TECHNICAL REPORT NO 5

NOISE ASSESSMENT

SLR CONSULTING AUSTRALIA

REMONDIS Integrated Recycling Park

Grand Avenue, Camellia

Noise Impact Assessment

Report Number 10-8651-R1

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National Environmental Consulting Services
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REMONDIS Integrated Recycling Park

Grand Avenue, Camellia

Noise Impact Assessment

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1 INTRODUCTION

REMONDIS Pty Ltd is proposing to operate an integrated Alternative Waste Treatment (AWT) facility at Camellia to be known as the REMONDIS Integrated Recycling Park (RIRP).

Heggies Pty Ltd, now SLR Consulting Australia Pty Ltd (SLR Consulting) has been commissioned by National Environmental Consulting Services (NECS) to undertake a noise assessment for the construction and operation (including traffic noise) of the RIRP, for inclusion in their Environmental Assessment (EA).

The RIRP site is located at 1 Grand Avenue, Camellia. The site consists of an area of approximately 4.5 hectares, and is level with approximately 95% of the area covered with "hard" surfaces of concrete and bitumen. All other areas are grassed, and there are no buildings.

The proposed RIRP will comprise:

- A Commercial and Industrial AWT facility (CIRRF) with the capacity to process up to 100,000 tonnes per annum (tpa) of C&I waste; and
- A Source Separated Organic Materials AWT facility (SSORRF) with the capacity to process 50,000 tpa of food and green waste.

The RIRP will include ancillary facilities including a weighbridge, administrative offices, parking and workshops. It will operate 24 hours per day, seven days per week.

This report identifies the potential construction, operational and traffic noise impacts associated with the proposed RIRP on the community.

A summary of the acoustic terminology used in this report is presented in **Appendix A**.

2 LOCAL SETTING AND PROJECT OVERVIEW

2.1 Site Location and Sensitive Receivers

The RIRP site is located at 1 Grand Avenue, Camellia. The nearest potentially affected existing residence is situated at 100 m to the west of the closest boundary of the RIRP Site, at the intersection between Grand Avenue and James Ruse Drive (RR1-BG2). The nearest potentially affected residences to the west-southwest are located 285 m from closest boundary of the RIRP Site, on James Ruse Drive (RR2). Other residences are located further to the west 550 m from closest boundary of the RIRP Site, on Arthur Street (RR3).

The nearest potentially affected educational receiver, the University of Western Sydney (CR1-BG3), is located on the other side of the river 500 m to the north from the closest boundary of the RIRP. It is noted accommodation associated with the university is on another site north of Victoria Rd and more than 1 km from the RIRP. A child care centre (CR2) is located 30 m to the south of the closest boundary of the RIRP.

The nearest potentially affected commercial receivers are the Hooters restaurant (CR3) and the Rosehill Bowling Club (CR4) and are located 250 m to the west-southwest of the closest boundary and 276 m to the west of the closest boundary of the RIRP respectively. The nearest potentially affected industrial premises are located 120 m to the west of the closest boundary of the RIRP Site (IR1), 20 m to the east of the closest boundary of the RIRP Site (IR4) and 30 m to the south of the closest boundary of the RIRP Site (IR2 and IR3).

A Locality Plan showing the location of the Project Site and surrounding area is shown in **Appendix B**.

2.2 Description of the Project

The proposed RIRP at Camellia comprises of two AWT plants for:

- Commercial & Industrial Resource Recovery Facility (CIRRF), and
- Source Separated Organic Resource Recovery Facility (SSORRF).

Both plants are designed to maximise recovery of resources for the market and minimise disposal to landfill. The CIRRF facility is capable of receiving & processing up to 100,000 tonnes per annum. The SSORRF facility is capable of receiving and composting up to 50,000 tpa of mainly green and food wastes. The waste streams will be sourced from within the greater Sydney Metropolitan Area and delivered by collection contractors.

Appendix C shows the RIRP layout.

CIRRF

Wastes Composition

The average waste composition into the CIRRF plant is expected to be as shown in **Table 1**.

Table 1 Mixed C&I Waste Composition Estimate

Mixed C&I Waste	Estimate Composition
Food / Vegetation	20%
Paper / Cardboard	17%
Wood	17%
Plastic	17%
Textile	5%
Metals	2%
Construction/Demolition	10%
Other	12%
Total	100%

Further to above material, REMONDIS expects also commingled recyclables loads to be delivered to the plant, mainly comprising paper, cardboard and plastics.

Processes

<u>Waste Delivery and Storage</u>

The delivery areas for the predominately ‘dry’ and ‘wet’ deliveries are within the same building however spatially separated. Each delivery area (‘dry’ and ‘wet’) can accommodate 2 trucks at any one time during the operation.

<u>Mixed loads</u>

Once the truck has unloaded in this area, a wheeled loading machine (grab or similar) visually screens the material for gross contaminants (dropped into bins) and clean, dry materials before feeding the hopper of the crusher or stockpiling the material in the designated storage area.

Dry loads

Dry loads are handled with a FEL which segregates and screens the waste prior to either feeding the hopper of the sorting line or pushing the screened material into the dry waste storage area.

Mono loads

The facility also provides for a separate delivery of mono loads in form of a pit conveyor, which feeds a baling machine at the eastern side of the building.

Storage Requirement

The corresponding storage area within the building is 600-700 m^2 for dry/mixed waste deliveries.

Dry Waste Feeding & Screening Line

To uncouple batch loading (via front-end loader) and screen feeding, the material is placed into a large hopper. The feeding hopper discharges onto an inclined conveyor which then feeds the screen.

A reverse directed conveyor connects to an inclined conveyor which drops this material into a holding bay for tunnel loading. The screen overflow is transported along a conveyor line into the resource recovery process.

Recycling Material Recovery Station

The basic resource recovery configuration includes:

- Sorting mezzanine with a sorting belt conveyor and three sorting spots on either side of the conveyor, each with drop chutes into separate HL-bins/bays underneath.
- Optional: One over belt magnet for automated recovery of ferrous metals from the overs.
- Optional: One eddy current separator for automated recovery of non ferrous items from the overs.

The remaining material stream is discharged in a separate disposal storage bay within the building.

Baler Facility

A bob-cat or similar machine will push the various recovered recyclables into the pit conveyor of the baling facility. Direct access to the baler for mono loads delivered by REMONDIS or other contractors is provided through the access door.

The baling press will be able to compress the recyclable materials into sorted, easily transportable bales. All the fully sorted recyclable materials such as paper / cardboard, plastics, ferrous and non ferrous recyclables will be baled into a cubical bale before transported out from the RIRF facility.

Baled materials are stored under cover in the baling storage area, which is attached to the main building.

Mixed Waste Feeding & Screening Line

Similar to the dry line, the mixed waste feeding line includes a large feed hopper, which provides an even material flow into the crusher.

The crusher is a slow speed shredder type equipment, which opens the bags and spreads the material evenly onto the crusher bottom discharge conveyor.

From there the material stream is conveyed passed a magnet to recover ferrous metals into a screen for separation similar to the dry line. The screen function is to remove non-compostable items such as plastic bags from the putrescible stream and reduce the capacity requirements for the biological treatment stage.

The sequence of conveyors transports the tunnel raw material from the screen into the storage bay which is located in the tunnel hallway. A separate storage & truck loading area with separate entrance roller gate for the screen overflow is separated from the input storage area.

Output Handling

All output steams (recycling material, residuals wastes) are automatically conveyed into either transport bins or containers for off site transport and recycling. The process allows for various storage & transport options (hook lift containers, skip bins, bales).

SSORRF

Wastes Composition

The average waste composition into the SSORRF plant is expected to be as shown in **Table 2**.

Table 2 SSORRF Composition Estimate

SSORRF Waste	Estimate Composition
Green waste	**60%**
Food waste	40%
Other Organics	0%
Wood Waste	0%
Total	100%

An average waste density of close to 0.5 t/m^3 has been assumed as annual average for the organic waste after unloading.

Process

Delivery & Storage

The material will be delivered via kerbside collection trucks only (plant not open to the public).

The load will be tipped onto a heavy duty concrete built floor and visually screened for nuisance, before the FEL pushes the screened waste either into the dedicated storage area or feeds straight into the process.

The main building caters for a total of 3 days storage capacity of delivered waste and prepared feedstock for the composting process. This is sufficient capacity to cover for unexpected down times without impacting on the collection service.

Pre-Treatment

Contaminated kerbside collected Biowaste (garden/kitchen waste mix)

Segregation and visual screening on the floor enable the removal of larger nuisance (eg steel bars, glass bottles, chemical containers) before the load is fed into the process. The FEL then picks up the screened material and feeds the hopper of the front-end process.

The heavy-duty hopper belt moves the material slowly towards the de-compactor unit, which evens the material stream and breaks-up lumps before the material drops onto the inclined belt conveyor underneath the de-compactor. A level indicator automatically adjusts hopper belt speed in order to even feed into the de-compactor.

The inclined conveyor then transports the material into a screen. Screening overflow and fines will be conveyed to the picking station, where both streams are screened for and cleaned from contamination.

The picking station provides for up to four ergonomic designed picking spots along each sorting conveyor with outlet chutes to discard items into bins placed under the picking station. Staffing numbers can be adjusted to reflect level of contamination.

The sorting belt conveyor (screen oversize only) finally drops the cleaned material stream into the feed hopper of the particle size reduction unit. The fine fraction conveyor drops the material onto the shredding outlet conveyor respectively into the storage bay for the tunnel raw material mix.

Clean Green Waste

Clean green waste deliveries may be stored separately and can be fed with the FEL straight into the shredder. This by-pass option enables the operator to decide on a load-by-load basis, which treatment strategy is to be pursued to increase the efficiency of the pre treatment process. Parallel feed of the shredder via FEL and via sorting conveyor provides a further contingency to the pre-treatment plant operation.

Particle Size Reduction

The sorted feedstock then automatically drops into the large feed hopper of the particle size reduction unit. The unit employed will be either a grinder mill or a slow speed shredder. The unit integrates a large feed hopper with optical feed control to uncouple manual sorting from processing.

A permanent magnet integrated into the head drum of the discharge conveyor will remove ferrous metals from the material via chute into a recycling bin.

Finally a conveyor will transport the tunnel raw material into the interim storage area within the main building, where the FEL loads the material into the designated tunnel.

Biological Processing Plants

The RIRP integrates two biological treatment plants for the organic stream derived from the CIRRF waste and the SSORRF waste streams. They are based on a technology commonly called tunnel composting.

Tunnel Composting Plants

The proposed tunnel composting plants for both the CIRRF waste and the SSORRF waste streams comprises 10 tunnels each of approx. 26 m length, 8m width and 4.5m height. Each tunnel is self-operating and comprises an air ducting system, blowers, process water collection and recycling system, and various process control features (temperature, pressure, fresh air ratio measuring devices etc.). Trenches in the slab run parallel over the full length of the slab and are covered with purpose designed panels. Access to each tunnel is via the front door, which can be lifted automatically. During the composting process, the door is locked hermetically to prevent any odour and leachate from discharge into the environment. Compost material is placed into each tunnel individually and removed after a given composting time by means of a FEL.

Each tunnel is equipped with a fan, which blows a mixture of fresh air and recycled air through the trenches into the tunnel. At the same time surplus exhaust air is being discharged to the deodorisation stage. The mixture of fresh and recycled air can be automatically controlled via the central process control for each tunnel. Surplus air from the tunnel facility is being discharged to the deodorisation stage.

The minimum tunnel residence time in both biological processes of average 14 days (plus 1 for emptying / filling) is proposed to maximise decomposition rates and achieve the objectives outlined previously.

Deodorisation Stage

All exhaust air from the tunnels is finally discharged into the deodorisation stage for treatment and dispersion. The deodorisation stage comprises bio filter fan, humidifier and bio filter.

Each plant (CIRRF & SSORRF) will have their stand alone deodorisation stage to treat the exhaust air independently and avoid any cross contamination between the two plants.

The purpose of the deodorisation stage is to eliminate odours and deodorise the exhaust air from the tunnel-composting units before being discharged into the atmosphere.

Air volume, moisture and temperature are also controlled via central process control. The bio filter structure comprises a segmented sub-ground concrete basement with perimeter walls, a grate floor (‘false floor’) at ground level with a layer of filter medium on top. The filter medium comprises a 1-1.5m thick layer of compost, bark or other mature organic matter.

Process Water Collection & Recirculation

Each biological process (CIRRF & SSORRF) is also equipped with its own process water collection and recirculation system, which functions as follows:

Leachate from the tunnels drains through the duct and piping system via siphons into a sealed process water tank, which is also connected to the bio filter / humidifier unit as drainage facility. The process water is then collected and recycled back into the respective composting process to establish and/or maintain the desired material moisture content.

A submerged pump mounted onto the process water tank has the purposes of topping up the humidifier and of supplying process water to the tunnel spraying system. Each tunnel is equipped with a solenoid valve controlled spray line, which connects to an array of nozzles, mounted onto the tunnel ceiling in a way to cover the entire tunnel surface area.

During the dry/hot period of the year, fresh water may be required to cover the water demand for the tunnel system; otherwise make-up water can be drawn from e.g. the rain water collection system on site.

Output

Organic output

The organic output from the SSORRF will be feed stock for high quality compost manufacture that meets AS4454 standards. This material will be further maturated (offsite) and prepared by others with distribution and value adding networks for the organic compost market (derived from source separated material).

The organic output from the CIRRF will be classified as a Class II waste and sent to landfill.

Dry Recyclables

Prime objective for the integrated sorting plant is the removal of environmentally sensitive items from the fuel raw material stream such as PVC and to explore the highest resource value for recycling material, which is driven by market value versus sorting costs. REMONDIS expect to recover high value plastic (HDPE containers etc.) and to some extend cardboard/paper (low contaminated).

Metals

The CIRRF recovers automatically ferrous and non-ferrous (mixed) metals, which are collected in various scrap bins for recycling.

Transportation

Product to/from the RIRP site will be hauled via contractors via James Ruse Drive and Grand Avenue. All trucks will depart the site with a left turn onto Grand Avenue.

The access road will provide trucks with direct access to the proposed development from Grand Avenue. This is a ring road which encompasses the site. When the Collection Truck arrives onsite from Grand Avenue, the truck will follow a clockwise direction on this ring road.

The RIRP is proposing to provide direct employment of 15-20 operational staff plus some additional casual staff which will be divided into three shifts (6 am to 2 pm, 2 pm to 10 pm, 10 pm to 6 am) such that the maximum on-site per shift will be 40 persons (19 for CIRRF plus 11 for SSORRF plus 10 additional admin and miscellaneous staff.

The daily traffic movements generated by the RIRP operations on the site are shown in **Table 3**.

Table 3 Daily Truck Movements Generated by the RIRP Operations

Time Slot	CIRRF	SORRF	Total
12.00 am to 1.00 am	0	0	0
1.00 am to 2.00 am	1	0	1
2.00 am to 3.00 am	1	0	1
3.00 am to 4.00 am	3	0	3
4.00 am to 5.00 am	3	0	3
5.00 am to 6.00 am	3	0	3
6.00 am to 7.00 am	3	1	4
7.00 am to 8.00 am	3	3	6
8.00 am to 9.00 am	4	5	9
9.00 am to 10.00 am	5	4	9
10.00 am to 11.00 am	5	2	7
11.00 am to 12.00 pm	3	0	3
12.00 pm to 1.00 pm	7	1	8
1.00 pm to 2.00 pm	4	0	4
2.00 pm to 3.00 pm	6	5	11
3.00 pm to 4.00 pm	6	3	9
4.00 pm to 5.00 pm	3	3	6
5.00 pm to 6.00 pm	2	0	2
6.00 pm to 7.00 pm	1	0	1
7.00 pm to 8.00 pm	1	0	1
8.00 pm to 9.00 pm	1	0	1
9.00 pm to 10.00 pm	0	0	0
10.00 pm to 11.00 pm	0	0	0
11.00 pm to 12.00 am	0	0	0

Hours of operations

The CIRRF facility is proposed to be open for waste delivery 24 hours per day and 7 days per week all year. REMONDIS currently plans for an 8 hour shift per day for the CIRRF. Operating hours per shift and number of shifts per day needs to accommodate the quantities of waste delivered at the facility and may change accordingly over the life of the project.

The SSORRF facility is proposed be open for waste delivery 24 hours per day and 7 days per week all year. REMONDIS currently plans for an 8 hour shift per day for the SSORRF. As with the CIRRF the operating hours per shift and number of shifts per day needs to accommodate the quantities of waste delivered at the facility and may change accordingly over the life of the project.

3 EXISTING ACOUSTICAL ENVIRONMENT

3.1 Noise Monitoring Location

Environmental noise monitoring was conducted at the potentially most affected (representative) noise-sensitive locations in order to:

- Characterise the existing noise environment in the vicinity of the RIRP; and
- To establish the noise levels upon which to base the operation noise emission objectives.

Unattended background noise monitoring was conducted between Tuesday 9 March 2010 and Thursday 18 March 2010 at three locations considered representative of the existing ambient noise environment in the vicinity of the proposed RIRP. The background noise monitoring locations are described in **Table 4**.

Table 4 Background Noise Monitoring Locations

Monitoring Locations	
BG1	240 George Street
BG2	33 James Ruse Drive
BG3	University of Western Sydney

Continuous weather data was obtained from the nearby Horsley Park weather station, in order to identify periods of adverse weather during the unattended noise logging survey. The Horsley Park Weather Station was selected as it is a station providing detailed meteorological data that falls within the guideline offset distance and topographical basin as nominated in the NSW Department of Environment Climate and Water Changes (DECCW) Industrial Noise Policy (INP). Data corresponding to periods of high winds and/or rain were excluded from the background noise analysis. The removal of the weather affected noise data did not significantly affect the resulting background noise levels.

3.2 Noise Monitoring Instrumentation

Equipment for the continuous unattended background noise surveys comprised Acoustic Research Laboratories (ARL) Environmental Noise Loggers Type EL-315 (Type 1) and Type EL-215 (Type2) fitted with a microphone windshield.

The EL-316 and EL-215 noise loggers are designed to comply with the requirements of AS IEC 61672.1-2004: *"Electroacoustics-Sound level meters-Specifications"* and carried appropriate and current NATA (or manufacturer) calibration certificates.

The unattended noise loggers were programmed to continuously monitor the ambient noise levels, recording relevant environmental statistical noise descriptors at the end of each 15 minute period throughout the survey period.

3.3 Ambient Noise Monitoring Results

The results of the noise surveys are presented in tabular form in **Table 5** and graphically in **Appendix E**. The statistical descriptors shown on the graphs are described in **Appendix A**.

The noise data were processed in accordance with the procedures documented in the DECCW's INP.

Table 5 presents the Rating Background Levels (RBLs) or background (L_{A90}) noise levels for the noise monitoring locations adjacent to the proposed RIRP.

Table 5 Summary of Existing $L_{A90(15minute)}$ Rating Background Levels (RBLs) and Existing $L_{Aeq(period)}$ Ambient Noise Levels - dBA re 20 µPa

Location	$L_{A90(15minute)}$ Rating Background Level (RBL)			$L_{Aeq(period)}$ Existing Ambient Noise Level		
	Daytime 0700-1800 Hours	Evening 1800-2200 Hours	Night-time 2200-0700 Hours	Daytime 0700-1800 Hours	Evening 1800-2200 Hours	Night-time 2200-0700 Hours
BG1 240 George Street	46	46	41	62	61	49
BG2 33 James Ruse Drive	54	51	48	65	61	60
BG3 University of Western Sydney	53	53	47	61	57	55

Operator-attended (15 minute) noise surveys were conducted at each of the locations listed in **Table 5**, on Tuesday 9 March and Thursday 18 March 2010, in order to determine the character of the existing background noise levels. The results of the background noise surveys are presented in **Table 6** together with a description of the noise sources and the prevailing weather conditions at the time of measurement.

