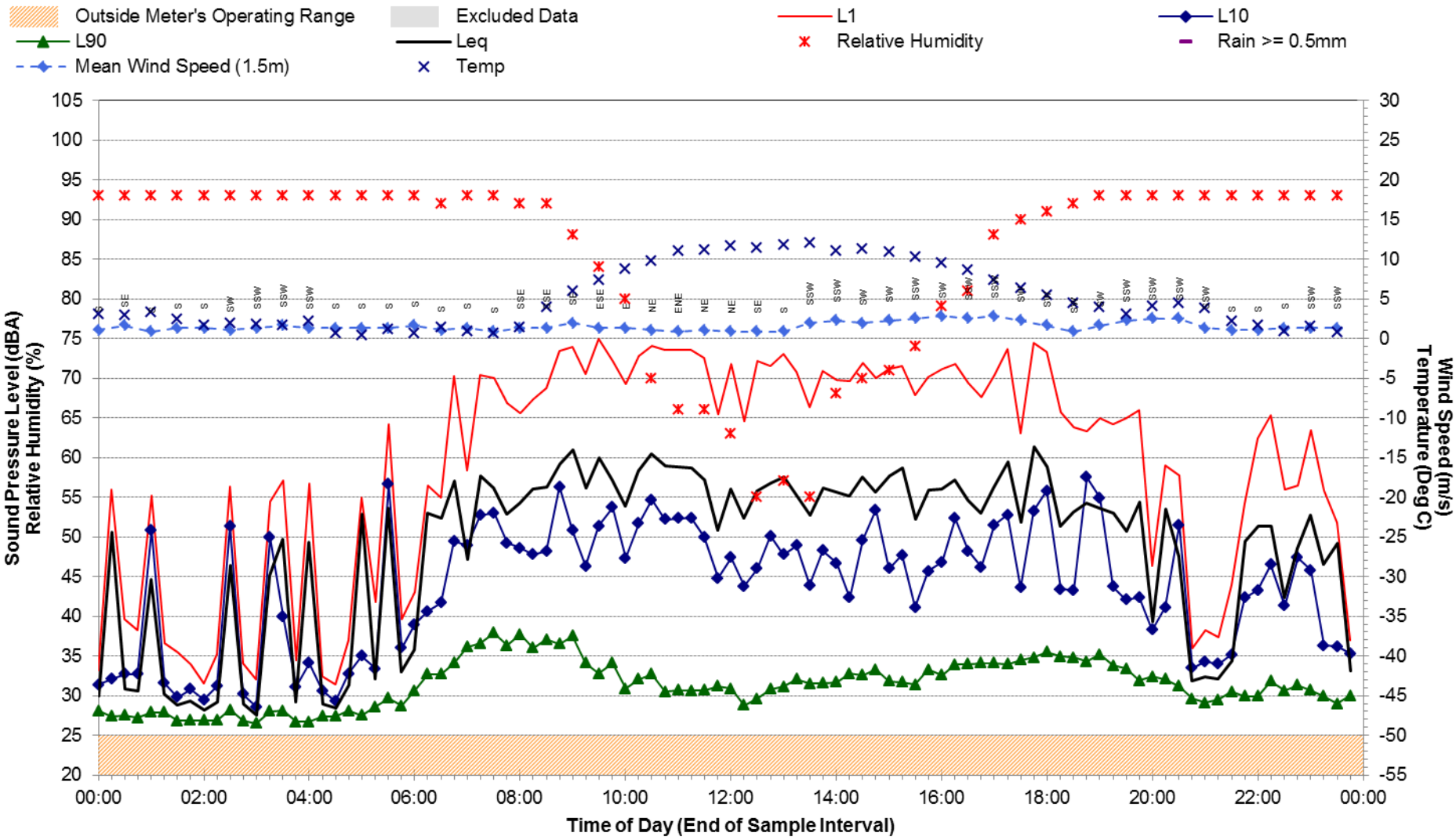
Statistical Ambient Noise Levels

M2 Monitoring Location - Friday, 6 June 2014



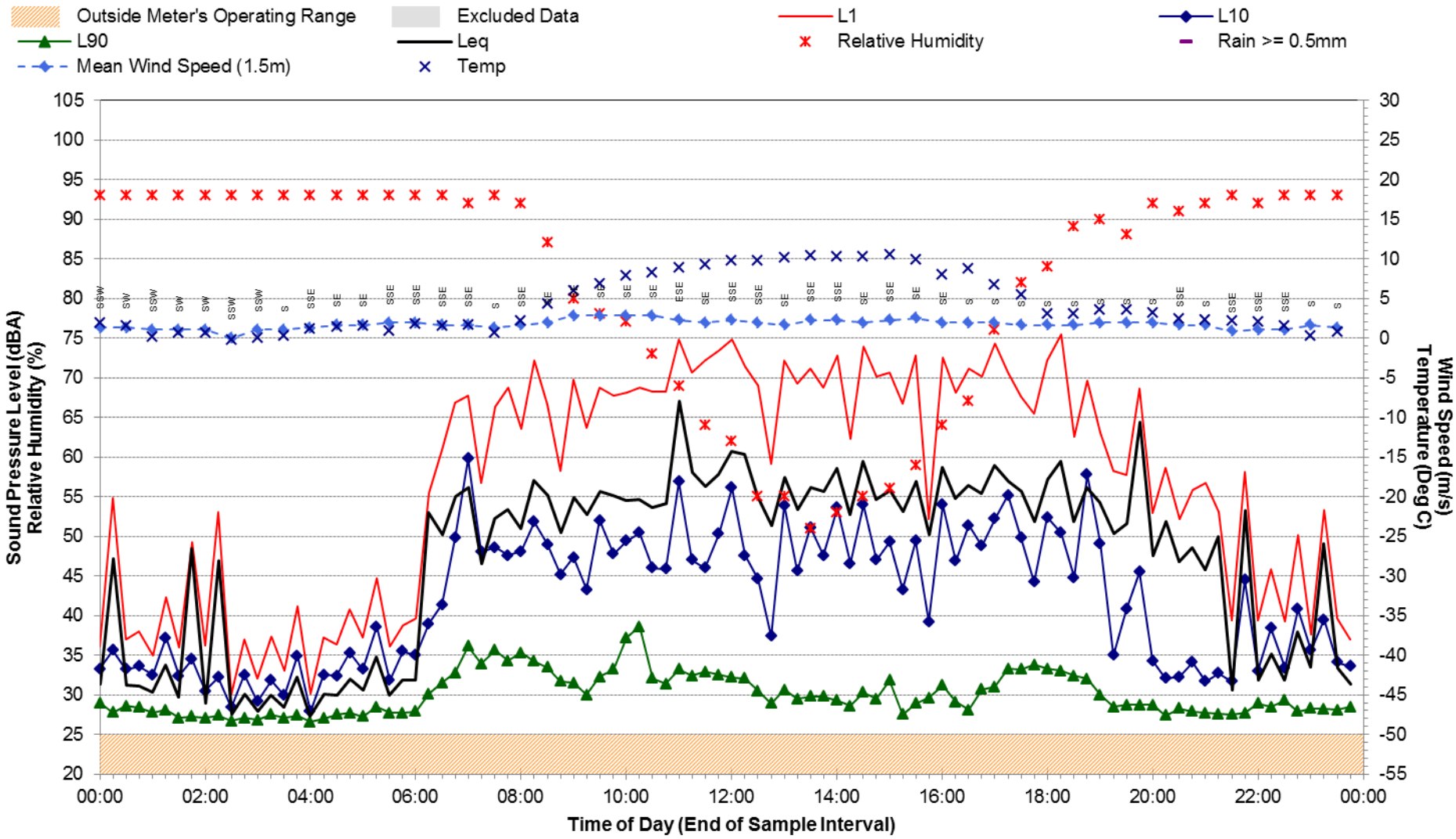
Statistical Ambient Noise Levels

M2 Monitoring Location - Saturday, 7 June 2014



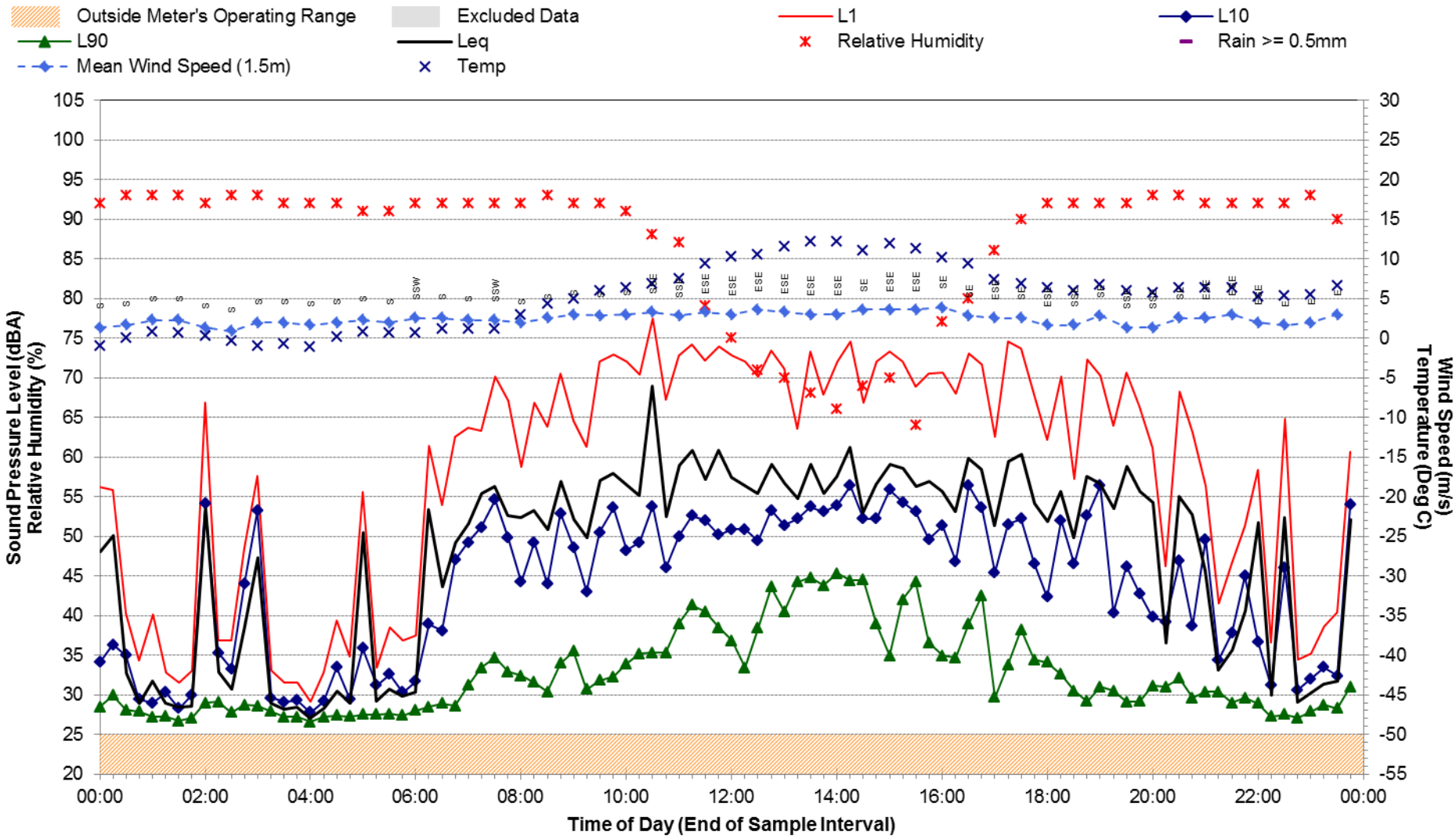
Statistical Ambient Noise Levels

M2 Monitoring Location - Sunday, 8 June 2014



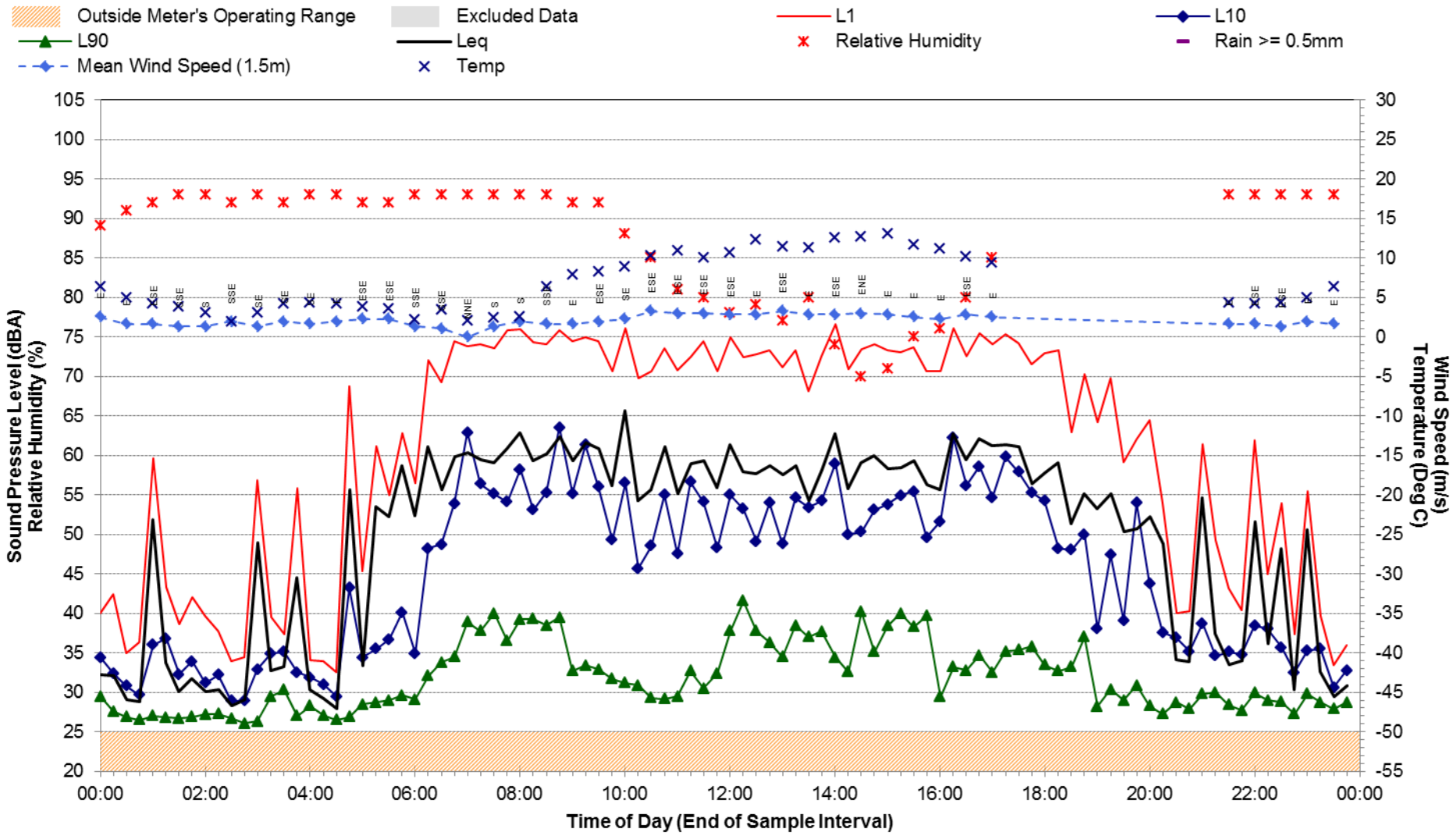
Statistical Ambient Noise Levels

M2 Monitoring Location - Monday, 9 June 2014



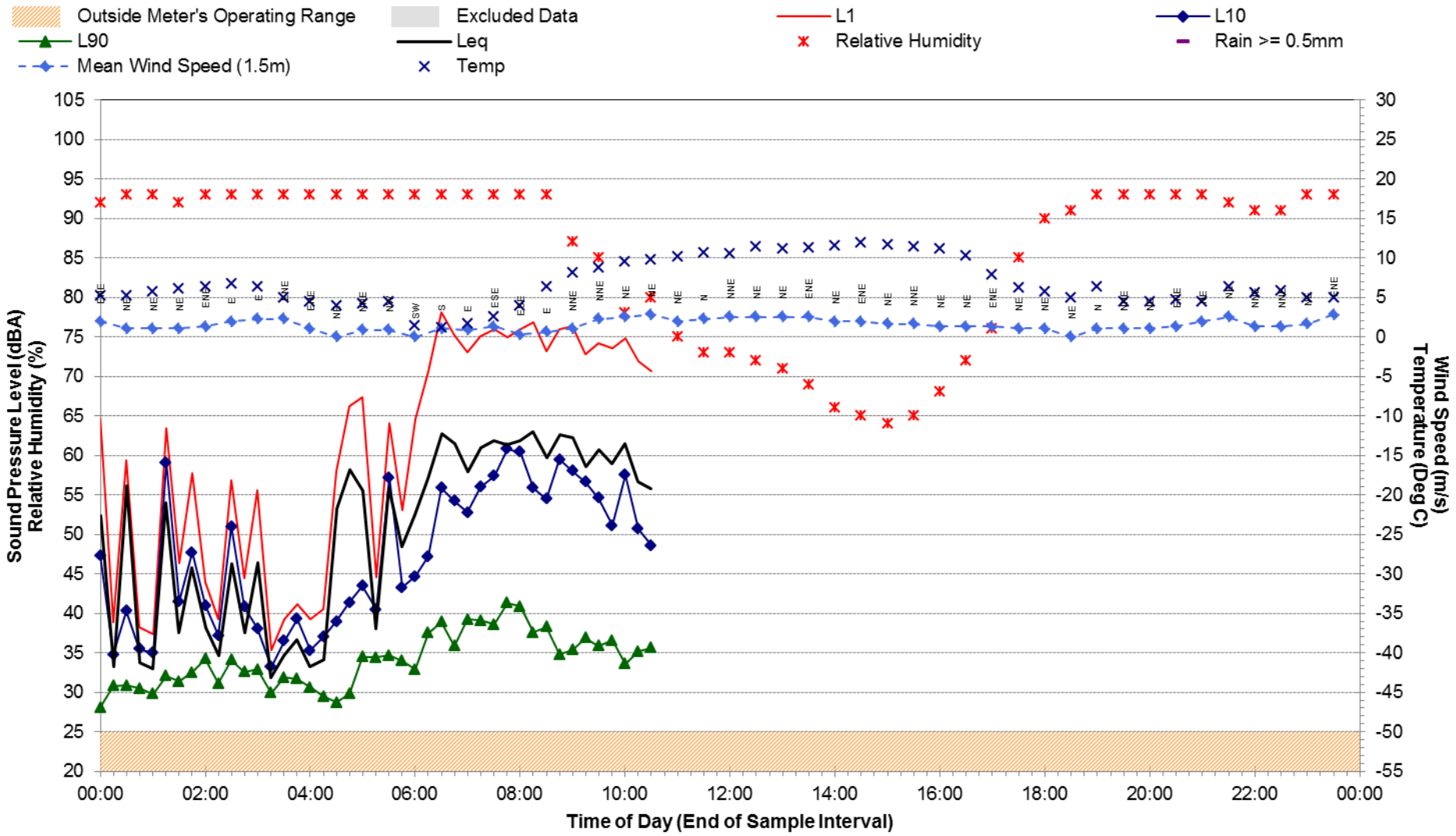
Statistical Ambient Noise Levels

M2 Monitoring Location - Tuesday, 10 June 2014



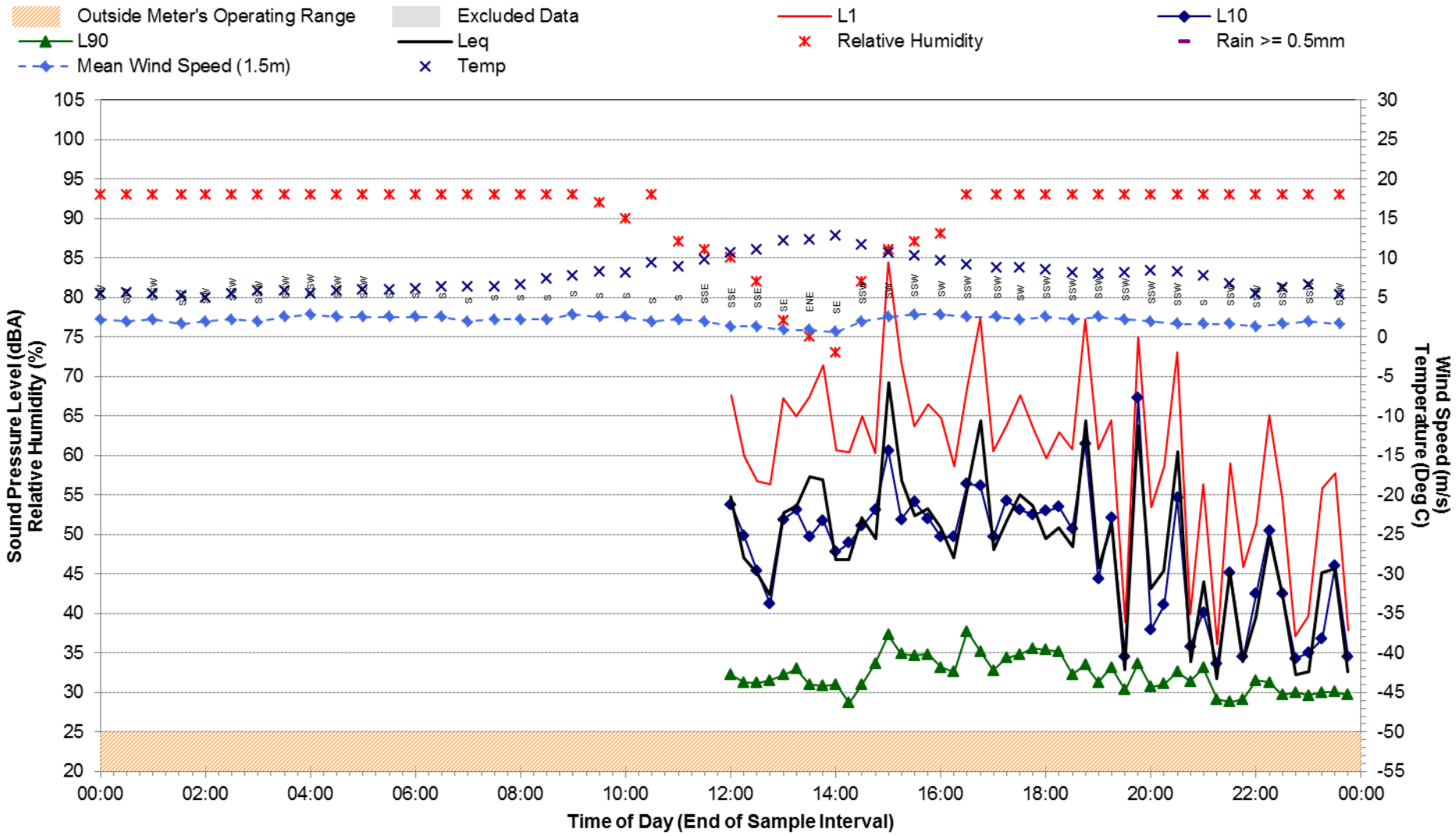
Statistical Ambient Noise Levels

M2 Monitoring Location - Wednesday, 11 June 2014



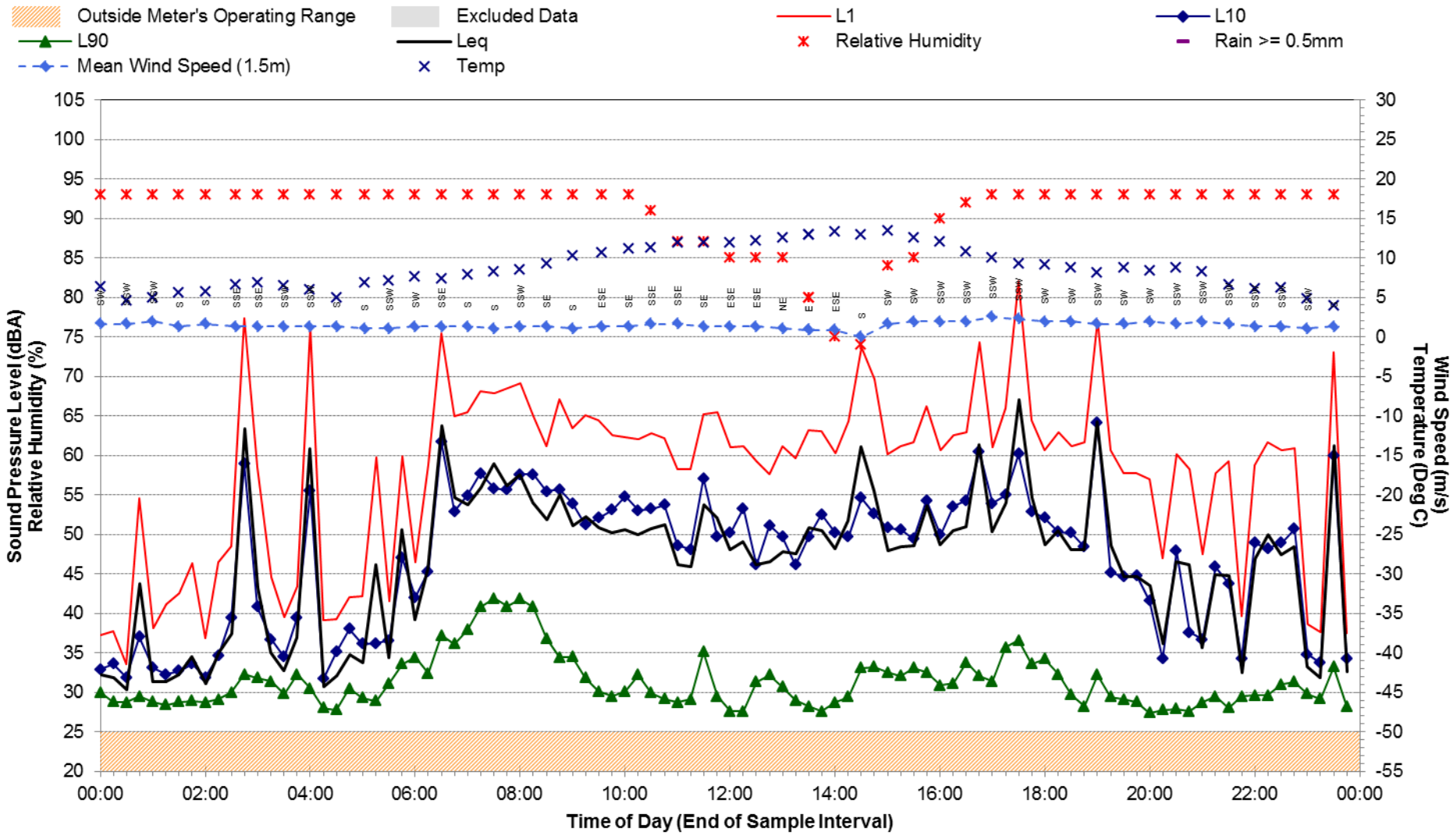
Statistical Ambient Noise Levels

M3 Monitoring Location - Wednesday, 4 June 2014



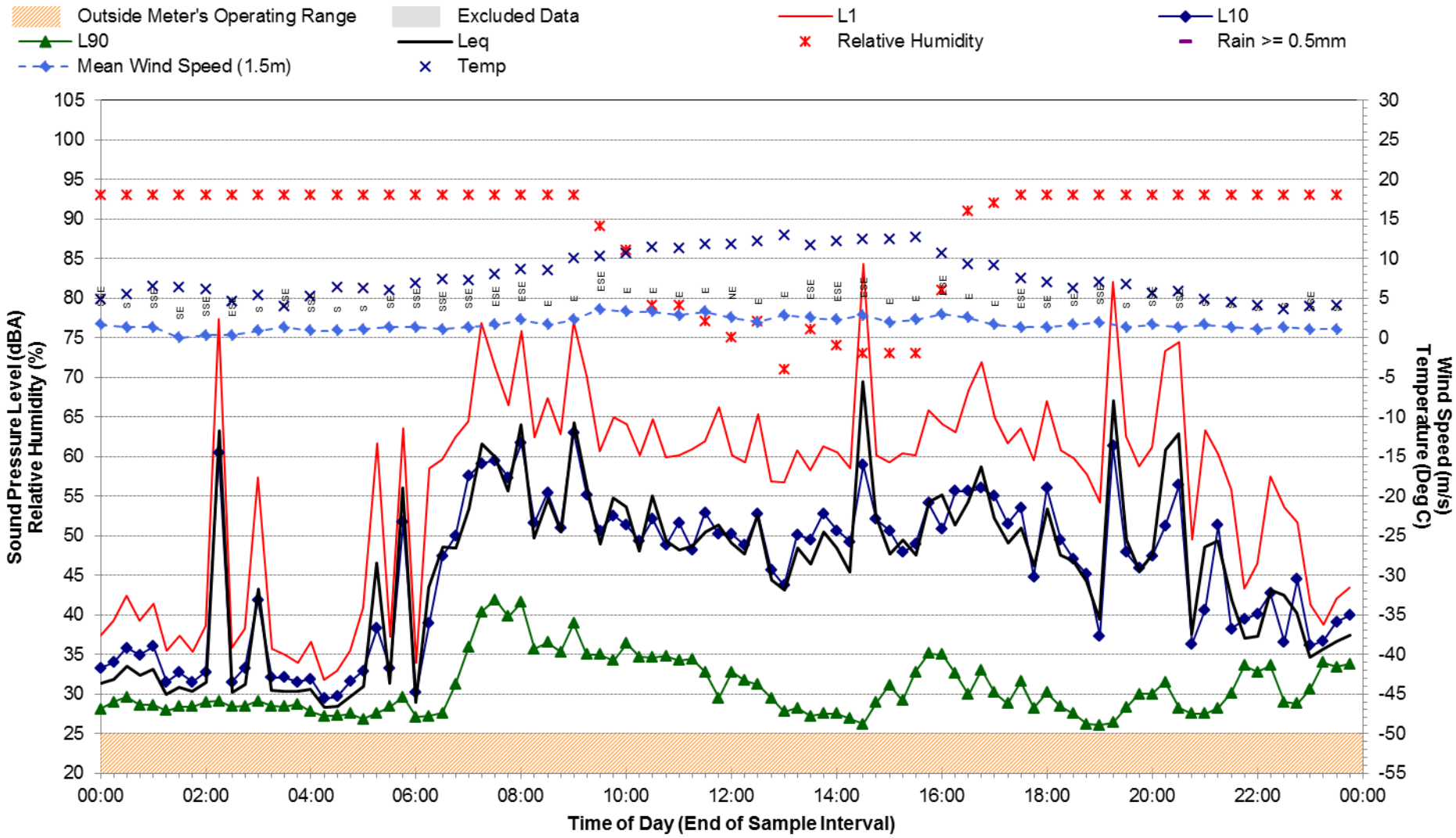
Statistical Ambient Noise Levels

M3 Monitoring Location - Thursday, 5 June 2014



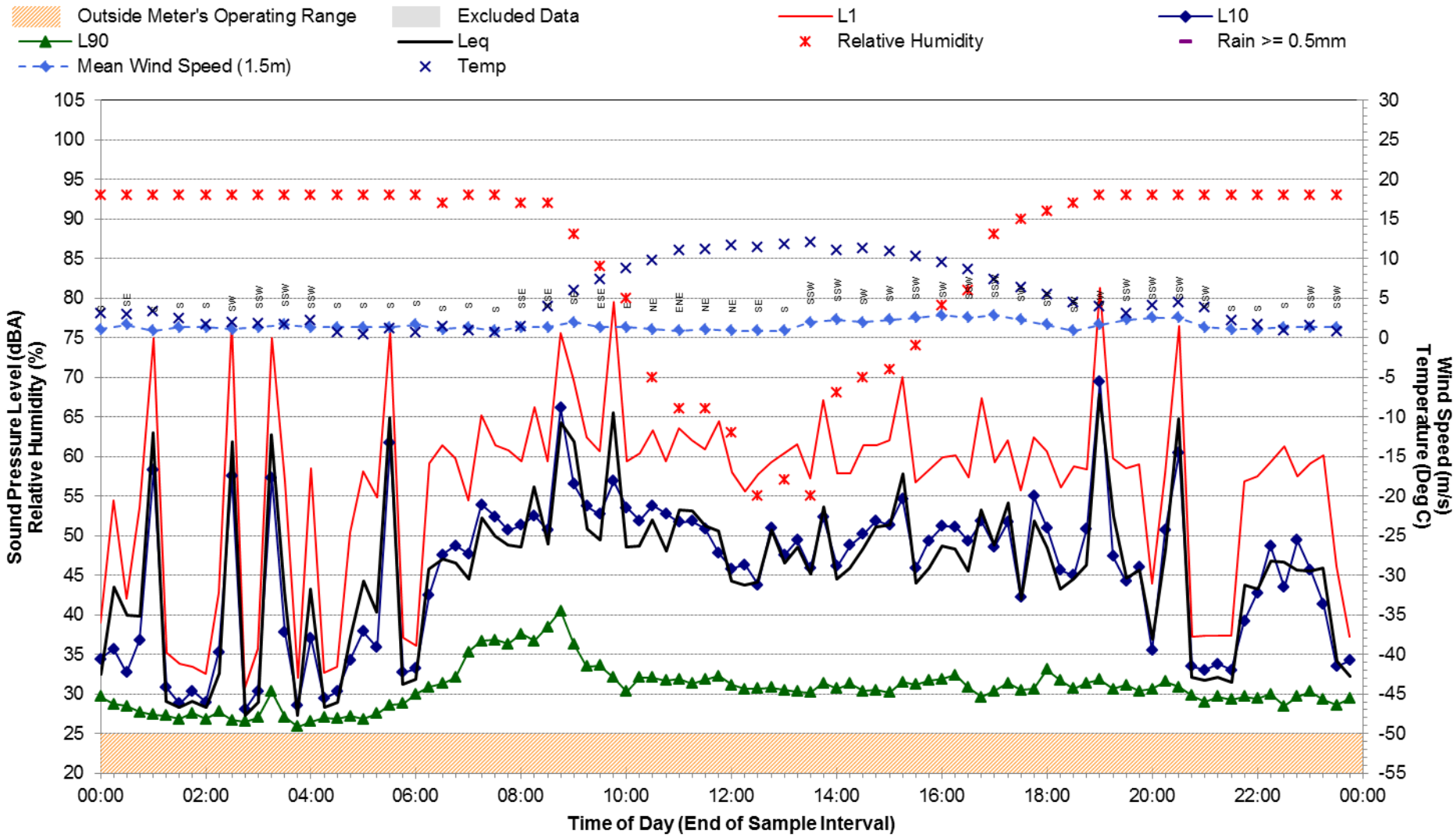
Statistical Ambient Noise Levels

M3 Monitoring Location - Friday, 6 June 2014



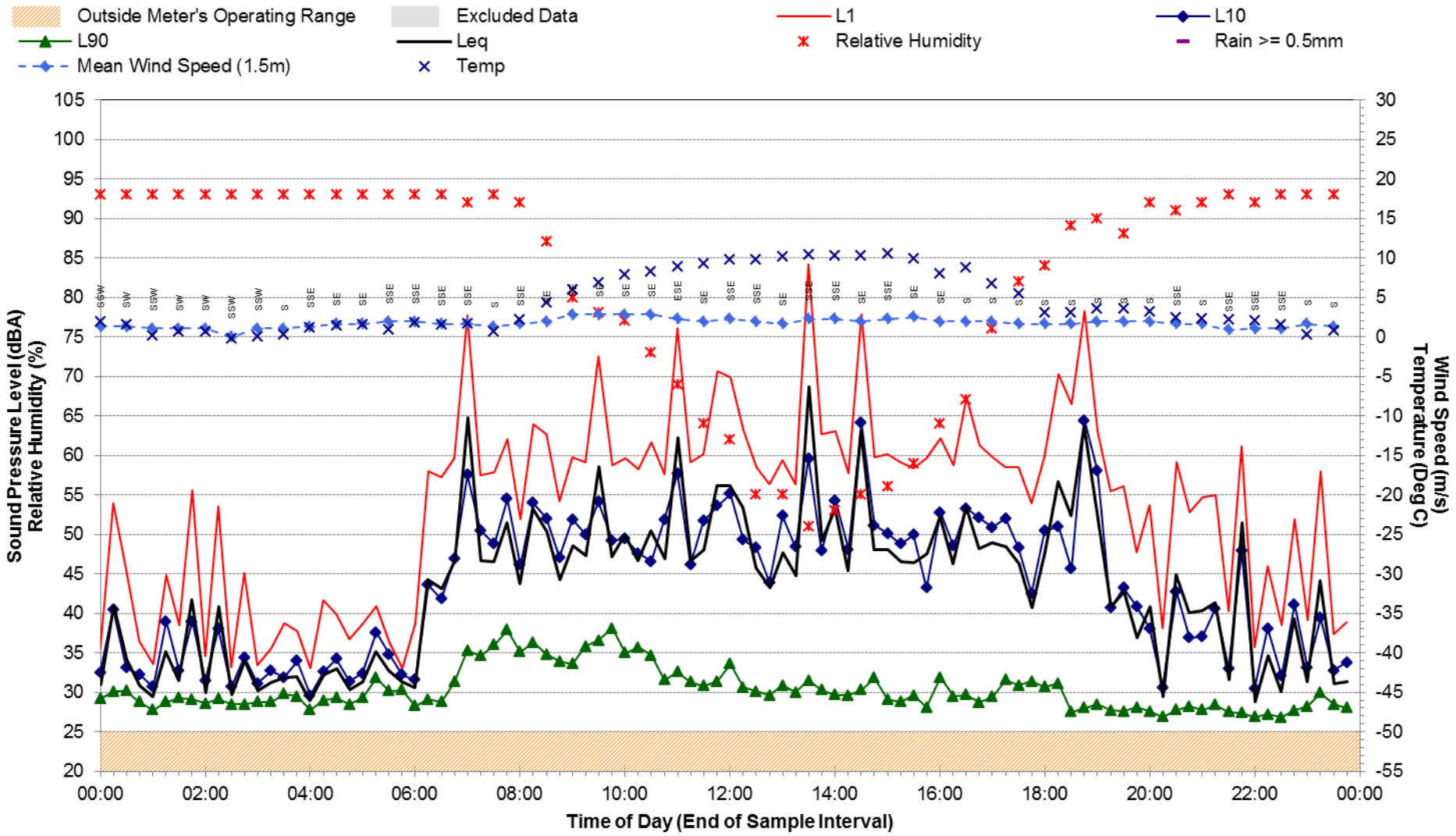
Statistical Ambient Noise Levels