Table 6 Operator-attended Background Noise Survey Results

Location Start Time Conditions	Measurement Description	Primary Noise Descriptor (dBA re 20 µPa)					Description of Noise Emission and Typical Maximum Levels (LAmax)
		LAeq	LA1	LA10	LA50	LA90	
Location BG1 [1] 240 George Street 1215 hours Wind At 10m : 4.2 m/s W	Ambient	63	75	68	52	47	Cicadas 48-49 Car 65 Aeroplane 57-58 Dogs barking 70-75
		Ambient background noise environment influenced by distant traffic					
Location BG2 [2] 33 James Ruse Drive 0925 hours Wind At 10m: 1.7 m/s W	Ambient	65	72	68	63	58	Trucks 65-75 General Traffic 59-67 Horn discernible Dog barking discernible Birds discernible
		Ambient noise dominated by traffic on Grand Avenue mainly					
Location BG3 [1] University of Western Sydney 1336 hours Wind At 10m: 5.3 m/s W	Ambient	56	66	59	53	49	Aeroplane 56-69 Cicadas 56-58 Wind in trees discernible
		Ambient noise environment by cicadas and traffic on James Ruse Drive					

Note 1: Measurement undertaken Tuesday 9 March.
Note 2: Measurement undertaken Thursday 18 March.

The attended noise monitoring confirmed that the measured background noise levels were dominated by traffic noise. Also no other significant industrial noise sources were audible at any of the monitoring locations during the attended noise measurements.

4 CONSTRUCTION NOISE IMPACT ASSESSMENT PROCEDURE

4.1 Construction Noise Guidelines

When dealing with noise from construction works, the NSW Department of Environment, Climate Change and Water (DECCW) now Office of Environment and Heritage recognises that higher levels of noise are likely to be tolerated by people in view of the relatively short duration of the works. As a result, the DECCW has published guidelines in its "*Interim Construction Noise Guideline*", 2009 (Guideline) for the management of construction works noise.

The Guideline recommends the following approaches to mitigating adverse noise impacts from construction sites.

4.2 Hours of Construction

The DECCW's Guideline recommend confining permissible work times as outlined in **Table 7**.

Table 7 Preferred Hours of Construction

Day	Preferred Construction Hours
Monday to Friday	7.00 am to 6.00 pm
Saturdays	8.00 am to 1.00 pm
Sundays or Public Holidays	No construction

4.3 Construction Noise Assessment Method

The DECCW's Guideline recognises that people are usually annoyed more by noise from longer-term works than by the same type of works occurring for only a few days. For this reason the Guideline identifies two methods of assessing noise from construction:

- The quantitative assessment method which applies to long-term duration work; and
- The qualitative assessment method which applies to short-term duration work.

Quantitative Assessment Method

The DECCW's Guideline interim recommends that the $L_{Aeq(15minute)}$ noise levels arising from a construction project, measured within the curtilage of an occupied noise-sensitive premises (ie at boundary or within 30 m of the residence, whichever is the lesser, should not exceed the levels indicated in **Table 8**. These Noise Management Levels (NMLs) are generally consistent with community reaction to construction noise. The DECCW's Guideline also recognises other kinds of noise sensitive receivers and provides recommended construction NMLs for them. Those specific receivers and their recommended noise levels are presented in **Table 9**.

Table 8 Recommended DECCW General NMLs for Construction Works

Period of Noise Exposure	$L_{Aeq(15minute)}$ Construction NML
Recommended Standard Hours	Noise affected[1] RBL[2] + 10 dBA
	Highly noise affected[3] 75 dBA
Outside Recommended Standard Hours	Noise affected[1] RBL + 5 dBA

Note 1: The noise affected level represents the point above which there may be some community reaction to noise.
Note 2: Refer to **Table 5** and **Appendix A**.
Note 3: The highly noise affected level represents the point above which there may be strong community reaction to noise.

Table 9 Noise at Sensitive Land Uses (other than Residences)

Land use	$L_{Aeq(15minute)}$ Construction NML
Classrooms at schools and other educational institutions	Internal noise level 45 dBA
Hospital wards and operating theatres	Internal noise level 45 dBA
Places of worship	Internal noise level 45 dBA
Active recreation areas (characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion)	External noise level 65 dBA
Passive recreation areas (characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, for example, reading, meditation)	External noise level 60 dBA
Community centres	Depends on the intended use of the centre
Industrial premises	External noise level 75 dBA

The DECCW's Guideline recommends using the following quantitative assessment when the noise affected level is not met.

Mitigation

Recommended Standard Hours - Noise affected RBL + 10 dBA

- Where the predicted or measured $L_{Aeq(15minutes)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices in order 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.

Recommended Standard Hours - Highly Noise affected RBL 75 dBA

- Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours during which the very noisy activities can occur, taking into account:
  - 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.
  - If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.

Qualitative Assessment Method

The qualitative method for assessing construction noise is a simplified way to identify the cause of potential noise impacts. It avoids the need to perform complex predictions by using a checklist approach to assessing and managing noise.

The following checklist for work practice can be used:

- Community notification.
- Operate plant in a quiet and efficient manner.
- Involve workers in minimising noise.
- Handle complaints.

The quantitative assessment method is considered the appropriate method for the subject RIRP as the construction works are expected to take 12-15 months.

4.4 Project Specific Construction NMLs

The assessment of the impact from on-site construction works is conducted according to the DECCW's Interim Construction Noise Guideline. The RIRP construction works are expected to take up to 15 months. Accordingly, the quantitative assessment method described in **Section 4.3** is to be followed.

It is anticipated that RIRP construction works will be undertaken during Recommended Standard Hours.

The DECCW's interim Guideline $L_{Aeq(15minute)}$ construction NMLs are presented in **Table 10**.

Table 10 Recommended DECCW NMLs for Construction Works

Location	Noise Management Levels ($L_{Aeq(15min)}$)
	Recommended Standard Hours[1]
BG1 - 240 George Street	56
BG2 - 33 James Ruse Drive	64
BG3a - University of Western Sydney (Internal)[2]	65
BG3b - University of Western Sydney (External)[3]	60

Note 1: DECCW's standard construction hours: 7.00 am to 6.00 pm Monday to Friday, 7.00 am to 1.00 pm (if inaudible at residential premises) otherwise 8.00 am to 1.00 pm on Saturdays and no work on Sundays or Public Holidays.

Note 2: The University NML of 65 dBA is based on the 45 dBA internal noise level and an external to internal noise reduction (fixed non-openable windows) of 20 dBA).

Note 3 : The NML for the University of Western Sydney is based on the external INP criterion of 60 dBA for passive recreation.

5 OPERATIONAL NOISE IMPACT ASSESSMENT PROCEDURE

5.1 Environmental Noise Control - General Objectives

Noise objectives for the assessment of industrial/commercial facilities at residential receivers are detailed in the INP, as administered by the DECCW. The policy is normally applied at the residential property boundary.

The INP's objectives are:

- To establish noise criteria that would protect the community from excessive noise.
- To preserve the amenity for specific land uses.
- To use the criteria for deriving project specific land uses.
- To promote uniform methods to estimate and measure noise impacts including a procedure for evaluating meteorological effects.

Implementation is achieved by ensuring that:

- Noise from any single source does not intrude greatly above the prevailing background noise level. This is known as the intrusive noise criterion.
- The background noise level does not exceed the level appropriate for the particular locality and land use. This is known as the amenity criterion.

In order to satisfy the above two requirements, an intrusive and an amenity noise criterion is determined of which the lower is adopted as the project specific noise level.

5.1.1 Assessing Intrusiveness

For assessing intrusiveness, the background noise generally needs to be measured. The intrusiveness criterion essentially means that the equivalent continuous noise level (L_{Aeq}) of the source should not be more than 5 dBA above the measured (or default) Rating Background Level (RBL).

5.1.2 Assessing Amenity

The amenity assessment is based on noise criteria specific to the land use and associated activities. The amenity criteria are shown is **Table 11** and relate only to industrial-type noise and do not include road, rail or community noise. If present, the existing noise level from industry is generally 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. The cumulative effect of noise from industrial sources also needs to be considered in assessing the impact. The correction to be applied to the source to account for existing levels of industrial noise is shown in **Table 12**.

Table 11 Amenity Criteria - Recommended L_{Aeq} Noise Levels from Industrial Noise Sources

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

Notes: For Monday to Saturday, Daytime 7.00 am - 6.00 pm; Evening 6.00 pm - 10.00pm; Night-time 10.00 pm - 7.00 am.
On Sundays and Public Holidays, Daytime 8.00 am hours - 6.00 pm; Evening 6.00 pm - 10.00 pm; Night-time 10.00 pm - 8.00 am.

Table 12 Modification to Acceptable Noise Level (ANL)[1] to Account for Existing Level of Industrial Noise

Total existing LAeq noise level from industrial sources, dB(A)	Maximum LAeq noise level for noise from new sources alone, dB(A)
≥ Acceptable noise level plus 2	If existing noise level is likely to decrease in future: acceptable noise level minus 10 If existing noise level is unlikely to decrease in future: existing level minus 10
Acceptable noise level plus 1	Acceptable noise level minus 8
Acceptable noise level	Acceptable noise level minus 8
Acceptable noise level minus 1	Acceptable noise level minus 6
Acceptable noise level minus 2	Acceptable noise level minus 4
Acceptable noise level minus 3	Acceptable noise level minus 3
Acceptable noise level minus 4	Acceptable noise level minus 2
Acceptable noise level minus 5	Acceptable noise level minus 2
Acceptable noise level minus 6	Acceptable noise level minus 1
< Acceptable noise level minus 6	Acceptable noise level

Note 1: ANL = recommended acceptable LAeq noise level for the specific receiver, area and time of day from **Table 11**.

The overall noise criterion for noise emissions from the site is the lower of the intrusive and amenity criteria. Note that the intrusive criterion is applicable over any 15 minute period whereas the amenity level is applicable over the whole daytime, evening or night-time period, as appropriate.

5.1.3 INP Assessment of Prevailing Weather Conditions

Wind

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

When the source to receiver wind component is at speeds of up to 3 m/s for 30% or more of the time in any seasonal period (ie daytime, evening or night-time), then wind is considered to be a feature of the area and noise level predictions must be made under these conditions.

The NSW INP Section 5.3, Wind Effects, states that:

> *"Wind effects need to be assessed where wind is a feature of the area. Wind is considered to be a feature where source to receiver wind speeds (at 10 m height) of 3 m/s or below occur for 30 percent of the time or more in any assessment period in any season."*

An assessment of existing wind conditions has been prepared from the meteorological data recorded by the Bureau of Meteorology at the Horsley Park weather station for the period January 2007 to April 2010. This weather station is located approximately 17 km from the proposed RIRP and the recorded weather conditions are considered representative of those in the vicinity of the RIRP. The dominant seasonal wind speeds and wind directions are presented in **Appendix D.**

Any prevailing winds of speed less than (or equal to) 3 m/s with a frequency of occurrence greater than (or equal to) 30%, and considered to be a feature of the RIRP site in accordance with the INP, are presented in **Table 13**.

Table 13 Project Site Prevailing Wind Conditions in Accordance with the INP

	Winds ±45° ≤3m/s with Frequency of Occurrence ≥30%		
	Daytime	**Evening**	**Night-time**
Any Season	Nil	Nil	Nil

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 30% or more of the total night-time during winter or about two nights per week. The NSW INP states that temperature inversions need only be considered for the night-time noise assessment period ie 10.00 pm to 7.00 am.

Temperature Inversion

The NSW INP Section 5.2, Temperature Inversions, states:

> *"Assessment of impacts is confined to the night noise assessment period (10:00 pm to 7:00 am), as this is the time likely to have the greatest impact - that is, when temperature inversions usually occur and disturbance to sleep is possible."*
>
> *"Where inversion conditions are predicted for at least 30% (or approximately two nights per week) of total night-time in winter, then inversion effects are considered to be significant and should be taken into account in the noise assessment."*

In the absence of measured data, the INP nominates default inversion parameters for non-arid areas where the average rainfall is greater than 500 mm namely:

> *"3°C/100 m temperature inversion for all receivers, plus a 2 m/s source-to-receiver component drainage-flow wind speed for those receivers where applicable."*

An assessment of atmospheric stability has been prepared from the meteorological data set at Horsley Park and the evening and night-time frequency of occurrences of atmospheric stability classes for the period January 2007 to April 2010 are presented in **Table 14** together with the estimated Environmental Lapse Rates (ELR).

Table 14 Prevailing Atmospheric Stability Frequency - Evening and Night-time - January 2007 to April 2010

Stability Class	**Frequency of Occurrence**				**Estimated ELR °C/100 m**	**Qualitative Description**
	Summer	**Autumn**	**Winter**	**Spring**		
A	0.0%	0.0%	0.0%	0.0%	<-1.9	Lapse
B	0.0%	0.0%	0.0%	0.0%	-1.9 to -1.7	Lapse
C	0.0%	0.0%	0.0%	0.0%	-1.7 to -1.5	Lapse
D	56.9%	47.2%	50.8%	53.4%	-1.5 to -0.5	Neutral
E	8.1%	10.7%	12.2%	9.5%	-0.5 to 1.5	Weak Inversion
F	13.9%	16.4%	17.3%	16.4%	1.5 to 4	Moderate Inversion
G	21.1%	25.7%	19.7%	20.7%	>4.0	Strong Inversion
F + G	35.0%	42.0%	37.0%	37.1%	>1.5	Moderate to Strong Inversion

Note 1: ELR (Environmental Lapse Rate).

In accordance with the INP, as the frequency of occurrence of moderate to strong (ie 1.5 to >4.0˚C/100 m) winter temperature inversions are greater than 30% during the combined evening and night-time period, temperature inversion requires assessment.

5.1.4 Modifying Factors

Modifying factors are to be applied to the predicted noise levels if the source noise, at the receiver, is low frequency, tonal or intermittent in nature. No modifying factors need to be applied in the subject assessment.

5.1.5 Sleep Disturbance

The DECCW's most recent policy considers sleep disturbance as the emergence of the $L_{A1(1minute)}$ level above the $L_{A90(15minute)}$ level at the time. Appropriate screening criteria for sleep disturbance are determined to be an $L_{A1(1minute)}$ level 15 dBA above the Rating Background Level (RBL) for the night-time period (10.00 pm to 7.00 am).

When the criterion is not met, a more detailed analysis may be required which should cover the maximum noise level or $L_{A1(1minute)}$, the extent that the maximum noise level exceeds the background level and the number of times this occurs during the night-time period. Some guidance on possible impacts is contained in the review of research results in the appendices to the NSW Environmental Criteria for Road Traffic Noise (ECRTN).

Other factors that may be important in assessing the extent of impacts on sleep include:

- How often high noise events will occur.
- Time of day (normally between 10.00 pm and 7.00 pm).
- Whether there are times of the day when there is a clear change in the noise environment (such as during early morning shoulder periods).

It is noteworthy that there are no specific criteria for sleep disturbance nominated in the INP, in the INP Application Notes, the ECRTN, or in the ICNG. This is consistent with the statement in the ECRTN 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".*

A substantial portion of the ECRTN is a review of international sleep disturbance research, indicating that:

- A maximum internal noise levels below 50-55 dBA are unlikely to cause awakening reactions.
- One or two noise events per night with maximum internal noise levels 65-70 dBA are not likely to significantly affect health and wellbeing.

5.1.6 Additional DECCW Noise Assessment Information

The DECCW's recommended noise assessment criteria aim to limit potential intrusive noise emissions and preserve noise amenity. In cases where the limiting noise assessment criterion (in this case $L_{Aeq(15minute)}$ intrusiveness criterion) cannot be achieved, then practicable and economically feasible noise control measures should be applied. This usually requires demonstration that Best Achievable Technology and Best Environmental Management Practices have been implemented in order to mitigate adverse acoustical impacts.

In the event that the lowest achievable noise emission levels remain above the noise assessment criteria, the potential noise impact needs to be balanced and assessed against any economic and social benefits the project may bring to the community. It then follows that where the consenting authority may consider that the development does offer community benefits, then these may be grounds for permitting achievable noise emission levels as statutory compliance levels.

5.2 Project Specific Operational Noise Goals

The RIRP operational noise emission criteria have been set with reference to the INP, as outlined in **Section 5.1**.

The intrusiveness criteria have been set for the proposed hours of the RIRP operations based on the RBLs (refer to **Section 5.1.1**) at the surrounding residences.

To assist in the determination of the indicative noise amenity area and hence determine the amenity criteria the INP notes and Parramatta Draft LEP Zoning map were used. The zoning map has areas of ‘low density residential’, ‘medium density residential’ and ‘high density residential’ in the residential areas to the west of the site and west of James Rouse Drive. The single isolated receiver located west of the site 33 James Rouse Drive (RR1-BG2) is in an area zoned ‘enterprise corridor’.

For the INP indicative noise amenity areas presented in **Table 11** and consistent with definitions for these areas in the INP and the Parramatta Draft LEP, the residences west of James Rouse Drive are best described by the ‘suburban’ receiver type. Residences on James Rouse Drive and 33 James Rouse Drive are best described by the ‘urban’ receiver type.

The amenity criteria have been set in accordance with the INP using both the recommended $L_{Aeq(period)}$ contribution from industrial noise as presented in **Section 5.1.2** for receivers west of James Rouse Drive and 33 James Rouse Drive.

The resulting operational intrusive and amenity noise emission criteria are given in **Table 15**.

Table 15 INP Project Specific Noise Assessment Criteria (dBA re 20 µPa)

	Project Specific Assessment Criteria					
	Intrusive $L_{Aeq(15minute)}$			**Amenity $L_{Aeq(Period)}$**		
	Day	**Evening**	**Night**	**Day**	**Evening**	**Night**
BG1 240 George Street	51	51	46	52	51	39
BG2 33 James Ruse Drive	59	56	53	55	51	50
BG3a University of Western Sydney (Internal)[1]	58	58	52	55	55	55
BG3b University of Western Sydney (External)[2]	58	58	52	50	50	50

Note 1: The amenity criteria for the University of Western Sydney is based on the internal INP criterion of 35 dBA for schools and an external to internal noise reduction of 20 dBA for fixed (non-openable) windows.

Note 2: The amenity criteria for the University of Western Sydney is based on the external INP criterion of 50 dBA for passive recreation.

The overall noise criterion for noise emissions from the site is generally the lower of the intrusive and amenity criteria. Note that the intrusive criterion is applicable over any 15 minute period whereas the amenity level is applicable over the whole daytime, evening or night-time period, as appropriate.

The INP and Australian Standard AS/NZS 2107:2000 ‘*Acoustics – Recommended design sound levels and reverberation times for building interiors’* do not provide guideline values for internal noise levels in childcare centres. The Association of Australian Acoustical Consultants has a Technical Guideline - *Child Care Centre Noise Assessment* and this recommends an internal level of 40 dBA for playing and sleeping areas, which has been adopted for this assessment.

6 ROAD TRANSPORTATION NOISE ASSESSMENT PROCEDURE

Whilst operating on the project site, the assessment procedure for vehicle noise is as previously outlined in **Section 5**. That is, road vehicle noise contributions are included in the overall predicted $L_{Aeq(15minute)}$ RIRP operational noise emissions. On public roads, different noise assessment criteria apply to the vehicles, which would be regarded as "traffic", rather than as part of the RIRP operations noise sources.

In June 1999, the DECCW (then the EPA) issued a document entitled "*Environmental Criteria for Road Traffic Noise*". The ECRTN presents recommended road traffic noise criteria for various types of road and land use developments. James Ruse Drive performs the role of a sub-arterial road and Grand Avenue the role of a local road that carries traffic to/from James Ruse Drive from/to an Industrial complex.

In terms of the functional categories of roads, the DECCW's document states that:

> *"It is noted that some industries (such as mines and extractive industries) are, by necessity, in locations that are often not served by arterial roads. Heavy vehicles must be able to get to their bases of operation, and this may mean travelling on local roads. Good planning practice recognises that we must acknowledge this type of road use and develop ways of managing any associated adverse impacts. To this end, the concept of 'principal haulage routes' has been endorsed by the Department of Urban Affairs and Planning's North Coast Extractive Industries Standing Committee. Ways of identifying 'principal haulage routes' and managing associated adverse impacts have not yet been fully defined. Where local authorities identify a 'principal haulage route', the noise criteria for the route should match those for collector roads, recognising the intent that they carry a different level and mix of traffic to local roads."*

Grand Avenue can then be considered as 'Principal Haulage Route' therefore the collector criteria apply.

Based on the above, the relevant assessment criteria for the RIRP traffic are presented in **Table 16**.

Table 16 Road Traffic Noise Criteria

Type of Development	Criteria Daytime (0700 hrs to 2200 hrs)	Criteria Night-time (2200 hrs to 0700 hrs)	Where Criteria Are Already Exceeded
7. Land use developments with potential to create additional traffic on existing freeways / arterials roads	$L_{Aeq(15h)}$ 60	$L_{Aeq(9h)}$ 55	Where feasible, existing noise levels should be mitigated to meet the noise criteria. Examples of applicable strategies include appropriate location of private access roads; regulating times of use; using clustering; using 'quiet' vehicles; and using barriers and acoustic treatments. In all cases, traffic arising from the development should not lead to an increase in existing noise levels of more than 2dB.
8. Land use developments with potential to create additional traffic on collector roads	$L_{Aeq(1h)}$ 60	$L_{Aeq(1h)}$ 55	Where feasible and reasonable, existing noise levels should be mitigated to meet the noise criteria. Examples of applicable strategies include appropriate location of private access roads; regulating times of use; using clustering; using "quiet" vehicles; and using barriers and acoustic treatments. In all cases, traffic arising from the development should not lead to an increase in existing noise levels of more than 2dB.

Note: Total traffic noise contribution including existing and project related vehicle movements.

Note that in all cases where the nominated criteria are already exceeded, traffic associated with a new development should not be permitted to lead to an increase in the existing noise traffic levels of more than 2 dBA. This can be achieved when the project related percentage increase in existing light and heavy vehicle movements is generally no greater than 60%.

7 CONSTRUCTION AND OPERATIONAL NOISE ASSESSMENT

7.1 Prediction of Noise Emissions - General Discussion

In order to determine the acoustical impact of the RIRP construction and operations on the surrounding community, a computer model was developed which incorporates the significant noise sources and the intervening terrain to the closest potentially affected receivers.

The computer model was prepared using the SoundPLAN V7.0 Industrial Module, a commercial software system developed by Braunstein and Berndt GmbH in Germany. The software allows the use of various internationally recognised noise prediction algorithms. The CONCAWE algorithm, suitable for the assessment of large industrial plants, has been selected for this assessment as it also enables meteorological influences to be assessed.

The noise modelling takes into account source sound level emissions and locations, screening effects, receiver locations, meteorological effects, ground topography and noise attenuation due to spherical spreading and atmospheric absorption.

Noise predictions were calculated to eleven receiver locations representing the closest potential noise affected receivers to the RIRP plant and equipment. The receiver locations are similar to the locations where the background noise levels where monitored and are outlined in **Table 17** and shown on the Receiver Locality Map in **Appendix B**.

Table 17 Receiver Locations for Operational Noise Assessment

Type	Name	Address	Representative Locality
Residential	RR1 - BG2	33 James Ruse Drive	West
	RR2	43 Oak Street	West South-west
	RR3	135 Arthur Street	West
Industrial	IR1	3/175 James Ruse Dr	West
	IR2	1 to 9 Grand Avenue	South
	IR3	11 Grand Avenue	South-east
	IR4	11B Grand Avenue	East
Educational	CR1 – BG3	University of Western Sydney, 171 Victoria Road	North North-West
Commercial	CR2	Child Care Centre, 1C Grand Avenue	South
	CR3	Hooters Restaurant, 132 James Ruse Drive	East
	CR4	Bowling Club, 110A Hassall Street	East

7.2 Prediction of Noise Emissions - Construction

7.2.1 Construction Scenarios

Based on our understanding of the RIRP Project, construction is planned to be undertaken sequentially. The proposed construction works for the RIRP can be summarised by the following scenarios listed in **Table 18**.

Table 18 Construction Scenarios and Equipment

Scenario	Equipment	Number of unit
Site preparation - Earthworks	30t excavator	2
	Dump truck	1 (per 15 minutes)
	Dozer	2
	Water cart	1
	Roller	1
	Grader	1
SSORRF and CIRRF Building Construction	Delivery truck	1 (per 15 minutes)
	Dump truck	1 (per 15 minutes)
	Crane	2
	Concrete pump	1
	Concrete truck	2
	Backhoe	2
	30t excavator	2
Services, water, sewer, electricity, stormwater installation	30t excavator	2
	Backhoe	2
	Delivery truck	1 (per 15 minutes)
	Dump truck	1 (per 15 minutes)
	Compactors	2
External paving	Delivery truck	1 (per 15 minutes)
	Concrete pump	1
	Concrete truck	2

7.2.2 Equipment sound power levels

A list of the Sound Power Levels (SWLs) for the equipment listed in **Table 18** has been sourced from the SLR Consulting in-house noise source database and is shown in **Table 19**.

Table 19 Construction Plant and Equipment Sound Power Levels (SWL)

Plant Item	Sound Power Level
Dump Truck	108 dBA
Excavator - 30 t	109 dBA
Concrete Truck	108 dBA
Concrete Pump	105 dBA
Delivery truck	105 dBA
Crane	110 dBA
Backhoe	101 dBA
Dozer	108 dBA
Roller	104 dBA
Grader	114 dBA
Water cart	98 dBA
Compactor	108 dBA

It should be noted that the sound power levels given for each item of mobile equipment do not include noise emissions which emanate from reversing alarms. In the event that reversing alarm noise is considered to be a source of disturbance, the alarm noise level should be checked against the appropriate regulatory and health and safety requirements and the necessary mitigating action taken in order to achieve an acceptable noise reduction without compromising safety standards.

7.2.3 Noise Impact Assessment - Construction

The two noisiest scenarios have been modelled (Site preparation - Earthworks and SSORRF and CIRRF buildings construction). The output results from the RIRP construction noise model are presented in **Table 20** together with the relevant $L_{Aeq(15minute)}$ construction noise management levels for each noise assessment location. A daytime $L_{Aeq(15minute)}$ noise contour diagram for the 'worst-case' construction scenario (SSORRF and CIRRF buildings construction) is presented in **Appendix F1**.

Table 20 Predicted Daytime RIRP Construction Noise Levels - dBA re 20 µPa

Noise Assessment Location	Predicted $L_{Aeq(15minute)}$ Noise Level		Recommended Standard Hours Management Level
	Earthworks Scenario	SSORRF and CIRRF Construction Scenario	
RR1 - 33 James Ruse Drive	52	53	64
RR2 - 43 Oak Street	43	44	64
RR3 - 135 Arthur Street	40	42	56
IR1 - 3/175 James Ruse Dr	57	58	75
IR2 - 1 Grand Avenue	67	70	75
IR3 - 11 Grand Avenue	62	64	75
IR4 - 11B Grand Avenue	67	67	75
CR1a - University of Western Sydney (Internal) [1]	42	44	65
CR1b - University of Western Sydney (External)	42	44	60
CR2 - Child Care Centre[1]	64	65	65
CR3 - Hooters Restaurant[1]	46	48	65
CR4 - Bowling Club[1]	44	46	65

Note 1: 65 dBA external noise level is assumed to correspond to an internal noise level of 45 dBA, based on a 20 dBA noise reduction from outside to inside for a building with fixed (non-openable) windows.

Discussion

Noise emissions from earthworks and concreting construction activities during daytime recommended Standard Hours are predicted to meet the $L_{Aeq(15minute)}$ criteria at all receivers. It is noted whilst compliance is 'just' achieved at the childcare centre, the 20 dBA noise reduction from outside to inside is conservative and is likely to be exceeded by the centre.

7.3 Prediction of Noise Emissions - Operations

7.3.1 Meteorological Parameters

The noise modelling meteorological parameters presented in **Table 21** are based on the meteorological conditions presented in **Section 5.1.3**.

Table 21 Operational Noise Modelling Meteorological Parameters

Season	Period	Air Temp	Relative Humidity	Wind Velocity	Temperature Gradient
Non-adverse Annual	Daytime	18°C	60%	0m/s	0°C/100m
Non-Adverse Annual	Evening	14°C	70%	0m/s	0°C/100m
Non-Adverse Annual	Night-time	10°C	90%	0m/s	0°C/100m
Adverse Winter	Night-time	10°C	90%	0m/s	3°C/100m

7.3.2 Equipment operating

The noise sources at the RIRP are as listed in **Table 22**.

Table 22 Operational Plant

Location	Equipment	Number of units
CIRRF Building	Crusher	1
	FEL	3
	Wheeled Grab	1
	Fork lift	1
	Hopper	2
	Screens	2
	Baler	1
	Tunnel fan	1 per tunnel unit
	Hallway Fan	1
SSORRF Building	Hopper	1
	De-compactor	1
	Shredder	1
	FEL	2
	Screens	2
	Tunnel fan	1 per tunnel unit
	Hallway Fan	1
Biofilter unit	Biofilter Fan	1 per Biofilter unit

Hours of operation

Apart from the blowers (Biofilter fans and Tunnel Fans), operating 24 hours over 7 days, all other equipment will be operating from 6.00 am to 10.00 pm.

On site transports trucks

In accordance with the INP, trucks and cars travelling on the site access road are included in site noise emissions.

Trucks have been modelled travelling from the site entrance to the proposed RIRP site as well as light vehicles travelling to the car park. The morning shift has 40 employees. It has been assumed that 80% of the employees will arrive or leave site with their own car.

It has been assumed that a maximum of 3 trucks will be entering and leaving the site in 15 minutes (6 truck movements/15 minutes) and 32 cars will be entering or leaving the site in 15 minutes (32 car movements/15 minutes).

A combination of the plant listed in **Table 22**, operating simultaneously, has been adopted as a conservative 'worst-case' existing operational scenario. **Appendix C** shows the proposed plant layout.

7.3.3 Equipment Sound Power Levels

Based on the information provided by NECS, AP Business & Technology Consultancy and SLR Consulting database, the sound power levels (SWL) listed in **Table 23**, have been adopted for this study.

Table 23 Equipment Plant and Associated Sound Power Levels

Equipment	Sound Power Levels (per unit)
Crusher	110 dBA
FEL	106 dBA
Wheeled Grab	106 dBA
Fork Lift	101 dBA
Hopper	104 dBA
Screen	110 dBA
Baler	105 dBA
Tunnel Fan	89 dBA
De-compactor	105 dBA
Shredder	110 dBA
Biofilter Fan	92 dBA
Hallway fan	92 dBA
On site car	94 dBA
On site truck	105 dBA
Truck reversing alarm[1]	110 dBA

Note 1: Typical truck reversing alarm is 105 dBA – 115 dBA and for the purpose of this assessment is assumed to be 110 dBA.

7.3.4 Operational Scenarios Modelled

The following operational scenarios were modelled:

- RIRP Operations - Daytime Calm
- RIRP Operations - Evening Calm
- RIRP Operations - Night-time Calm
- RIRP Operations - Night-time Adverse

The operational scenario modelled for this assessment comprised the following concurrent operations presented in **Table 24**.

Table 24 Operational Scenarios and Equipment Operating

Operational Scenarios	Period of Day	Equipment operating	On Site traffic
1	Daytime Calm	CIRRF Building, SSORRF Building, Biofilter Fans, Tunnel Fans	Up to 6 truck movements/15 minutes Up to 32 car movements/ 15 minutes
2	Evening Calm	CIRRF Building, SSORRF Building, Biofilter Fans, Tunnel Fans	Up to 6 truck movements/ 15 minutes Up to 5 car movements / 15 minutes
3	Night-time Calm	Biofilter Fans, Tunnel Fans, reduced operation of CIRRF Building and SSORRF Building	Up to 1 truck movements/ 15 minutes Up to 16 car movements/ 15 minutes
4	Night-time Adverse	Biofilter Fans, Tunnel Fans, reduced operation of CIRRF Building and SSORRF Building	Up to 1 truck movements/ 15 minutes Up to 16 car movements/ 15 minutes

Within the noise model, operations consisted of all plant items operating concurrently in order to simulate the overall maximum potential noise emission.

7.3.5 Noise Impact Assessment - Operations

Predicted $L_{Aeq(15minute)}$ noise level contributions from the 'worst case' proposed operations of the RIRP together with the respective criteria at the eleven assessment locations are presented in **Table 25**. Predicted $L_{A1(1minute)}$ noise level contributions to assess sleep disturbance are presented in **Table 26** together with the respective criteria at the three residential locations.

Table 25 Predicted RIRP $L_{Aeq(15minute)}$ Noise Levels - dBA re 20 µPa

	Existing Predicted LAeq(15minute) Noise Level				LAeq(15minute) Noise Criteria		
	Daytime Calm	Evening Calm	Night-time Calm	Night-time Adverse	Daytime	Evening	Night-time
RR1	49	49	46	48	55	51	50
RR2	37	37	36	38	55	51	50
RR3	33	33	32	35	51	51	39
IR1	50	50	47	48	70	70	70
IR2	59	59	57	57	70	70	70
IR3	57	57	55	55	70	70	70
IR4	59	60	57	57	70	70	70
CR1a[1]	34	34	33	36	55	55	55
CR1b[2]	34	34	33	36	50	50	50
CR2[3]	58	59	55	55	60	60	60
CR3	40	40	38	40	65	65	65
CR4	38	37	36	39	65	65	65

Note 1: The noise criteria for the University of Western Sydney is based on the internal INP criterion of 35 dBA for schools and an external to internal noise reduction of 20 dBA for fixed (non-openable) windows.|

Note 2: The noise criteria for the University of Western Sydney is based on the external INP criterion of 50 dBA for passive areas.

Note 3: The INP does not contain noise criterion for Childcare Centres. In this instance an internal noise level of 40 dBA has been adopted, which is applicable to sleeping areas. The external 60 dBA goal is based on fixed windows to the childcare centre.

Table 26 Predicted RIRP $L_{A1(1minute)}$ – Sleep Disturbance - dBA re 20 µPa

	Predicted $L_{A1(1minute)}$ Noise Level		$L_{A1(1minute)}$ Sleep Disturbance Criteria
	Night-time Calm	Night-time Adverse	Night-time
RR1	57	58	63
RR2	44	47	63
RR3	39	43	56
IR1[1]	N/A	N/A	N/A
IR2[1]	N/A	N/A	N/A
IR3[1]	N/A	N/A	N/A
IR4[1]	N/A	N/A	N/A
CR1a[1]	N/A	N/A	N/A
CR1b[1]	N/A	N/A	N/A
CR2[1]	N/A	N/A	N/A
CR3[1]	N/A	N/A	N/A
CR4[1]	N/A	N/A	N/A

Note 1 : N/A - Sleep disturbance apply to residences only.

Discussion

Review of **Table 25** indicates that the operational noise emissions from the proposed RIRP are predicted to be below the noise criteria at all of the noise assessment locations. Compliance is predicted for daytime, evening and night-time. $L_{Aeq(15minute)}$ noise contour diagrams for the daytime and night-time operational scenarios are presented in **Appendix F2** and **Appendix F3** respectively.

It is noted that the criteria presented in **Table 25** is the lower of the amenity and intrusive criteria. In this case the intrusive 15 minute noise levels have been calculated as a worse case scenario in a conservative approach. Amenity noise levels would be expected to be 3 dBA to 5 dBA lower than the intrusive noise levels.

In relation to the potential for sleep disturbance, the DECCW's INP Application Notes, as presented in **Section 5.1.5**, suggests that the $L_{A1(1minute)}$ noise level from any specific noise (ideally) should not exceed the L_{A90} background noise level by more than 15 dBA.

A review of noise events from the RIRP operations shows that the $L_{A1(1minute)}$ noise levels comply with the DECCW's sleep disturbance criterion.

Furthermore the noise levels from a truck reversing alarm at RR1 are predicted to be 54 dBA, being 9 dBA below the criteria. It is noted whilst the sleep disturbance criteria is clearly met the alarm might be audible. In the event that reversing alarm noise is considered to be a source of disturbance, the alarm noise level should be checked against the appropriate regulatory and health and safety requirements and the necessary mitigating action taken to achieve an acceptable noise reduction without compromising safety standards.

8 ROAD TRAFFIC NOISE ASSESSMENT

8.1 Prediction of Noise Emissions - General Discussion

In order to assess the potential impact of traffic noise at existing residences from the RIRP, noise level calculations were carried out using the UK Department of Transport, *"Calculation of Road Traffic Noise"* (CORTN 1988) algorithms. The modelling allows for traffic volume and mix, type of road surface, vehicle speed and ground absorption. The algorithm output of CORTN has been modified to calculate the relevant L_{Aeq} road traffic noise emission descriptors, as required.

The calculated noise levels are determined by taking into account overall traffic volumes, vehicle speed, percentage of heavy vehicles and the distance between roadway and the receiver and includes a 2.5 dBA facade reflection.

In accordance with the ECRTN traffic noise levels at residences on access roads to the site are predicted with and without the contribution of the subject site associated traffic.

It should be noted that relevant criteria for James Ruse Drive is a daytime 15 hours and night-time 9 hours criteria, therefore the assessment for this road will be based on the Annual Average Daily Traffic data. Relevant criteria for Grand Avenue are a daytime 1 hour and night-time 1 hour criteria, therefore the assessment for this road will be based on the peak hourly traffic data.

8.2 Traffic Movements

Traffic movements on James Ruse Drive have been sourced from the RTA website. Traffic movements on Grand Avenue and traffic movements generated by the RIRP were sourced or estimated from the Traffic Impact Assessment report from Traffix together with the information provided by NECS and assumption based on traffic measurements at 33 James Drive.

The existing and additional traffic movements on James Ruse Drive and Grand Avenue are presented in **Table 27** and **Table 28** on an average daily and peak hourly basis respectively.

Table 27 Estimate average Daily Traffic Movements - James Ruse Drive

Time Period	Existing traffic	Additional Traffic generated by RIRP	Total Cumulative Traffic	% Contribution of Traffic generated by RIRP
Day (7.00 am to 10.00 pm)	57,867[1]	207[2]	58,074	0.36
Night (10.00 pm to 7.00 am)	9,267[1]	83[2]	9,350	0.89
24h	67,133	290	67,423	0.43

Note 1: Source AADT 2005 traffic flows.

Note 2: Source Traffic information provided by NECS. It is also assumed that 80% of the employees will arrive or leave site with their own car.

Table 28 Estimated Peak Hourly Traffic Movements - Grand Avenue

Peak Period	Existing Traffic			Additional Traffic generated by RIRP			Cumulative total			% Contribution of Traffic generated by RIRP		
	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total
Night-time 5.00 am - 6.00 am	219[2]	40[2]	258	32[4]	6[4]	38	251	46	296	12.8	13.2	12.8
Night-time 6.00 am - 7.00 am	311[2]	51[2]	362	5[4]	8[4]	13	316	59	375	1.6	13.5	3.5
Daytime 7.15 am - 8.15 am	466[1]	77[1]	543	0[4]	12[4]	12	466	89	555	0	13.5	2.2
Daytime 8.00 am- 9.00 am	405[1]	87[1]	492	0[4]	18[4]	18	405	105	510	0	17.1	3.5
Daytime 2.00 pm - 3.00 pm	540[2]	116[2]	656	32[4]	22[4]	54	572	138	710	5.6	15.9	7.6
Daytime 4.30 pm - 5.30 pm	103[1]	74[1]	177	0[4]	12[4]	12	103	86	189	0	14.0	6.3

Note 1: Source from Traffix's Traffic Impact Assessment.