M3 Monitoring Location - Saturday, 7 June 2014



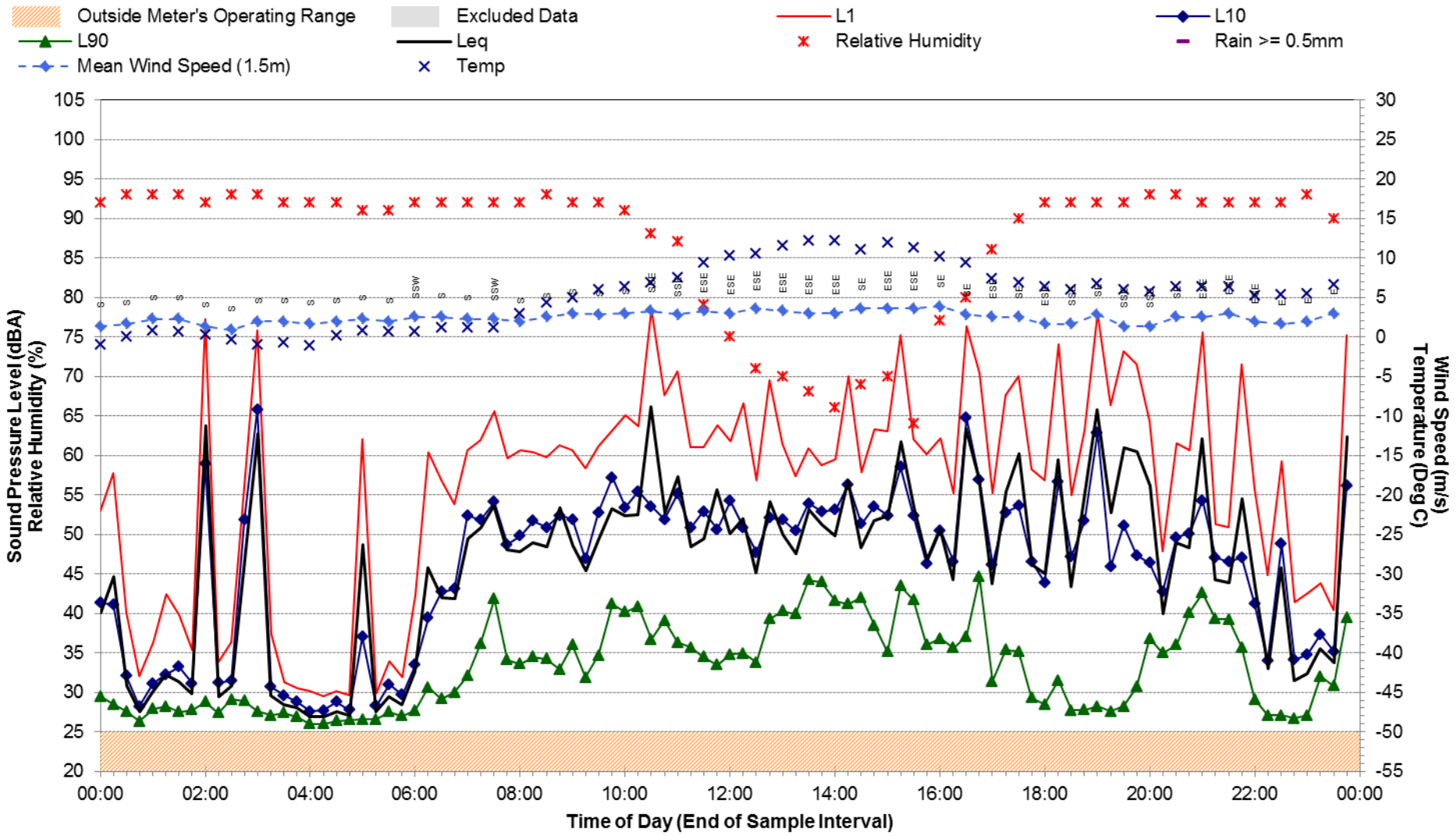
Statistical Ambient Noise Levels

M3 Monitoring Location - Sunday, 8 June 2014



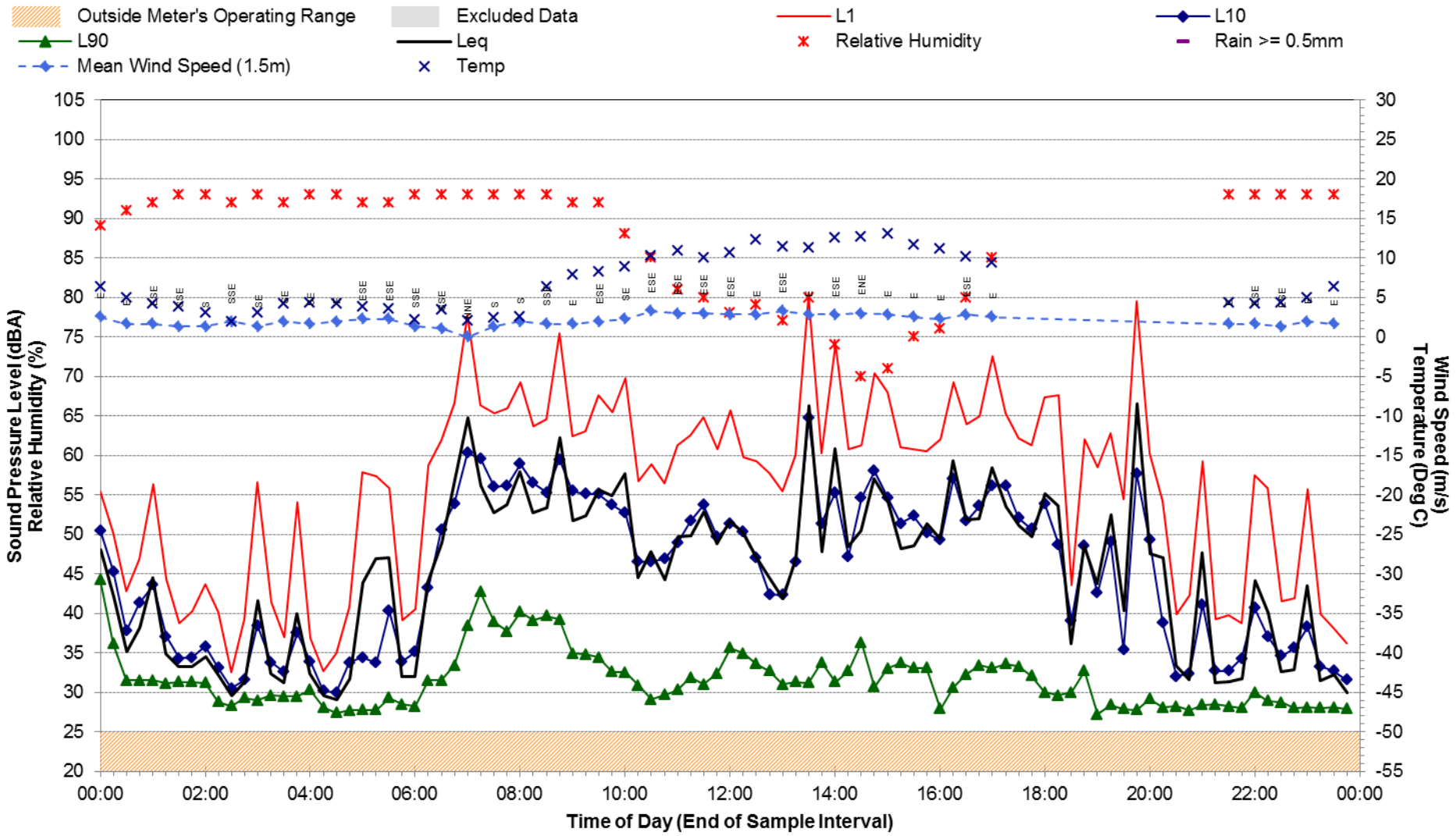
Statistical Ambient Noise Levels

M3 Monitoring Location - Monday, 9 June 2014



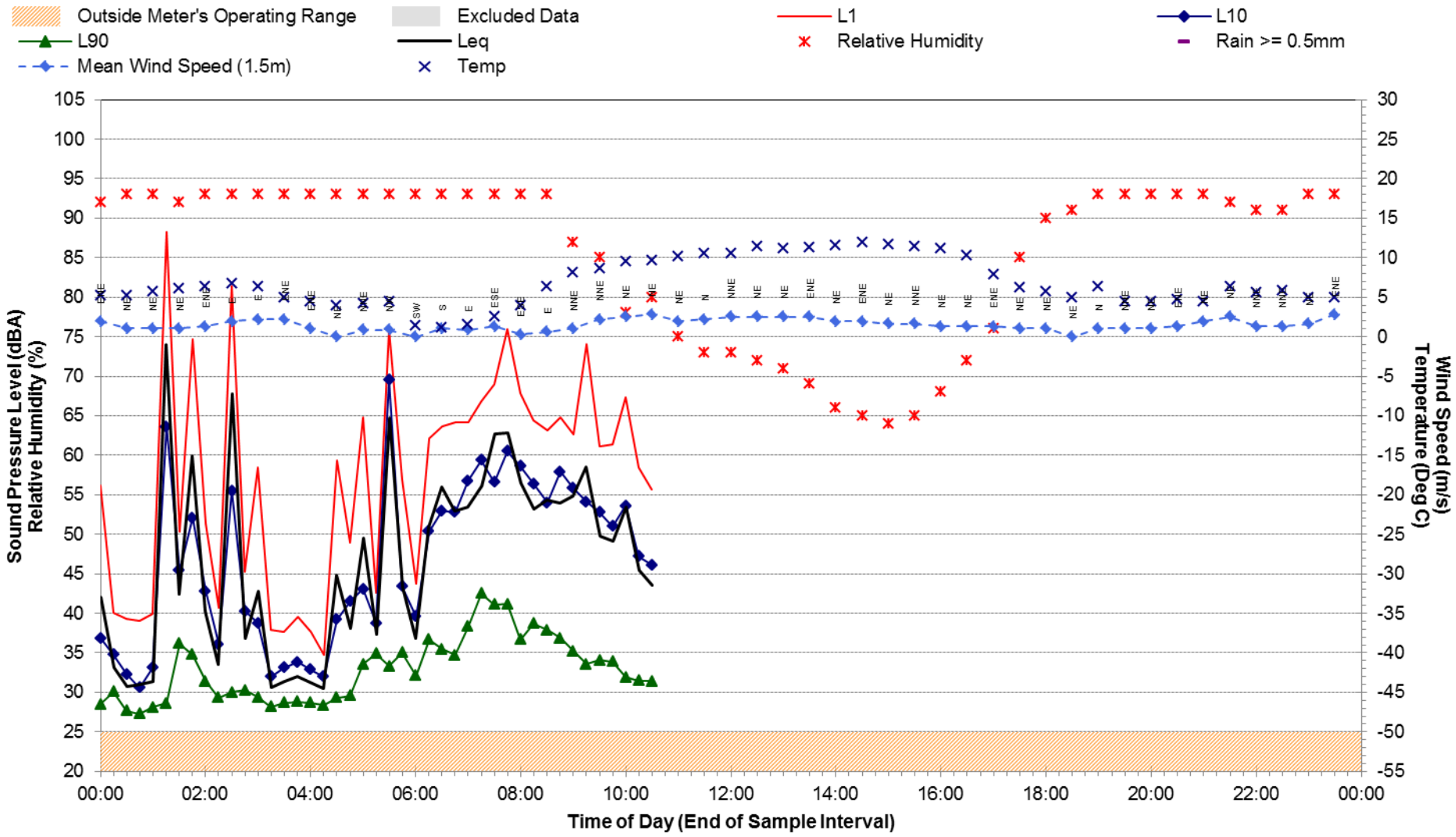
Statistical Ambient Noise Levels

M3 Monitoring Location - Tuesday, 10 June 2014



Statistical Ambient Noise Levels

M3 Monitoring Location - Wednesday, 11 June 2014



1 Introduction

This Appendix explains SLR Consulting's approach towards the analysis of meteorological conditions required for the noise impact assessment.

The meteorological data inputs required to estimate potential noise impacts vary from those required for other specific environmental impact assessments such as air quality or soil and land assessments.

For example, air quality models generally require a spatially and time varying meteorological field which takes into consideration surrounding land use and topography over an entire year to encompass meteorological variability on timescales appropriate to the air quality criteria (e.g. 1 hour, 24 hour and Annual). Noise impact assessments generally do not require this level of detail and require only the prevailing (dominant) meteorological characteristics during specific times of day and seasons.