Note 2: Traffic estimated from logger results and Traffix's Traffic Impact Assessment.

Note 3: Assume trucks' speed of 40 km/h and cars' speed of 50km/h.

Note 4: Source Traffic information provided by NECS. Furthermore, it has been assumed that workers will arrive during the hour preceding the change of shift work and will leave during the hour following the change of shift work.

8.3 Traffic Noise Impact Assessment

According to the ECRTN (EPA, 1999) described in **Section 6**, traffic associated with the development should comply with the baseline criteria, and when this is exceeded the traffic associated with the development should not lead to an increase in the existing noise traffic levels of more than 2 dBA. Note, a 2 dBA increase is typically achieved when the project related percentage increase in light and heavy vehicles movements is no greater than 60% of the existing flows.

James Ruse Drive

Predicted noise levels for residences on James Ruse Drive have not been calculated given that the average daily percentage increase in light and heavy vehicles movements on these roads is predicted to be less than 1%. The associated increase in noise level will be significantly less than 1 dBA, complying with the 2 dBA allowance criterion.

Grand Avenue

There is only one residence potentially affected by RIRP trucks on Grand Avenue. The house is located at 33 James Ruse Drive, 46 m away from Grand Avenue and a noise logger was installed at that location to capture the ambient noise. The logger installed at 33 James Ruse Drive is representative of traffic noise occurring mainly on Grand Avenue. **Table 29** below shows the results of the traffic noise. The nominated criteria are already exceeded for both daytime and night-time; therefore traffic associated with the RIRP should not be permitted to lead to an increase in the existing noise traffic levels of more than 2 dBA. .

Table 29 Traffic $L_{Aeq(1hour)}$ Measured at 33 James Ruse Drive and Corresponding Estimated Increase in Noise Levels due to Traffic Generated by RIRP

Peak Period	$L_{Aeq(1hour)}$	Increase in noise level generated by traffic from the RIRP
Night-time 5.00 am - 6.00 am	60	0.6 dBA
Night-time 6.00 am - 7.00 am	62	0.4 dBA
Daytime 7.15 am - 8.15 am	64	0.3 dBA
Daytime 8.00 am - 9.00 am	64	0.5 dBA
Daytime 2.00 pm - 3.00 pm	65	0.6 dBA
Daytime 4.30 pm - 5.30 pm	63	0.5 dBA

Discussion

The existing traffic noise levels exceed the baseline ECRTN criteria of 60 dBA and 55 dBA for daytime and night-time respectively. The traffic noise increase of up to 0.6 dBA for both daytime and night-time complies with the 2 dBA allowable increase.

9 CONCLUSION

REMONDIS Pty Ltd is proposing to operate an integrated Alternative Waste Treatment (AWT) facility at Camellia to be known as the REMONDIS Integrated Recycling Park (RIRP). SLR Consulting has been commissioned by National Environmental Consulting Services (NECS) to undertake a noise assessment for the construction and operation (including traffic noise) of the RIRP, for inclusion in their Environmental Assessment (EA). The results of the study are summarised in the following points:

- An ambient noise survey was conducted and design criteria for operational noise developed in accordance with the NSW DECCW's Industrial Noise Policy. For residences, a daytime goal of 51 dBA to 55 dBA, evening goal of 51 dBA and night-time goal of 39 dBA to 50 dBA were set. Goals where also set for the nearby childcare centre, the University of Western Sydney and commercial and industrial receivers.
- Predicted operational daytime, evening and night-time noise levels comply with the design goals at existing residences, childcare centre, University of Western Sydney and commercial and industrial receivers.
- Changes to traffic noise levels as a result of the project comply with the NSW DECCW's Environmental Criteria for Road Traffic Noise.
- Noise levels predicted for construction activities comply with design criteria developed in accordance with the NSW DECCW's Interim Construction Guideline.

10 CLOSURE

This report has been prepared by SLR Consulting Australia Pty Ltd with all reasonable skill, care and diligence, and taking account of the manpower and resources devoted to it by agreement with the client. Information reported herein is based on the interpretation of data collected and has been accepted in good faith as being accurate and valid.

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

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

ACOUSTIC TERMINOLOGY

1. Sound Level or Noise Level

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

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

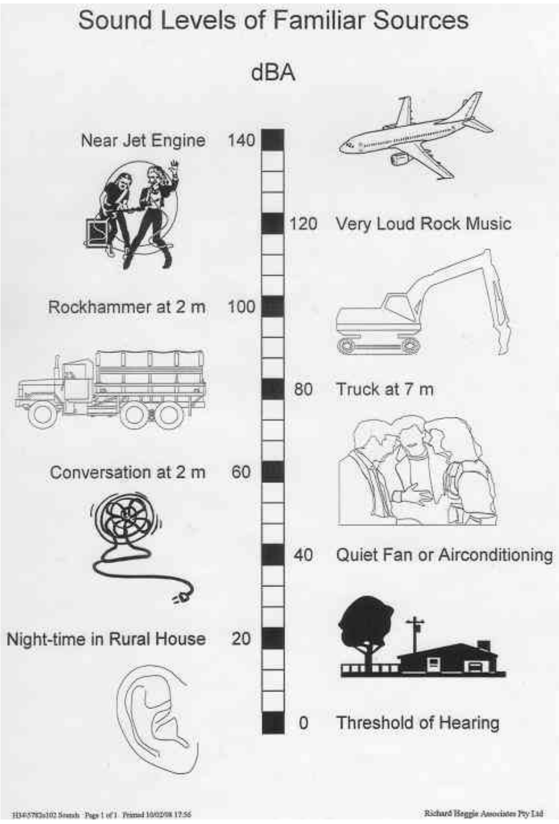
The symbols SPL, L or L_P are commonly used to represent Sound Pressure Level. The symbol L_A represents A-weighted Sound Pressure Level. The standard reference unit for Sound Pressure Levels expressed in decibels is 2 x 10^{-5} Pa.

2. "A" Weighted Sound Pressure Level

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

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

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



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

3. Sound Power Level

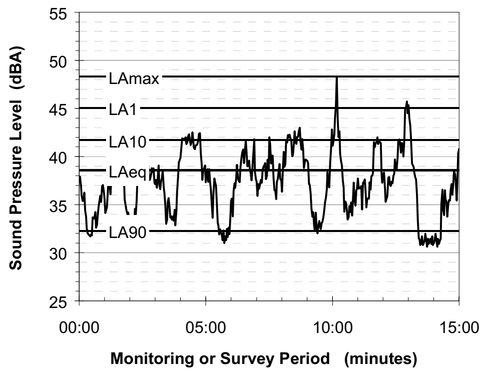
The Sound Power of a source is the rate at which it emits acoustic energy. As with Sound Pressure Levels, Sound Power Levels are expressed in decibel units (dB or dBA), but may be identified by the symbols SWL or L_W, or by the reference unit 10^{-12} W.

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

4. Statistical Noise Levels

Sounds that vary in level over time, such as road traffic noise and most community noise, are commonly described in terms of the statistical exceedance levels L_{AN}, where L_{AN} is the A-weighted sound pressure level exceeded for N% of a given measurement period. For example, the L_{A1} is the noise level exceeded for 1% of the time, L_{A10} the noise exceeded for 10% of the time, and so on.

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



Of particular relevance, are:

L_{Amax}	The maximum noise level during the 15 minute interval
L_{A1}	The noise level exceeded for 1% of the 15 minute interval.
L_{A10}	The noise level exceed for 10% of the 15 minute interval. This is commonly referred to as the average maximum noise level.
L_{A90}	The noise level exceeded for 90% of the sample period. This noise level is described as the average minimum background sound level (in the absence of the source under consideration), or simply the background level.
L_{Aeq}	The A-weighted equivalent noise level (basically the average noise level). It is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.

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

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

5. Tonality

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

6. Impulsiveness

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

7. Frequency Analysis

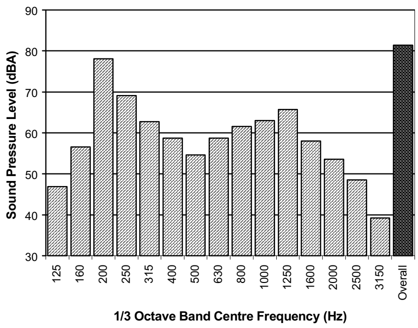
Frequency analysis is the process used to examine the tones (or frequency components) which make up the overall noise or vibration signal. This analysis was traditionally carried out using analogue electronic filters, but is now normally carried out using Fast Fourier Transform (FFT) analysers.

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

Frequency analysis can be in:

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

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



8. Vibration

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

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

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

The common units for velocity are millimetres per second (mm/s). As with noise, decibel units can also be used, in which case the reference level should always be stated. A vibration level V, expressed in mm/s can be converted to decibels by the formula 20 log (V/V_o), where V_o is the reference level (10^{-9} m/s). Care is required in this regard, as other reference levels may be used by some organizations.

9. Human Perception of Vibration

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

10. Over-Pressure

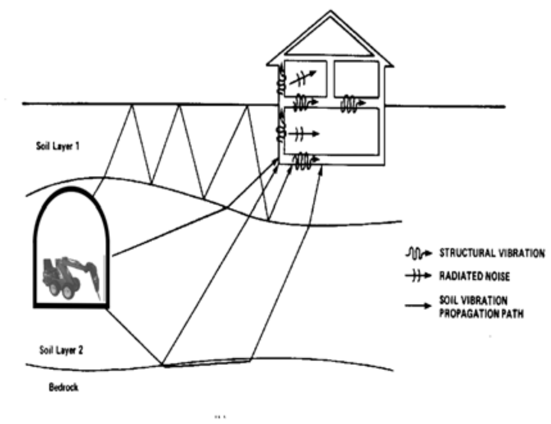
The term “over-pressure” is used to describe the air pressure pulse emitted during blasting or similar events. The peak level of an event is normally measured using a microphone in the same manner as linear noise (ie unweighted), at frequencies both in and below the audible range.

11. Ground-borne Noise, Structure-borne Noise and Regenerated Noise

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

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

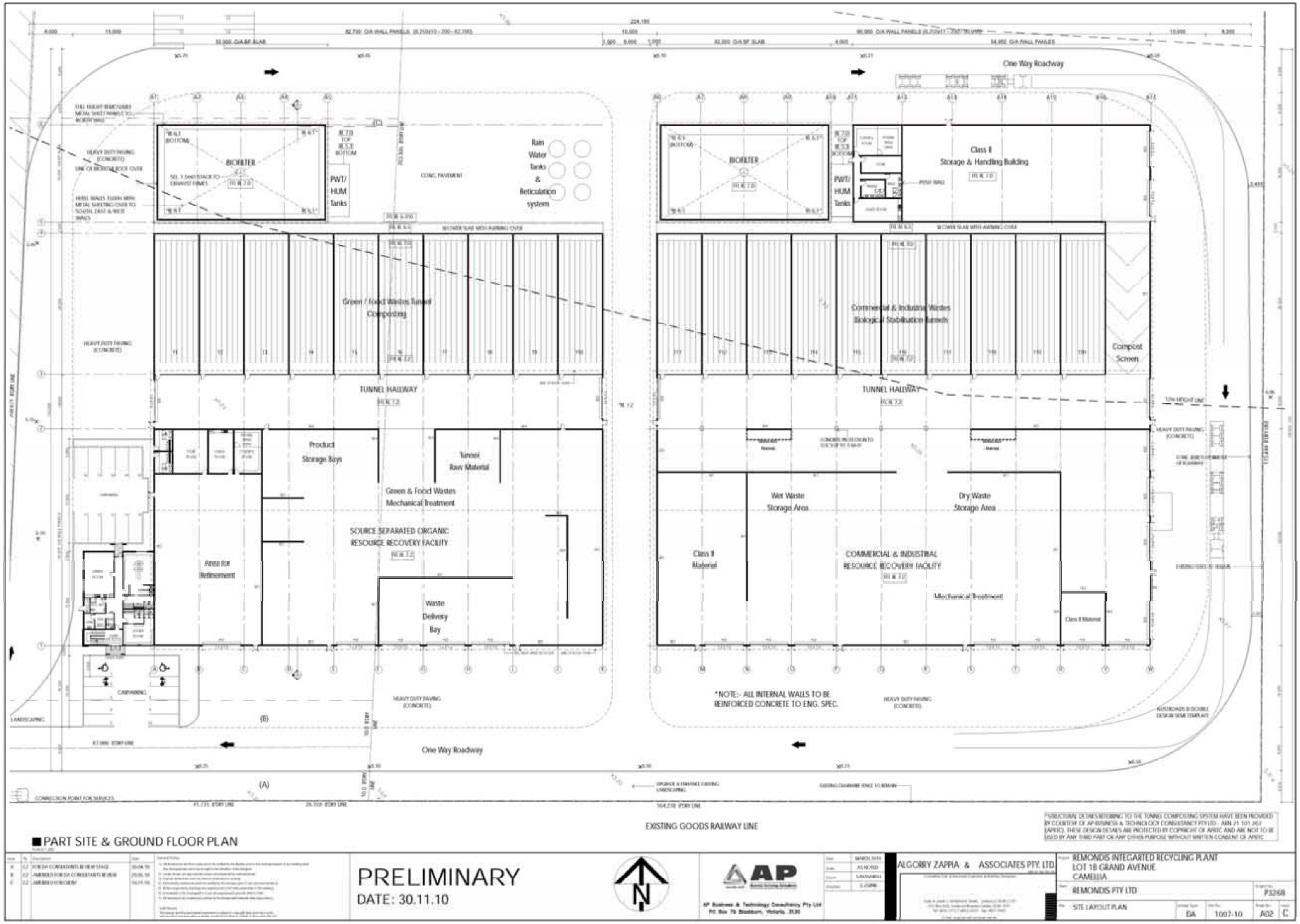
The following figure presents the various paths by which vibration and ground-borne noise may be transmitted between a source and receiver for construction activities occurring within a tunnel.



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

LOCALITY PLAN AND SENSITIVE RECEIVERS

RIRP LAYOUT


One Way Roadway
BIOFILTER
PWT/ HUM Tanks
Rain Water Tanks & Reticulation system
Class II Storage & Handling Building
Green / Food Wastes Tunnel Composting
Commercial & Industrial Wastes Biological Stabilisation Tunnels
Compost Screen
TUNNEL HALLWAY
Product Storage Bays
Tunnel Raw Material
Green & Food Wastes Mechanical Treatment
SOURCE SEPARATED ORGANIC RESOURCE RECOVERY FACILITY
Area for Refinement
Waste Delivery Bay
Wet Waste Storage Area
Dry Waste Storage Area
Class II Material
COMMERCIAL & INDUSTRIAL RESOURCE RECOVERY FACILITY
Mechanical Treatment
Class II Material
HEAVY DUTY PAVING (CONCRETE)
CARPARKING
LANDSCAPING
*NOTE:- ALL INTERNAL WALLS TO BE REINFORCED CONCRETE TO ENG. SPEC.
EXISTING GOODS RAILWAY LINE
PART SITE & GROUND FLOOR PLAN
PRELIMINARY
DATE: 30.11.10
AP Business & Technology Consultancy Pty Ltd
ALGORRY ZAPPIA & ASSOCIATES PTY. LTD.
REMONDIS INTEGARTED RECYCLING PLANT
LOT 1B GRAND AVENUE
CAMELLIA
REMONDIS PTY LTD
SITE LAYOUT PLAN
P3268
DA
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HORSLEY PARK WEATHER CONDITIONS - JANUARY 2007 TO APRIL 2010

Table 1 Seasonal Frequency of Occurrence Wind Speed Intervals – Daytime

Period	Calm (<0.5 m/s)	Wind Direction ±(45°)	Wind Speed		
			0.5 to 1.5 m/s	1.5 to 3 m/s	0.5 to 3 m/s
Summer	1.8%	N	4.6%	6.2%	10.8%
Autumn	4.6%	NNW	8.6%	7.3%	15.9%
Winter	6.3%	NW	9.5%	9.2%	18.7%
Spring	0.8%	NNW	4.4%	6.1%	10.5%

Table 2 Seasonal Frequency of Occurrence Wind Speed Intervals - Evening

Period	Calm (<0.5 m/s)	Wind Direction ±(45°)	Wind Speed		
			0.5 to 1.5 m/s	1.5 to 3 m/s	0.5 to 3 m/s
Summer	4.2%	E	5.4%	9.6%	15.0%
Autumn	11.6%	SW	6.9%	11.0%	18.0%
Winter	11.9%	W	7.8%	11.6%	19.5%
Spring	8.0%	SSE	5.4%	8.4%	13.7%

Table 3 Seasonal Frequency of Occurrence Wind Speed Intervals - Night-time

Period	Calm (<0.5 m/s)	Wind Direction ±(45°)	Wind Speed		
			0.5 to 1.5 m/s	1.5 to 3 m/s	0.5 to 3 m/s
Summer	21.2%	SSW	10.4%	14.6%	25.0%
Autumn	23.0%	WSW	12.8%	13.5%	26.3%
Winter	16.5%	WNW	15.4%	9.2%	24.5%
Spring	18.5%	SW	10.6%	11.7%	22.3%

Table 4 Summary

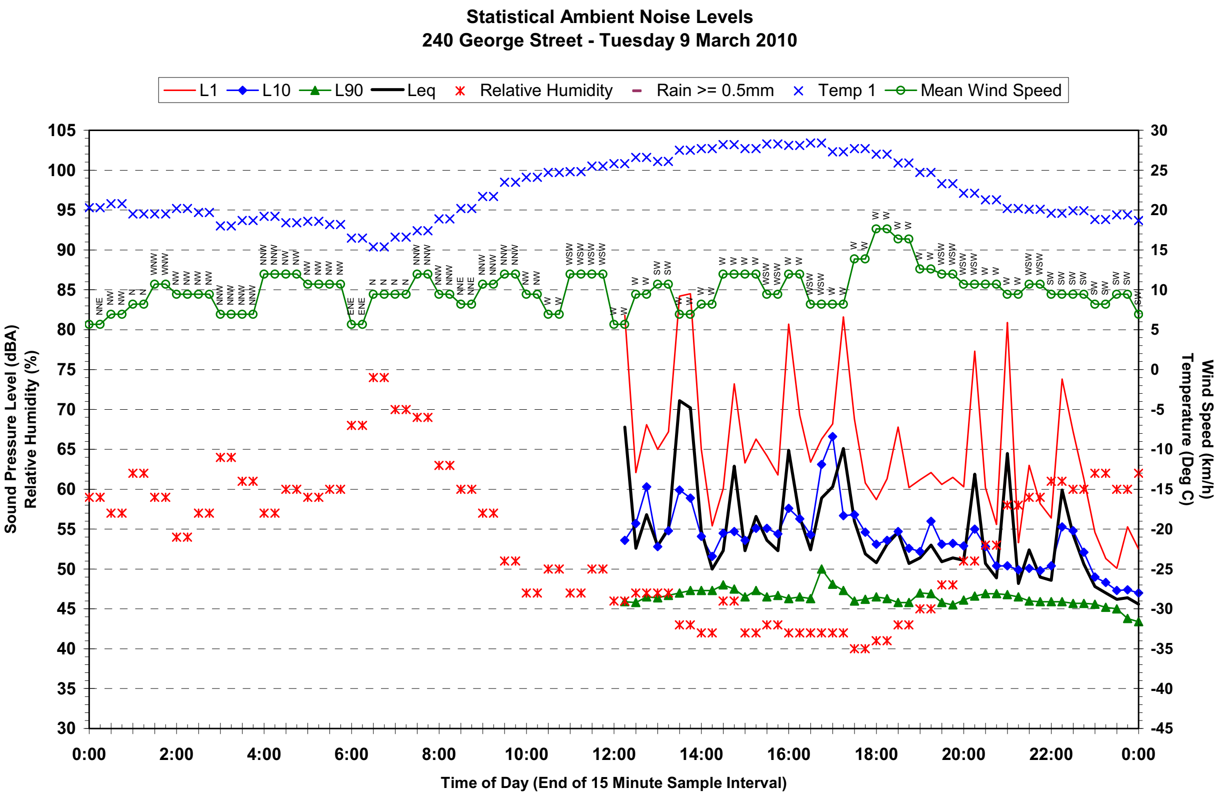
Season	Winds ±45o ≤3m/s with Frequency of Occurrence ≥30%		
	Daytime	Evening	Night-Time
Summer	Nil	Nil	Nil
Autumn	Nil	Nil	Nil
Winter	Nil	Nil	Nil
Spring	Nil	Nil	Nil

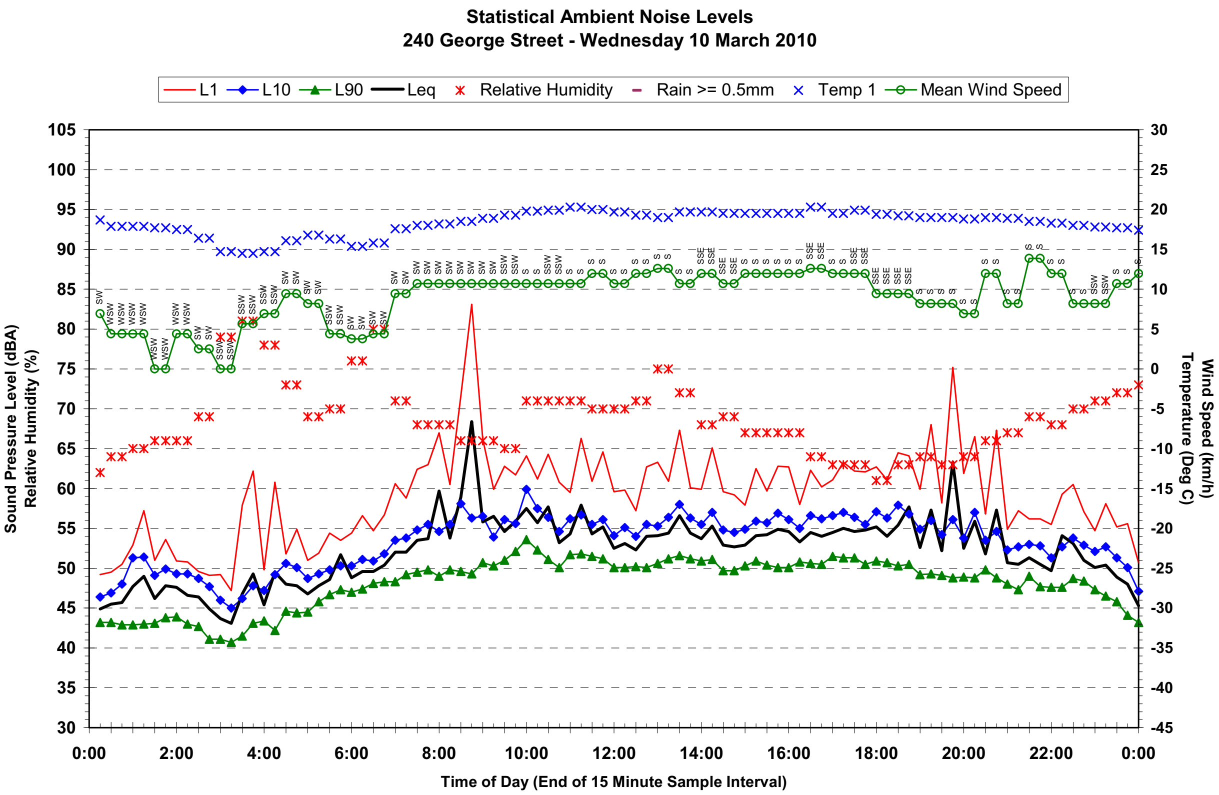
Table 5 Frequency of Occurrence of Atmospheric Stability Classes - Evening and Night-time

Stability Class	Frequency of Occurrence				Estimated ELR oC/100 m	Qualitative Description
	Summer	Autumn	Winter	Spring		
A	0.0%	0.0%	0.0%	0.0%	<-1.9	Lapse
B	0.0%	0.0%	0.0%	0.0%	-1.9 to -1.7	Lapse
C	0.0%	0.0%	0.0%	0.0%	-1.7 to -1.5	Lapse
D	56.9%	47.2%	50.8%	53.4%	-1.5 to -0.5	Neutral
E	8.1%	10.7%	12.2%	9.5%	-0.5 to 1.5	Weak inversion
F	13.9%	16.4%	17.3%	16.4%	1.5 to 4	Moderate inversion
G	21.1%	25.7%	19.7%	20.7%	>4.0	Strong inversion
F+G	35.0%	42.0%	37.0%	37.1%		Moderate to strong inversion

Note: ELR (Environmental Lapse Rate).