Whilst the starting point for each assessment may be similar, the requirements for meteorological data vary as stated in guidance documentation from the appropriate regulatory authorities.

2 Meteorological Overview – Noise Impact Assessment

The NSW Industrial Noise Policy (INP) provides the methodology used for assessing meteorological conditions for noise impact assessments. The following excerpt is from the INP which describes the two approaches to assessing meteorological effects:

In assessing noise impacts, the criteria are expected to apply under weather conditions that would be expected to occur at a particular site for a significant period of time. These include conditions of calm, wind and temperature inversions. As the criteria are expected to apply under weather conditions characteristic of the area, it is important at the start of a noise assessment to assess the potential for such meteorological effects occurring, thus enabling better prediction of potential noise impacts.

Essentially, there are two underlying approaches to assessing these effects: the simple and the more detailed approach.

Simple approach

With the simple approach, the proponent may forego detailed analyses of meteorological data and simply apply given default meteorological parameters to predict noise levels. This approach assumes that meteorological effects are present for a significant amount of time, avoiding the need to quantify these effects in detail. It is conservative, in that it is likely to predict the upper range of increases in noise levels. Actual noise levels may be less than predicted. This approach is generally used to test whether further analyses are warranted.

Detailed approach

The detailed approach involves analysing meteorological data to determine whether inversion and/or wind effects are significant features warranting assessment. Where assessment is warranted, default parameters are available for use in predicting noise or, where preferred, measured values may be used instead. The detailed approach gives a more accurate prediction of noise increases due to meteorological factors—as a tradeoff for the additional work involved.

The INP recommends that for weather data to be suitable for the purpose of a noise impact assessment it should be collected within a 30km radius of the subject site and in the same topographical basin.

2.1 Assessing Temperature Inversions

Temperature inversions, when they occur, have the ability to increase noise levels by focusing sound waves. Temperature inversions occur predominantly at night during the winter months. For a temperature inversion to be a significant characteristic of the area it needs to occur for approximately 30% of the total night-time during winter, or about two nights per week.

Meteorological data from the nearest weather station to the project site, if available, is analysed in determining the percentage occurrence of temperature inversions during winter nights. It is typical that data relating to the occurrence of temperature inversions is not available from the nearest weather station. In this case, default values for inversion strength and corresponding wind speed for the purpose of noise modelling are provided in the INP and are reproduced here:

Non-arid areas (annual average rainfall greater than 500 mm):

Moderate (F-class stability category) inversions

- *3 °C/100 m temperature inversion strength for all receivers, plus a 2 m/s source-to-receiver component drainage-flow wind speed for those receivers where applicable. (See below for applicability of drainage-flow wind.)*

Arid and semi-arid areas (annual average rainfall less than 500 mm):

Strong (G-class stability category) inversions

- *8°C/100 m temperature inversion strength for all receivers, plus a 1 m/s source-to receiver component drainage-flow wind speeds for those receivers where applicable. (See below for applicability of drainage-flow wind.)*

Applicability of drainage-flow wind

The drainage-flow wind default value should generally be applied where a development is at a higher altitude than a residential receiver, with no intervening higher ground (for example, hills). In these cases, both the specified wind and temperature inversion default values should be used in the noise assessment for receivers at the lower altitude.

Furthermore, the INP states: '*Temperature inversions occur during E, F and G stability categories. These three categories are considered to represent weak, moderate and strong inversions, respectively. For noise-assessment purposes, only moderate and strong inversions are considered significant enough to require assessment'*.