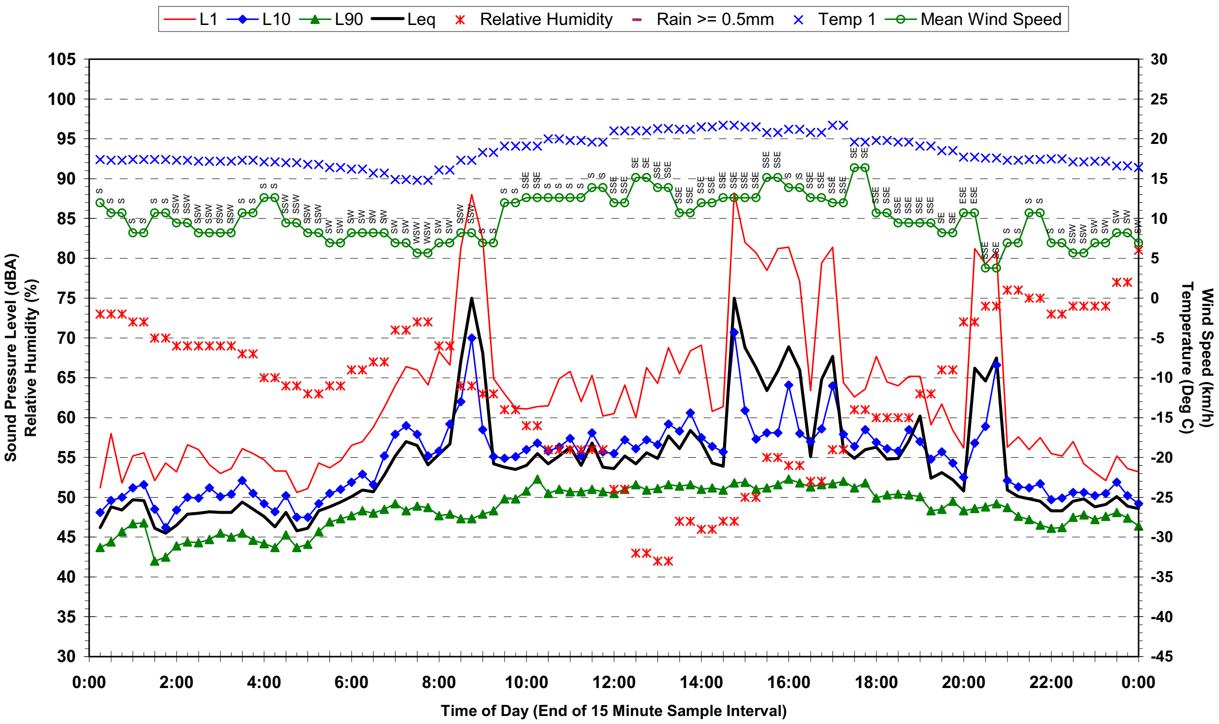
UNATTENDED AMBIENT NOISE AND WEATHER DATA – BG1: 240 GEORGE STREET



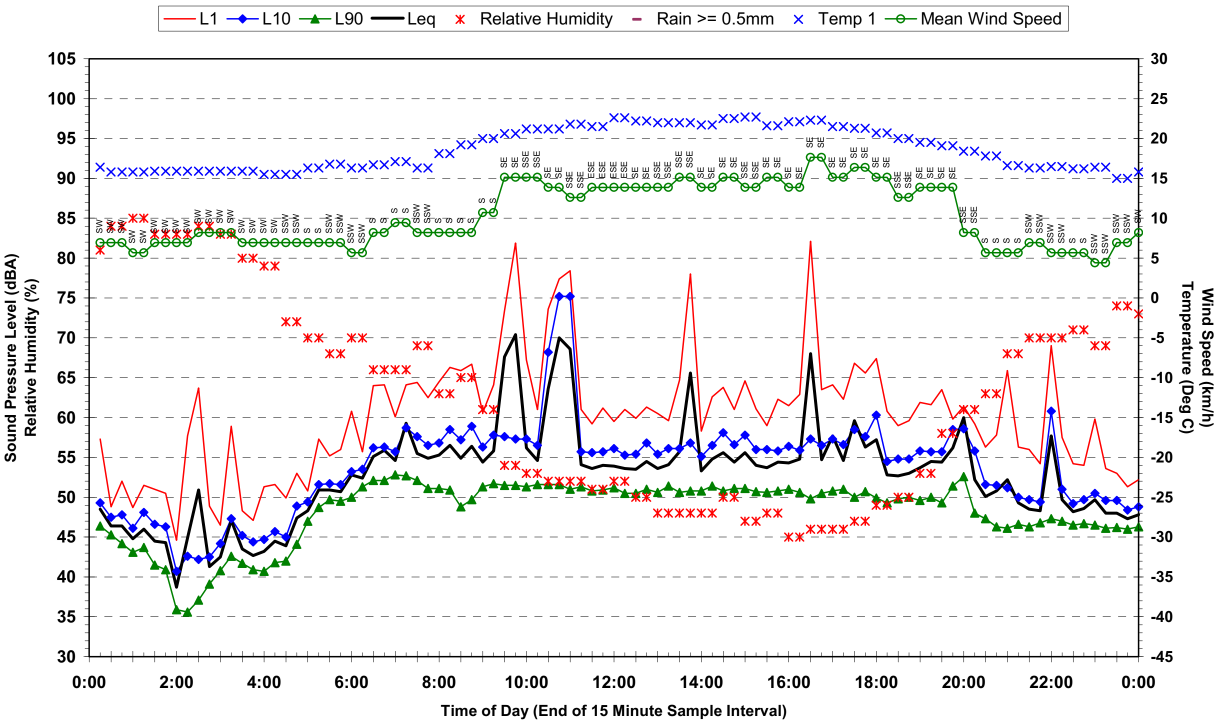


UNATTENDED AMBIENT NOISE AND WEATHER DATA – BG1: 240 GEORGE STREET

Statistical Ambient Noise Levels
240 George Street - Thursday 11 March 2010

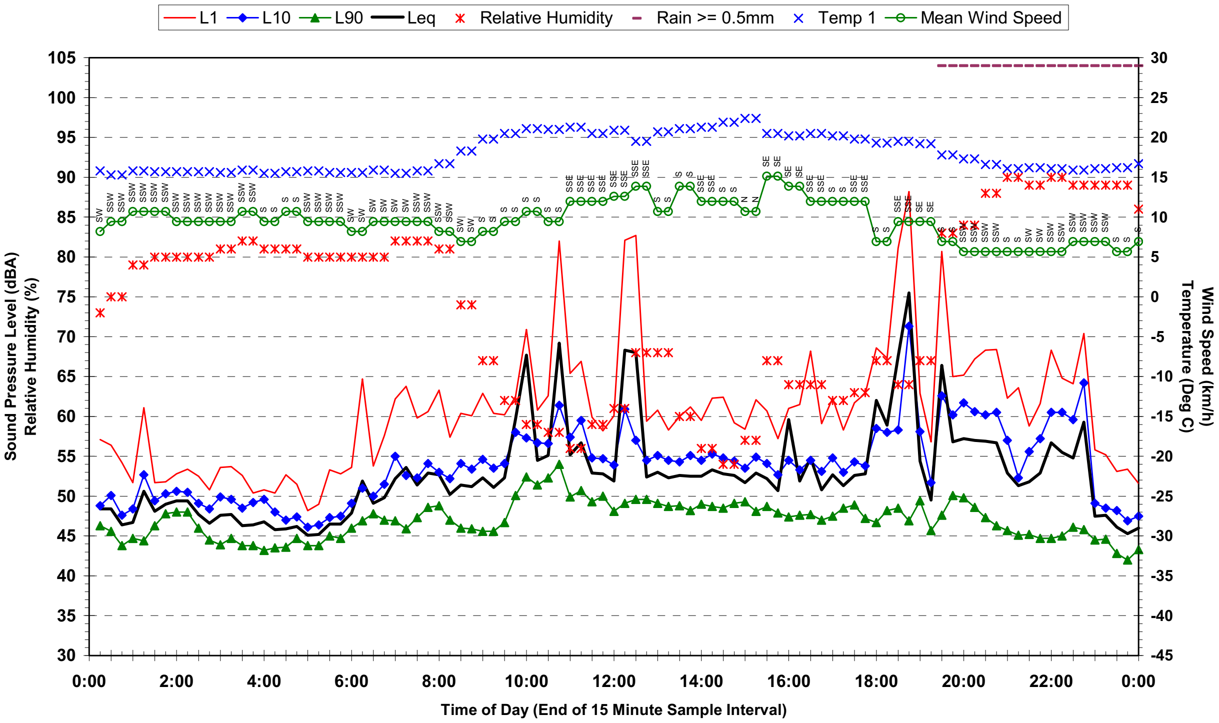


Statistical Ambient Noise Levels
240 George Street - Friday 12 March 2010

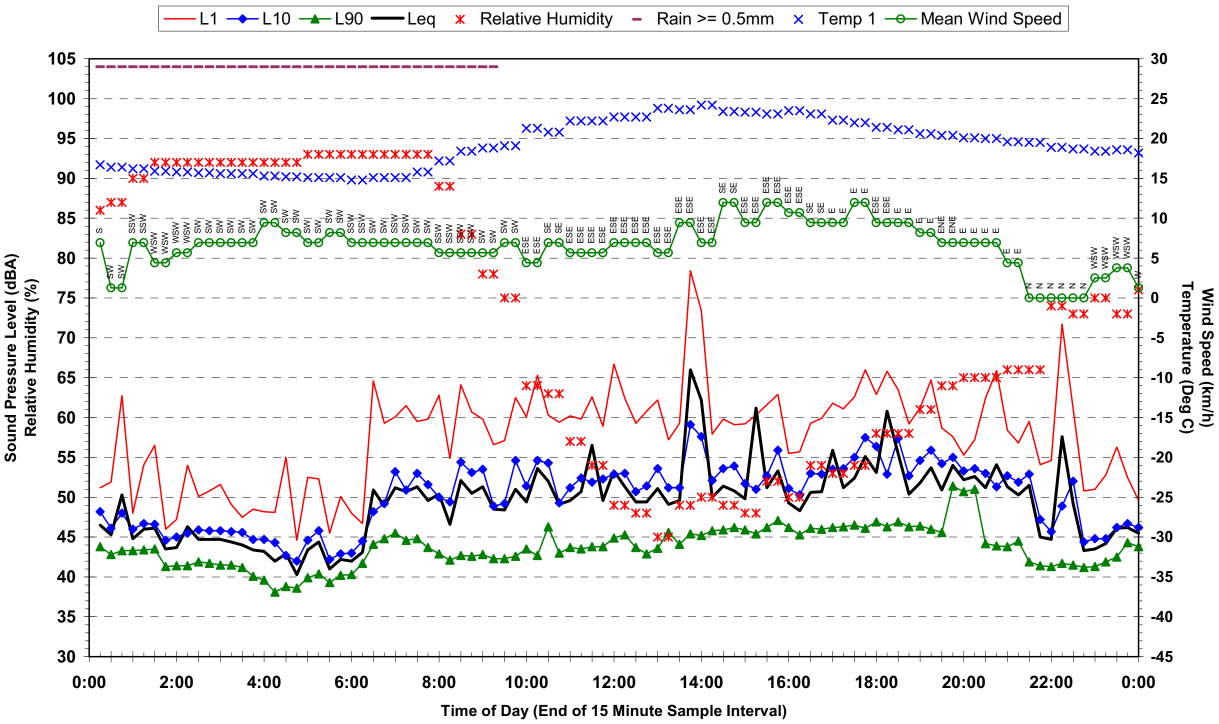


UNATTENDED AMBIENT NOISE AND WEATHER DATA – BG1: 240 GEORGE STREET

Statistical Ambient Noise Levels
240 George Street - Saturday 13 March 2010



Statistical Ambient Noise Levels
240 George Street - Sunday 14 March 2010



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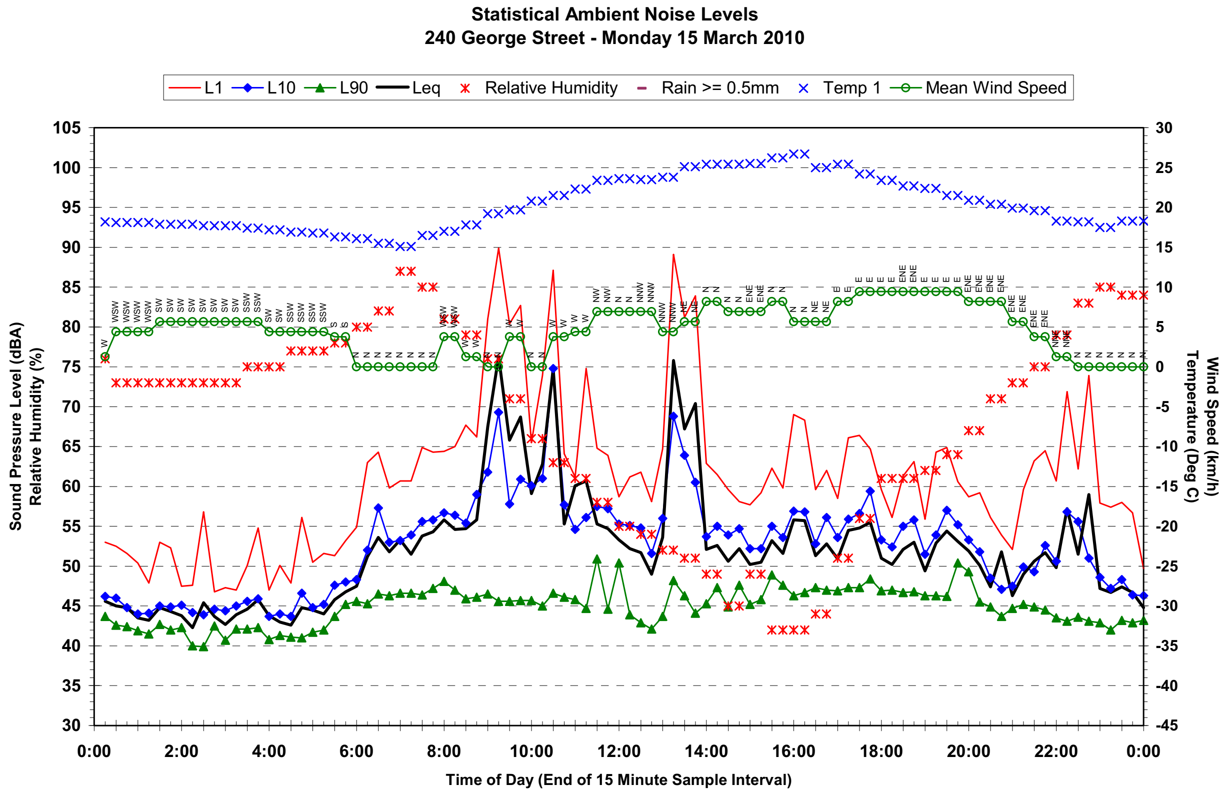
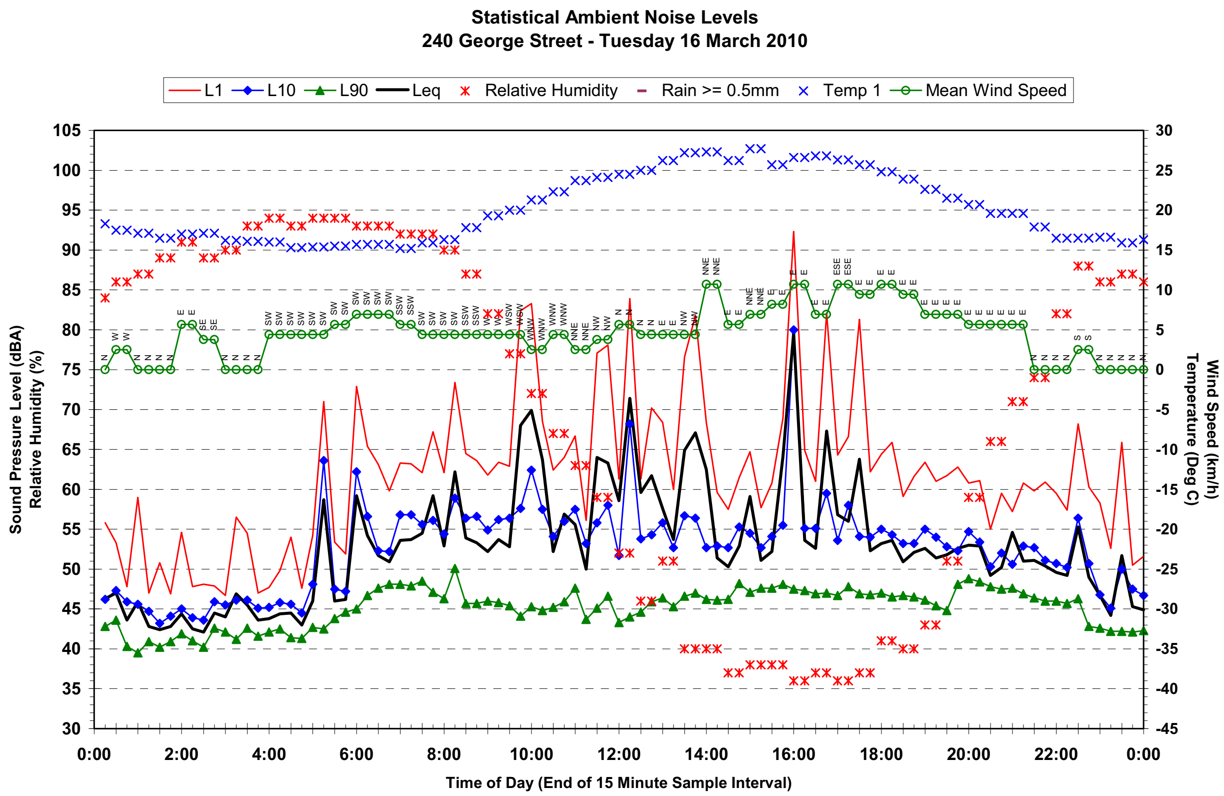
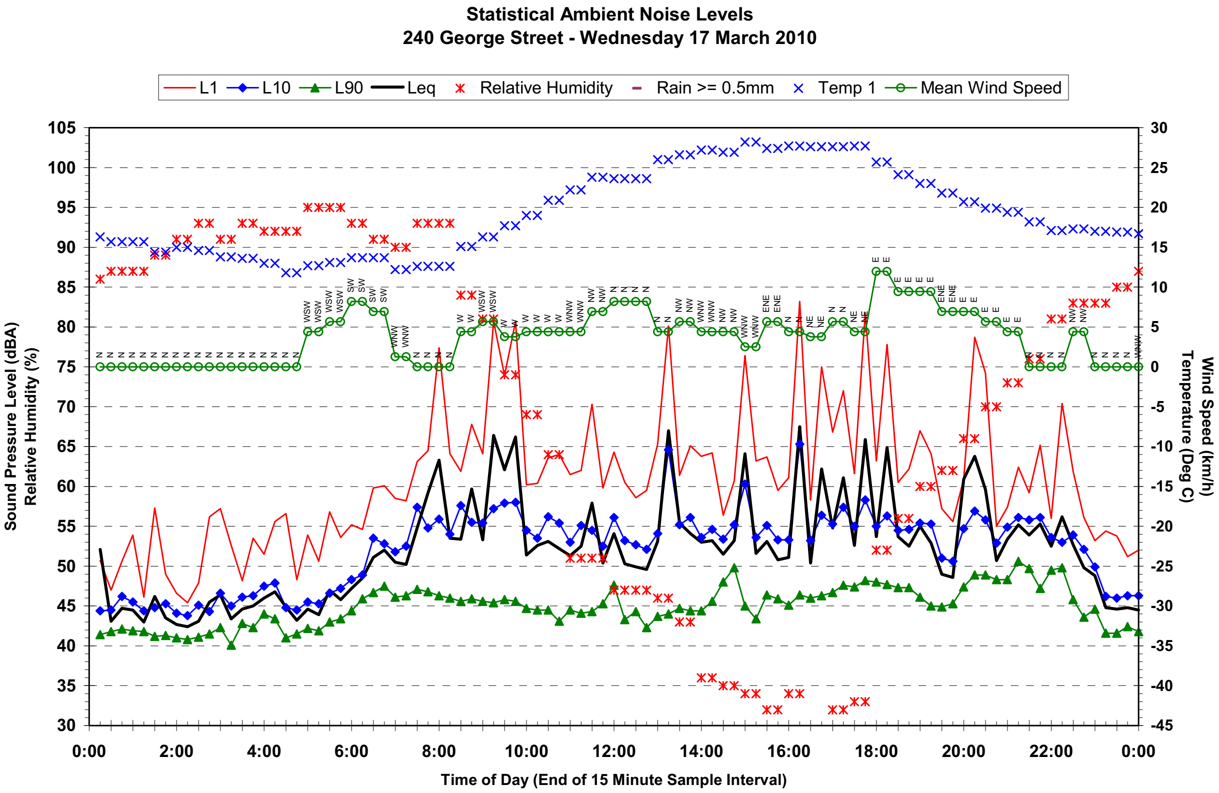
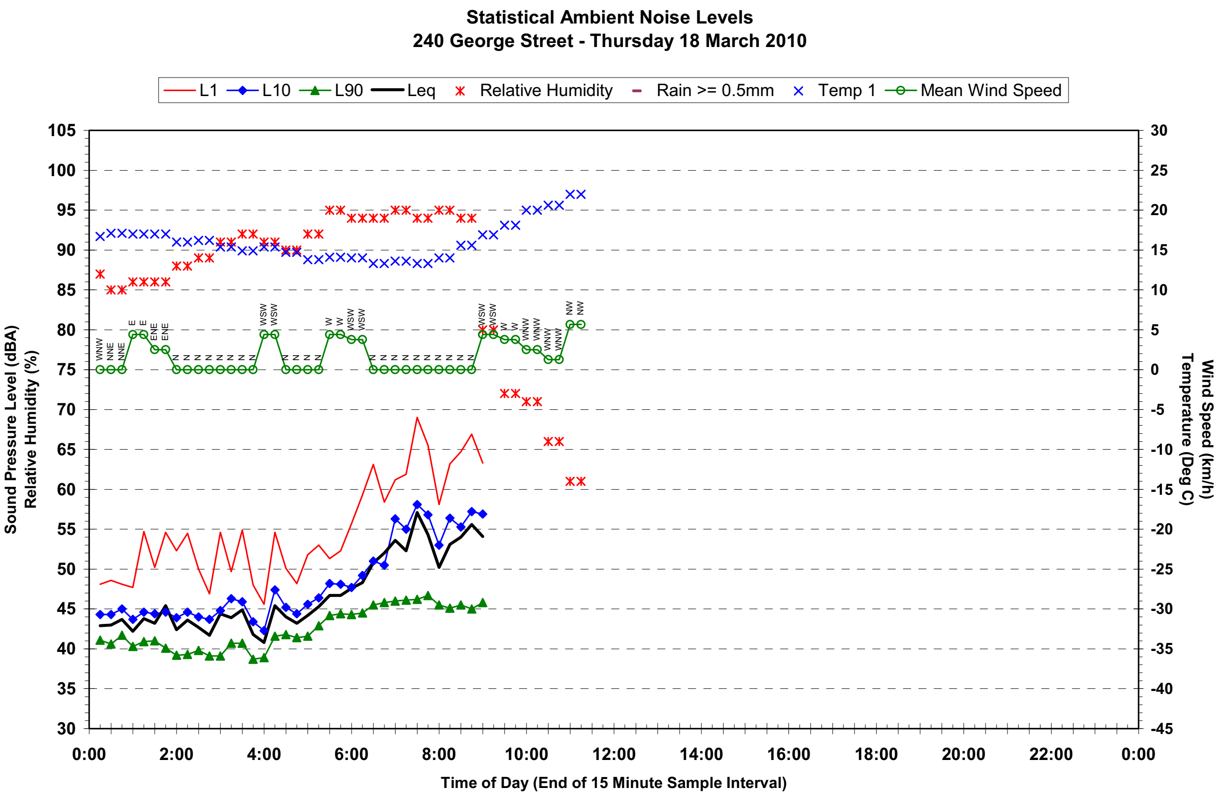