2.2 Assessing Wind effects

Wind has the potential to increase noise at a receiver when it is light and stable and blows from the direction of the source of the noise. As the strength of the wind increases the noise produced by the wind will obscure noise from most industrial and transport sources.

Wind effects need to be considered when wind is a feature of the area under consideration (in accordance with the INP). Where wind blows from the source to the receiver at speeds up to 3 m/s for 30% (or more) of the time in any assessment period (day, evening, night) in any season, then wind is considered to be a feature of the area and noise level predictions should be made under these conditions.

There are two ways to assess wind effects:

1. Use a wind rose to determine whether wind is a feature of the area based on the frequency occurrence and wind speed. Care should be taken to assess the source-to-receiver components of wind that are relevant.
2. Simply assume that wind is a feature of the area and apply a 'maximum impact' scenario.

A default wind speed of 3 m/s (at 10m height) is proposed for assessing noise impacts. Where there is 30% or more occurrence of wind speeds below 3 m/s (source-to-receiver component), then use the highest wind speed (below 3 m/s) instead of the default.

3 Project Specific Approach

Wind data is readily available for the BoM AWS at Orange Airport (Station Number 063303) automatic weather station and has been recorded at this location for many years. Hence, the NVIA has used the 'detailed approach' in assessing winds and potential effects of temperature inversion relevant to the Project site.

Weather data was obtained from the BoM AWS at Orange Airport (Station Number 063303) automatic weather station for the period of one (1) years of weather data (2013).

Wind speed and direction data was analysed to determine the frequency of occurrence of winds up to speeds of 3 m/s for daytime, evening and night in each season. A summary of the most frequently occurring winds is contained within the NIA.

Meteorological data was available from the BoM AWS at Orange Airport (Station Number 063303) to allow the determination of the percentage occurrence of temperature inversions during winter nights. The most complete temperature inversion data was contained in the years 2013.