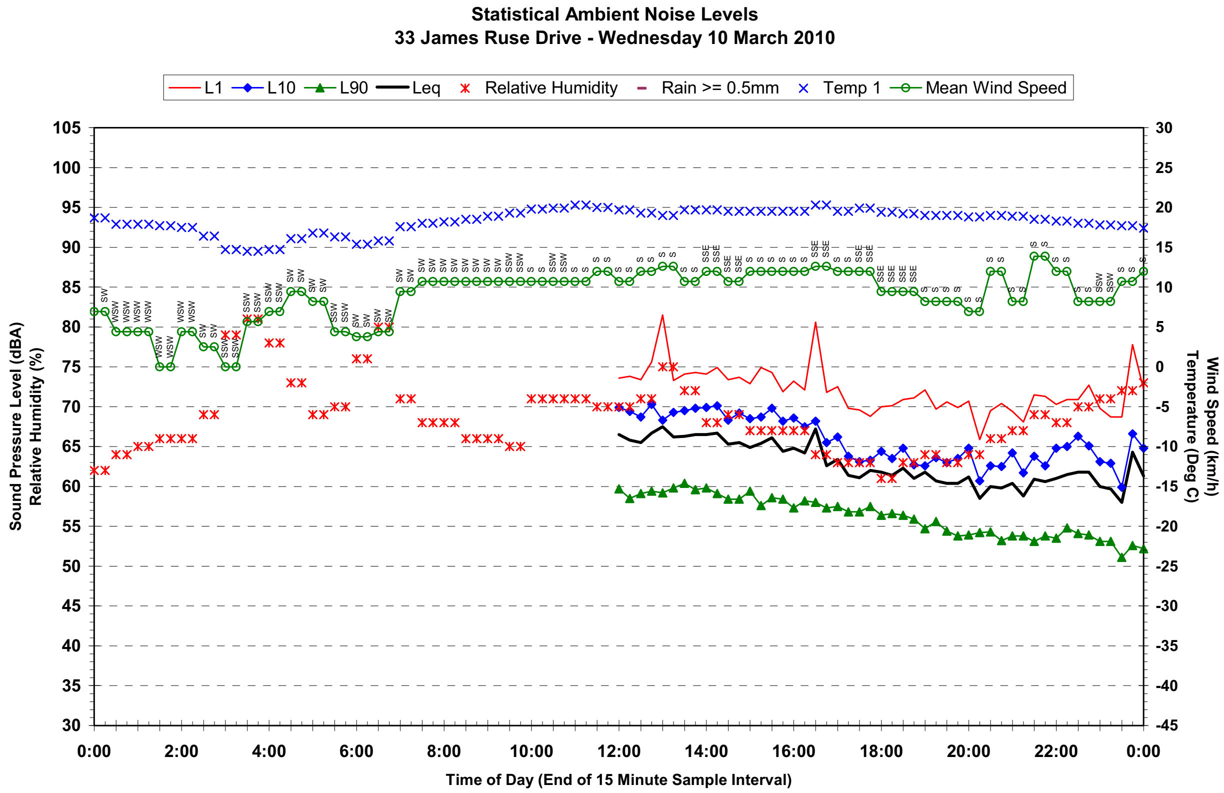


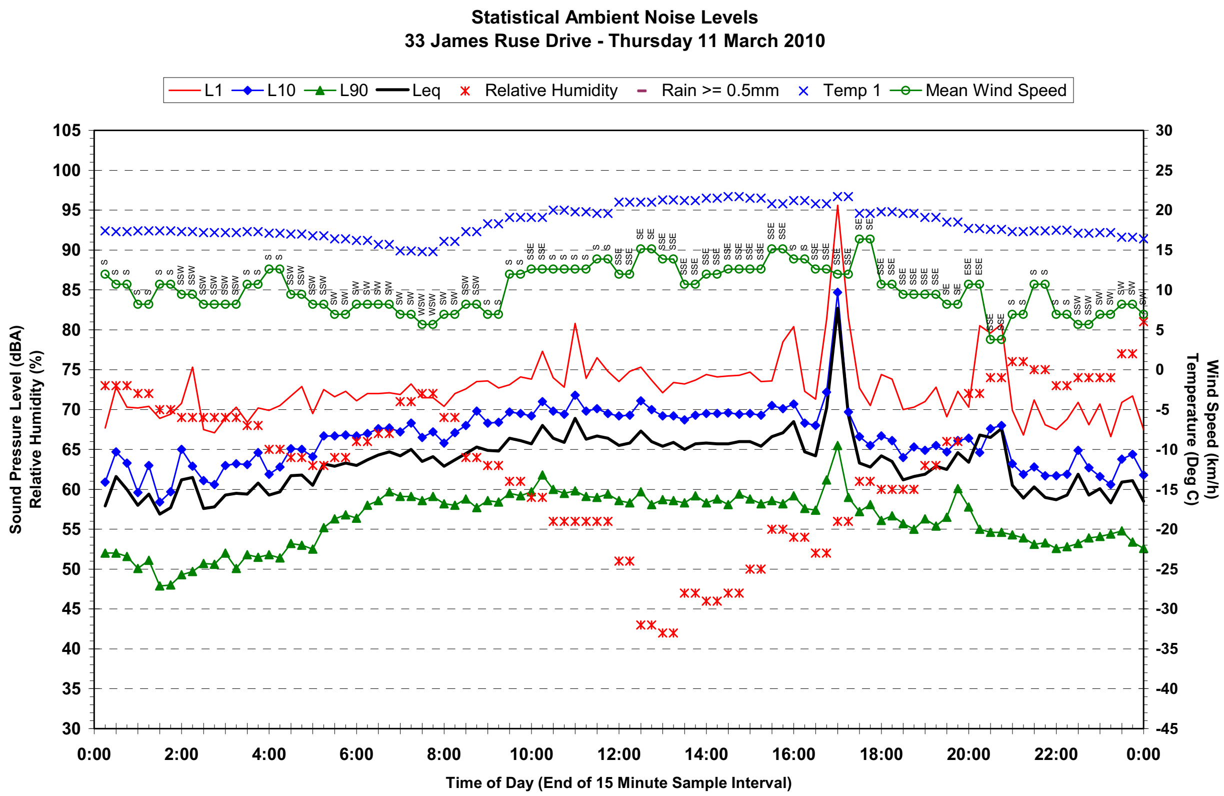
UNATTENDED AMBIENT NOISE AND WEATHER DATA – BG1: 240 GEORGE STREET



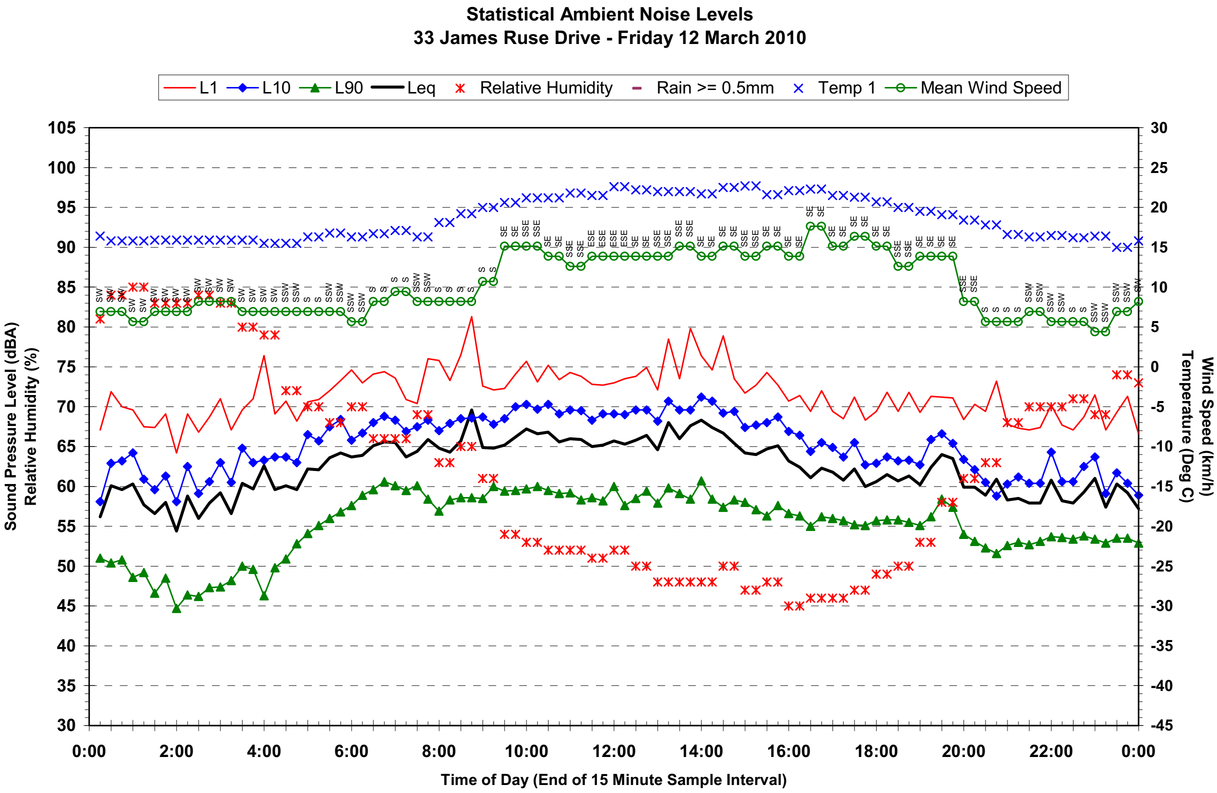


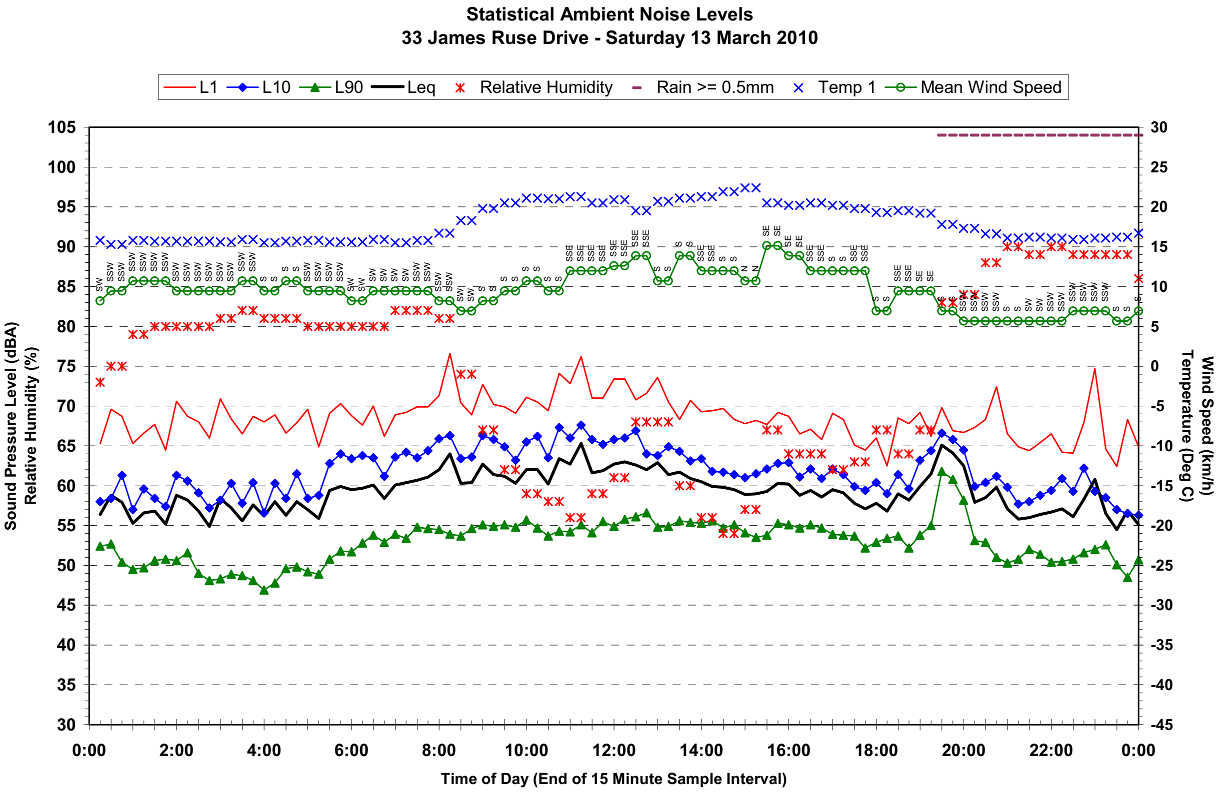
UNATTENDED AMBIENT NOISE AND WEATHER DATA – BG2: 33 JAMES RUSE DRIVE





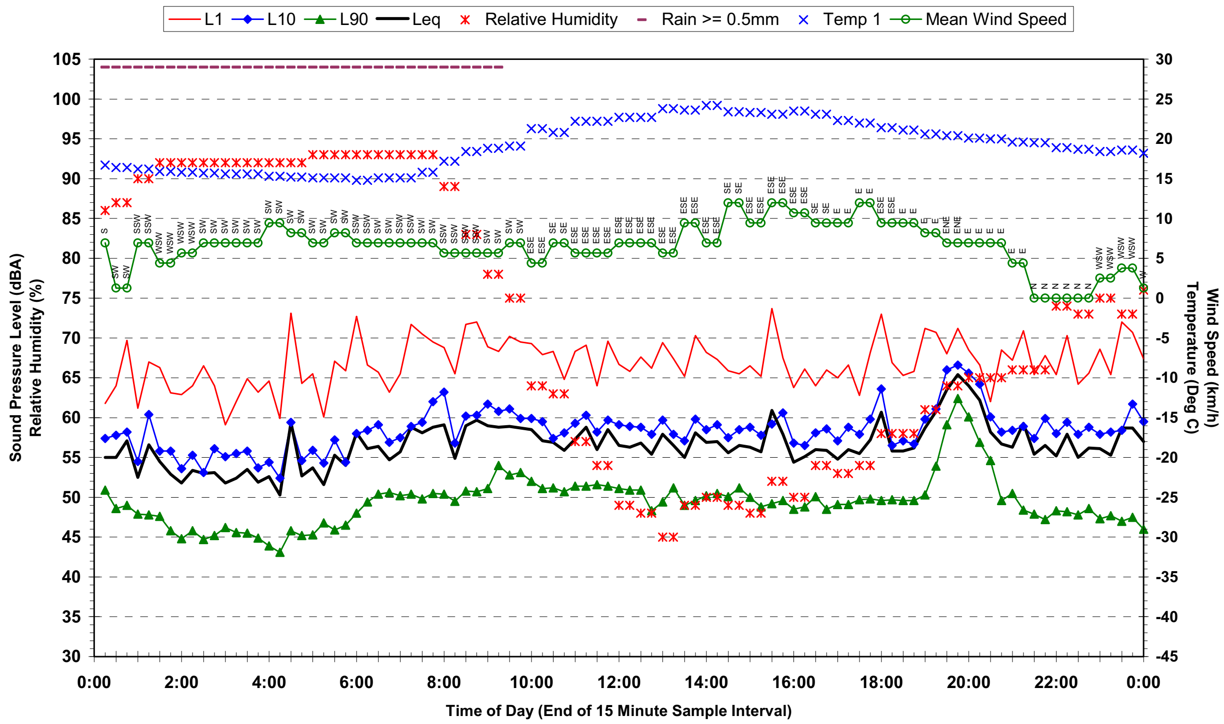
UNATTENDED AMBIENT NOISE AND WEATHER DATA – BG2: 33 JAMES RUSE DRIVE



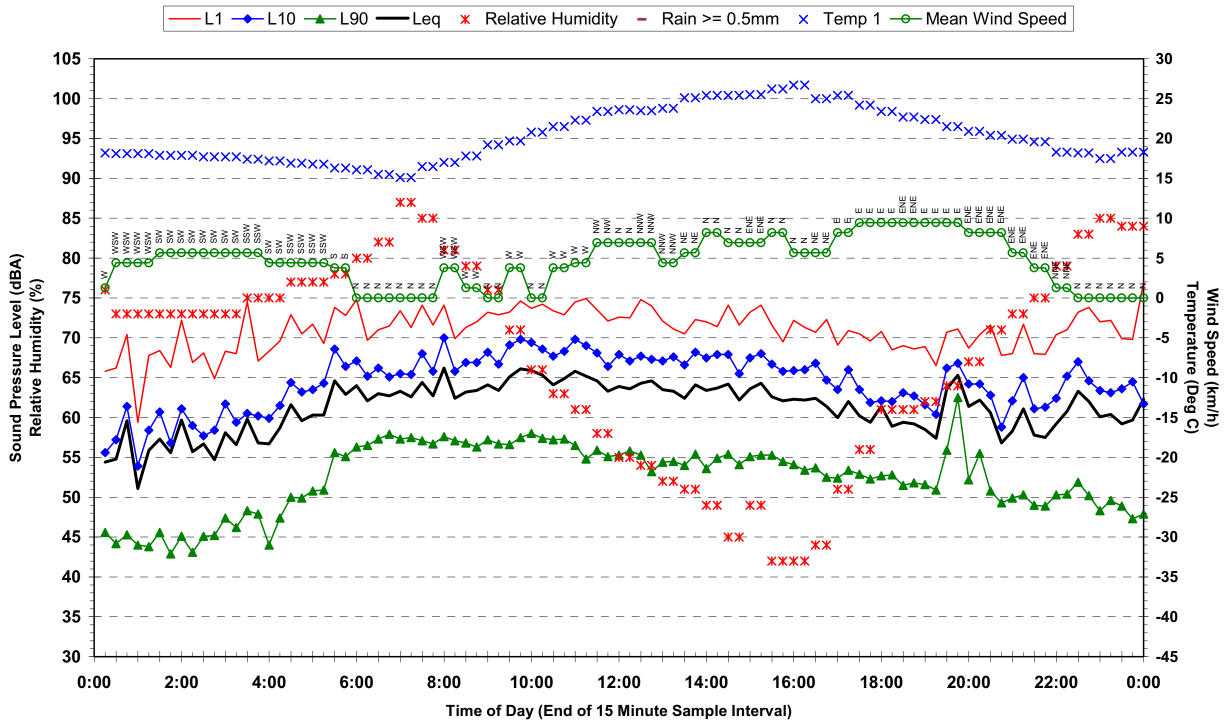


UNATTENDED AMBIENT NOISE AND WEATHER DATA – BG2: 33 JAMES RUSE DRIVE

Statistical Ambient Noise Levels
33 James Ruse Drive - Sunday 14 March 2010

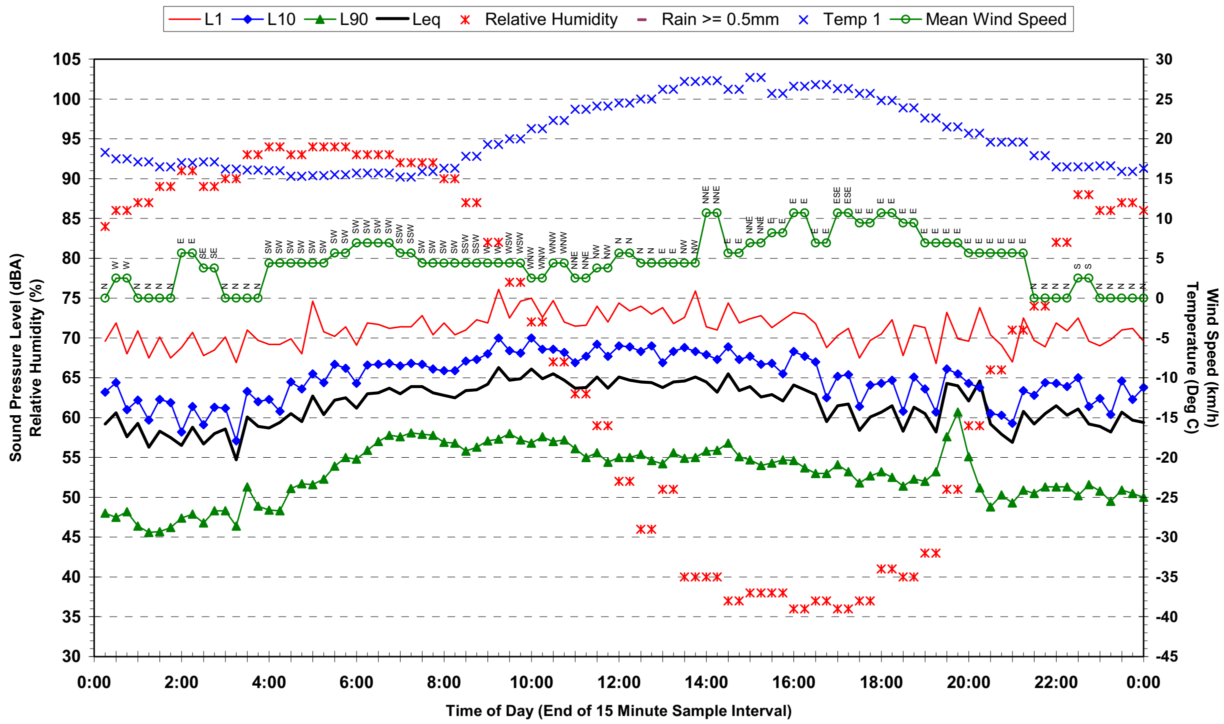


Statistical Ambient Noise Levels
33 James Ruse Drive - Monday 15 March 2010

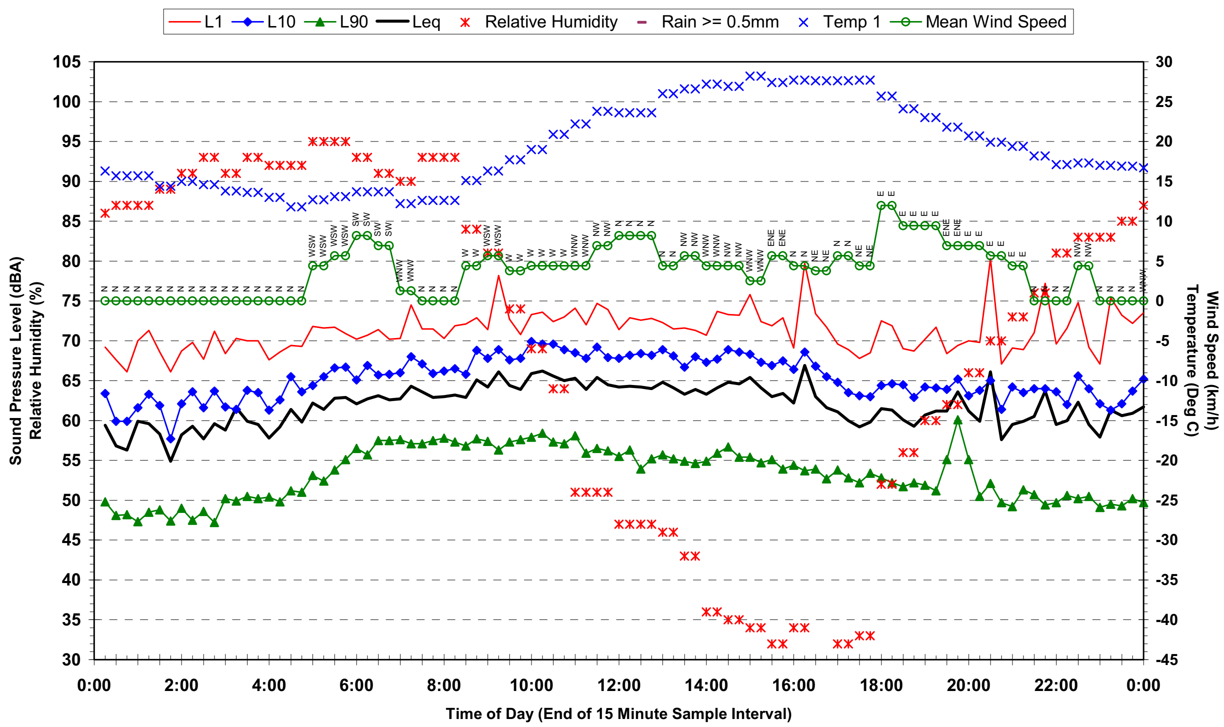


UNATTENDED AMBIENT NOISE AND WEATHER DATA – BG2: 33 JAMES RUSE DRIVE

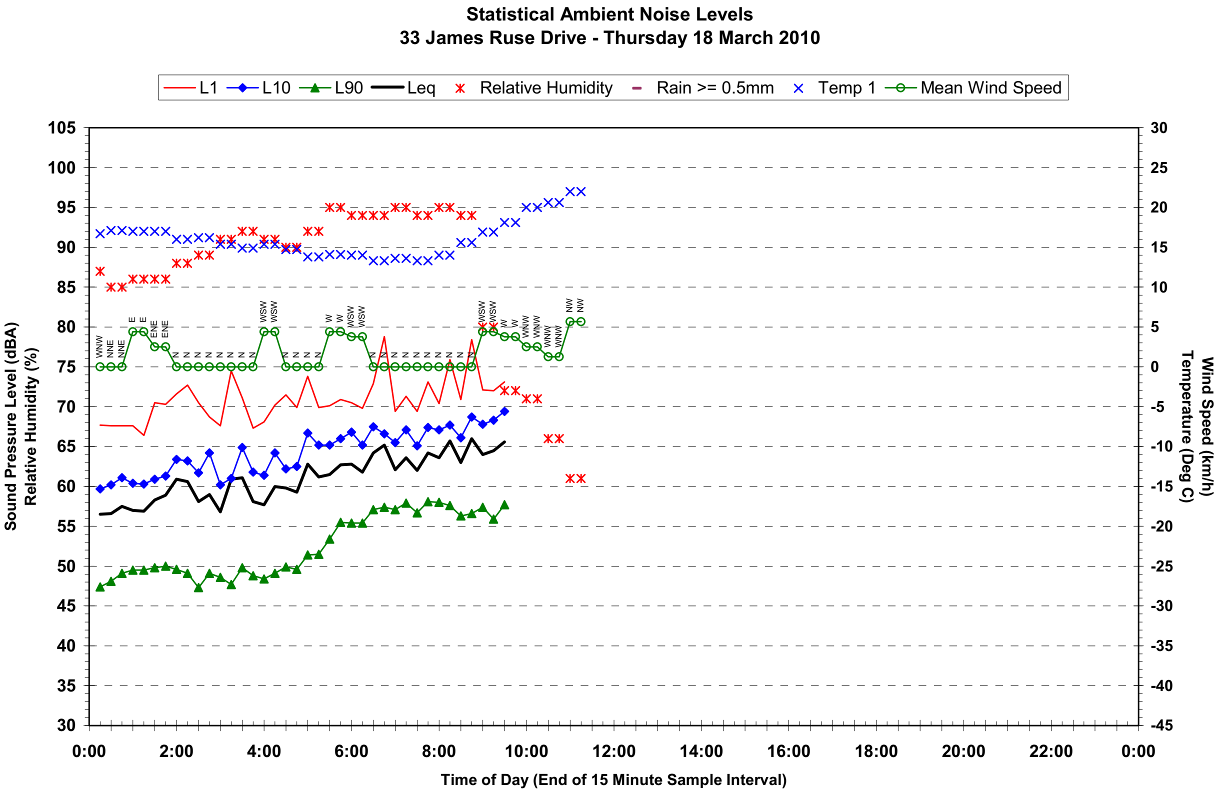
Statistical Ambient Noise Levels
33 James Ruse Drive - Tuesday 16 March 2010



Statistical Ambient Noise Levels
33 James Ruse Drive - Wednesday 17 March 2010

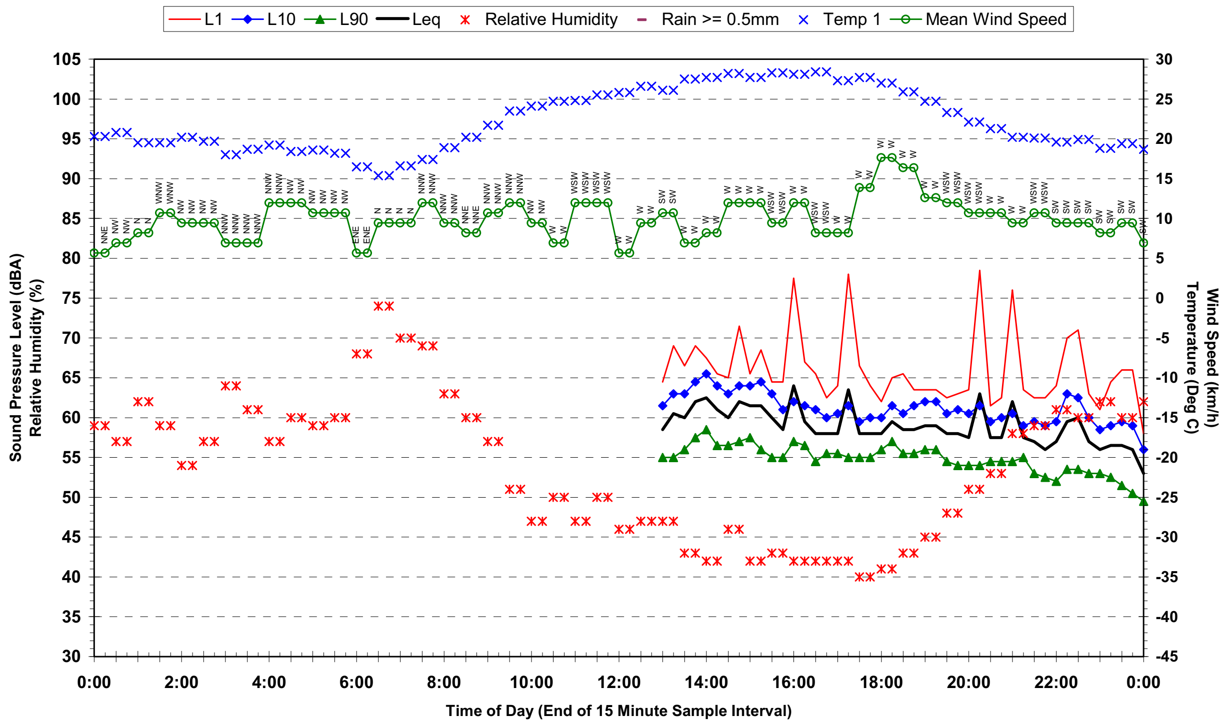


UNATTENDED AMBIENT NOISE AND WEATHER DATA – BG2: 33 JAMES RUSE DRIVE

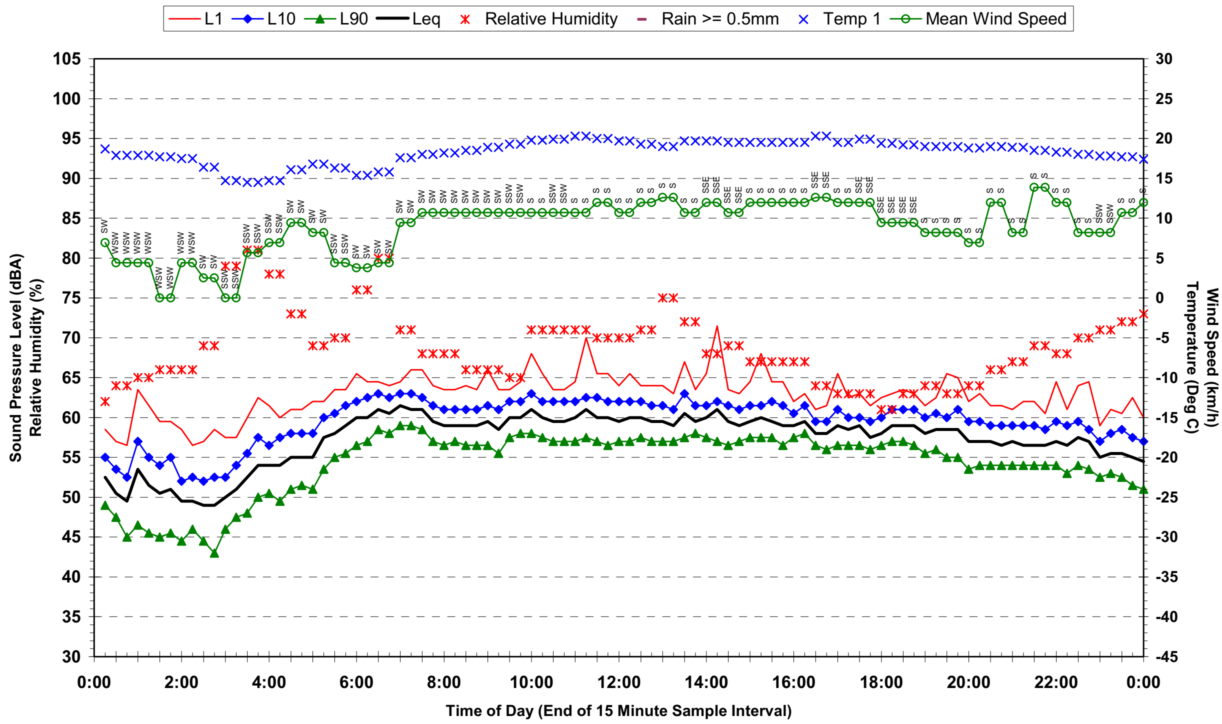


UNATTENDED AMBIENT NOISE AND WEATHER DATA – BG3: UNIVERSITY

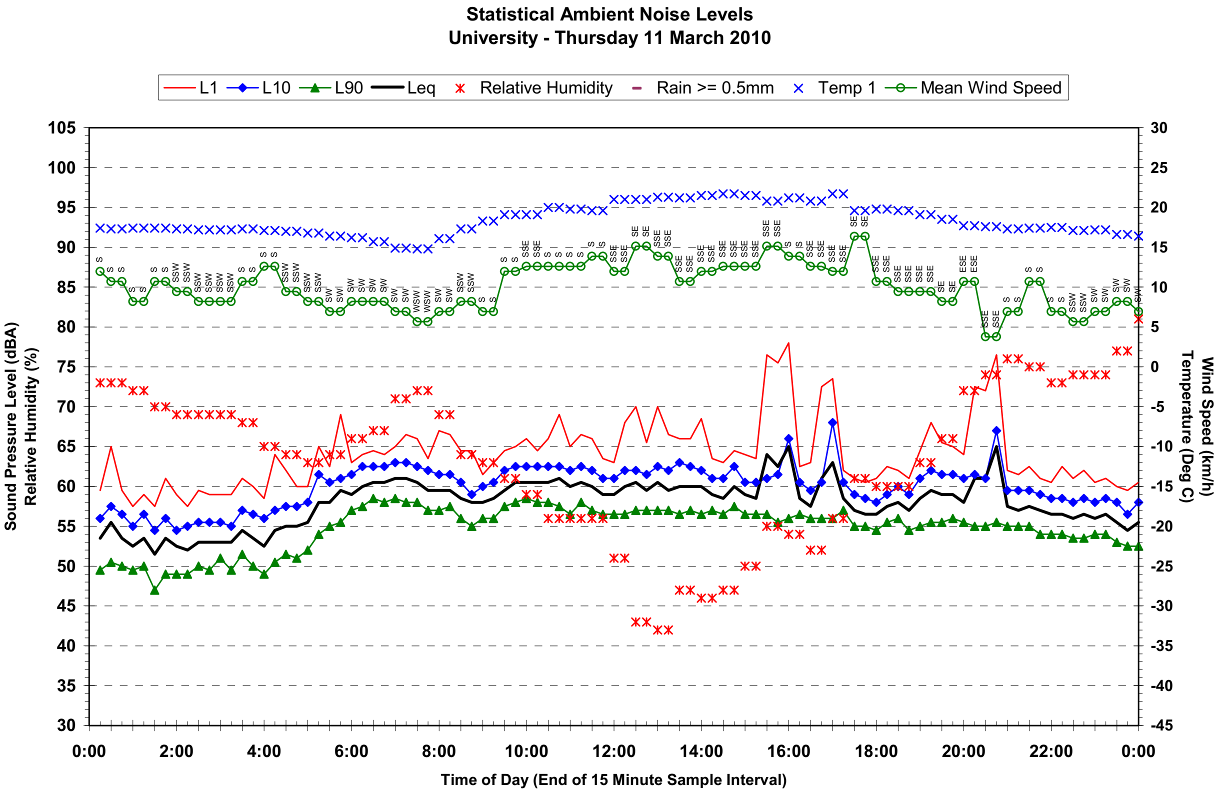
Statistical Ambient Noise Levels
University - Tuesday 9 March 2010

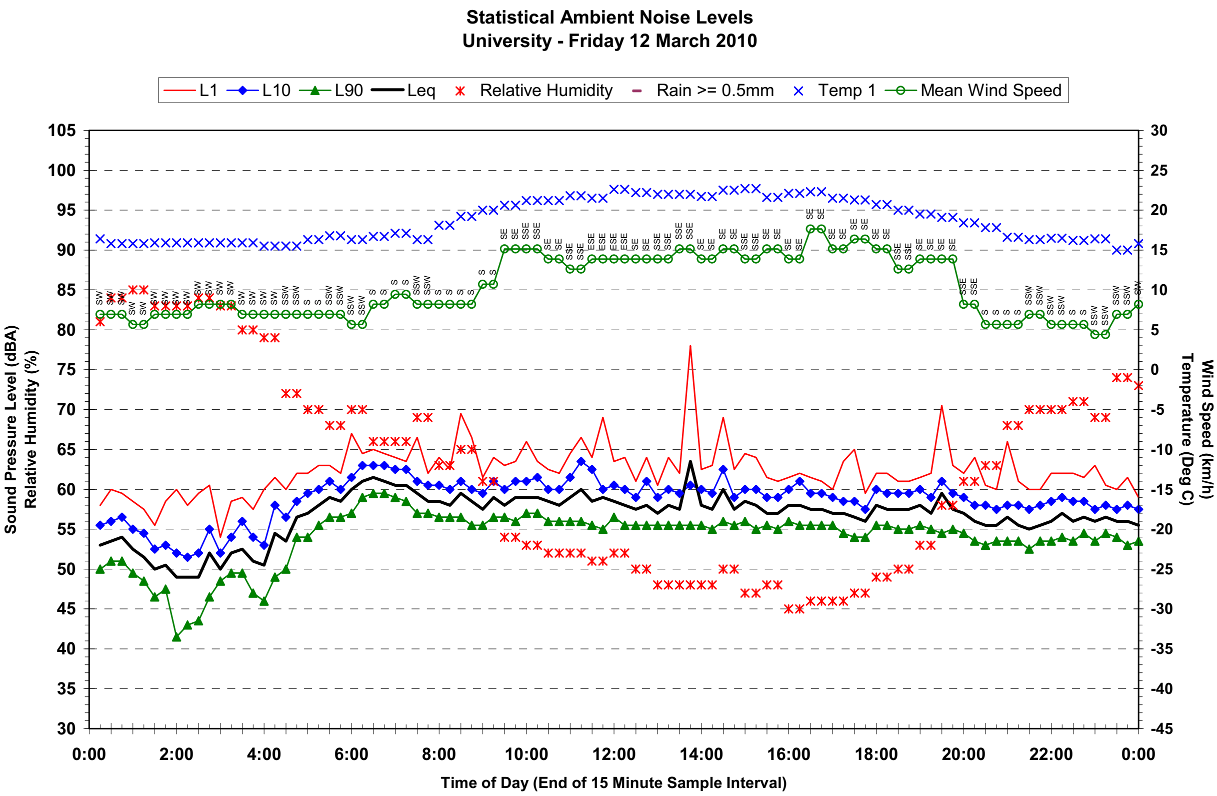


Statistical Ambient Noise Levels
University - Wednesday 10 March 2010

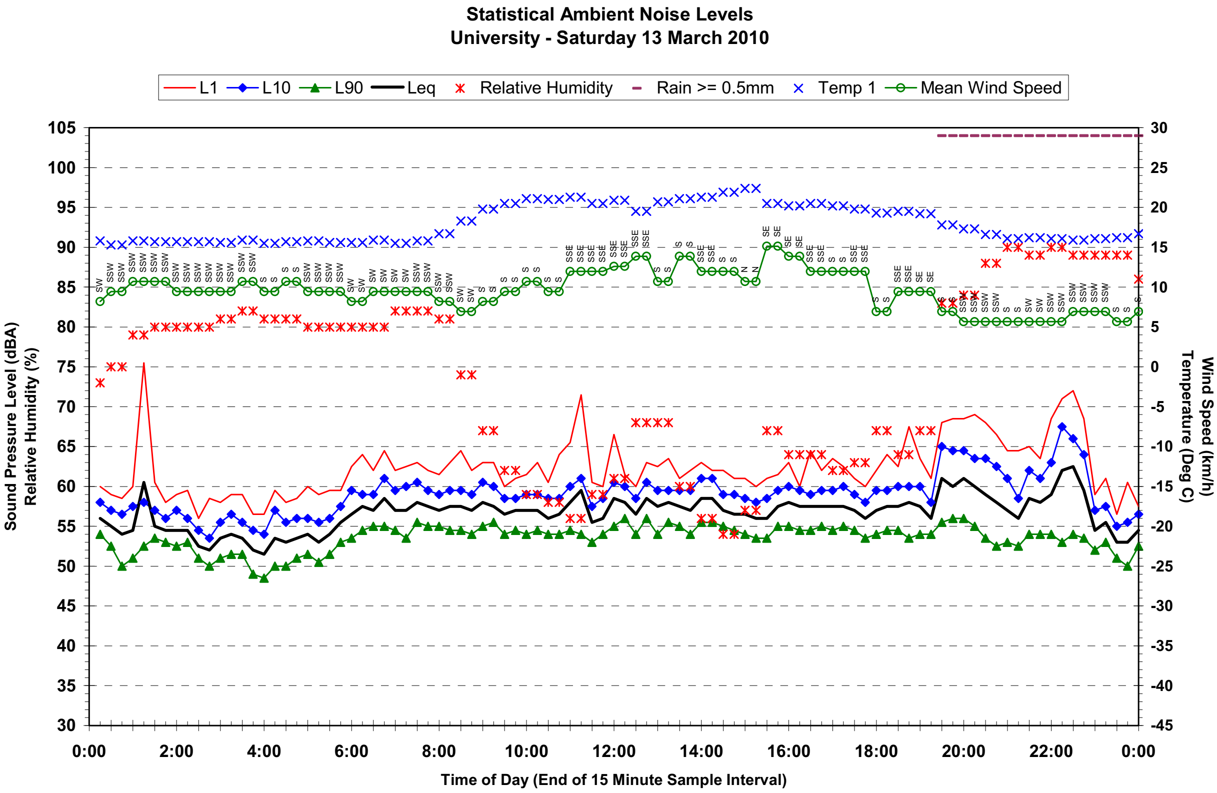


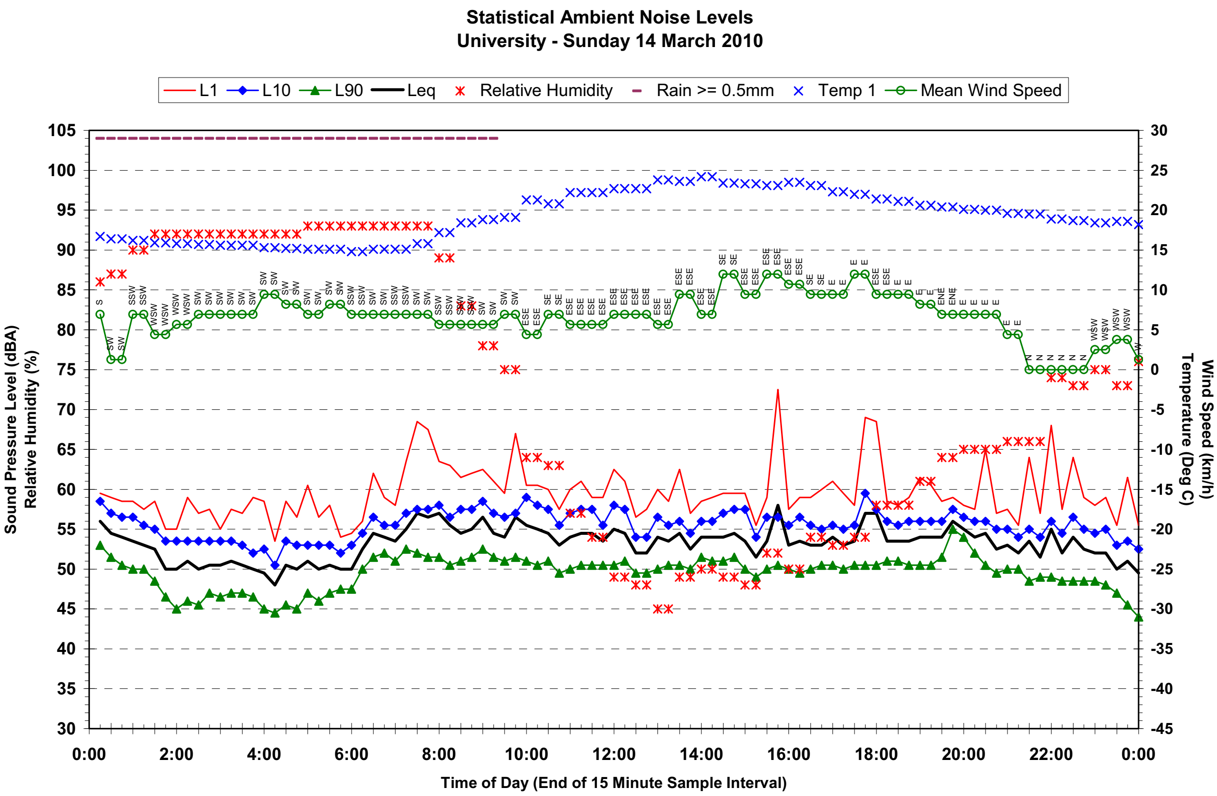
UNATTENDED AMBIENT NOISE AND WEATHER DATA – BG3: UNIVERSITY



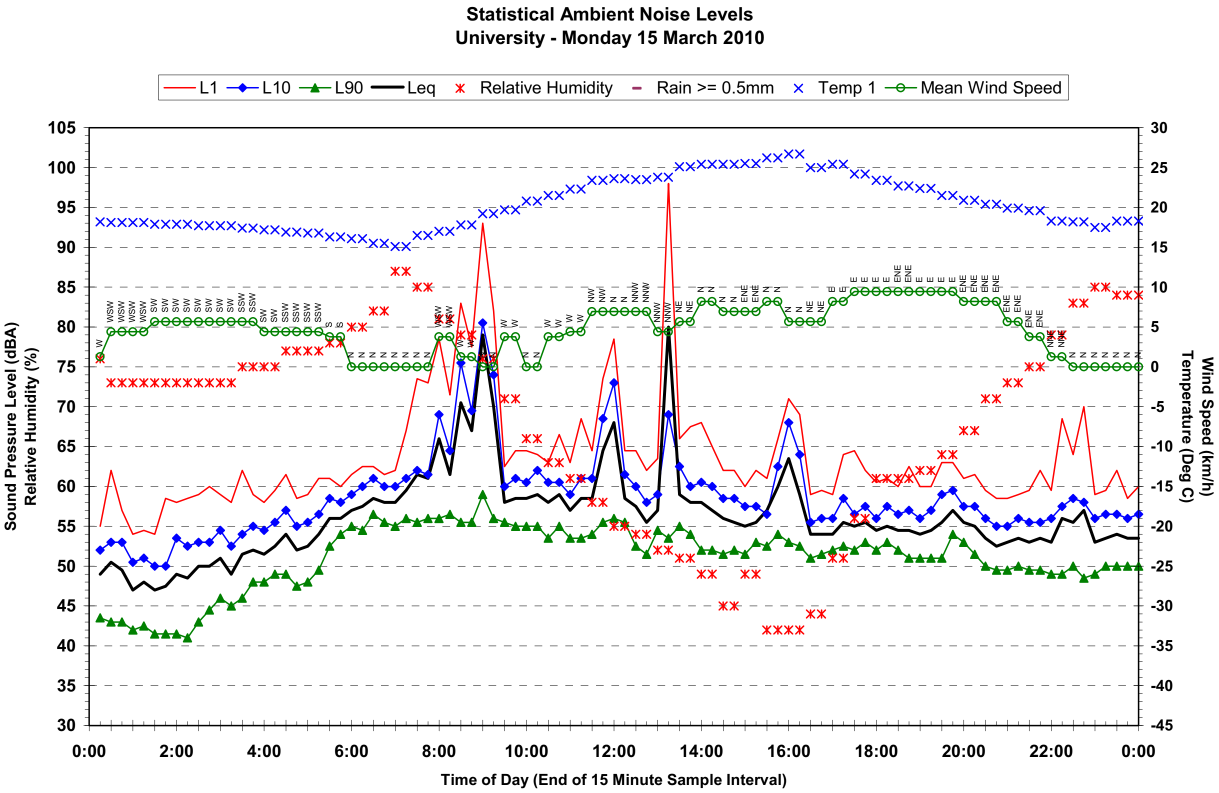


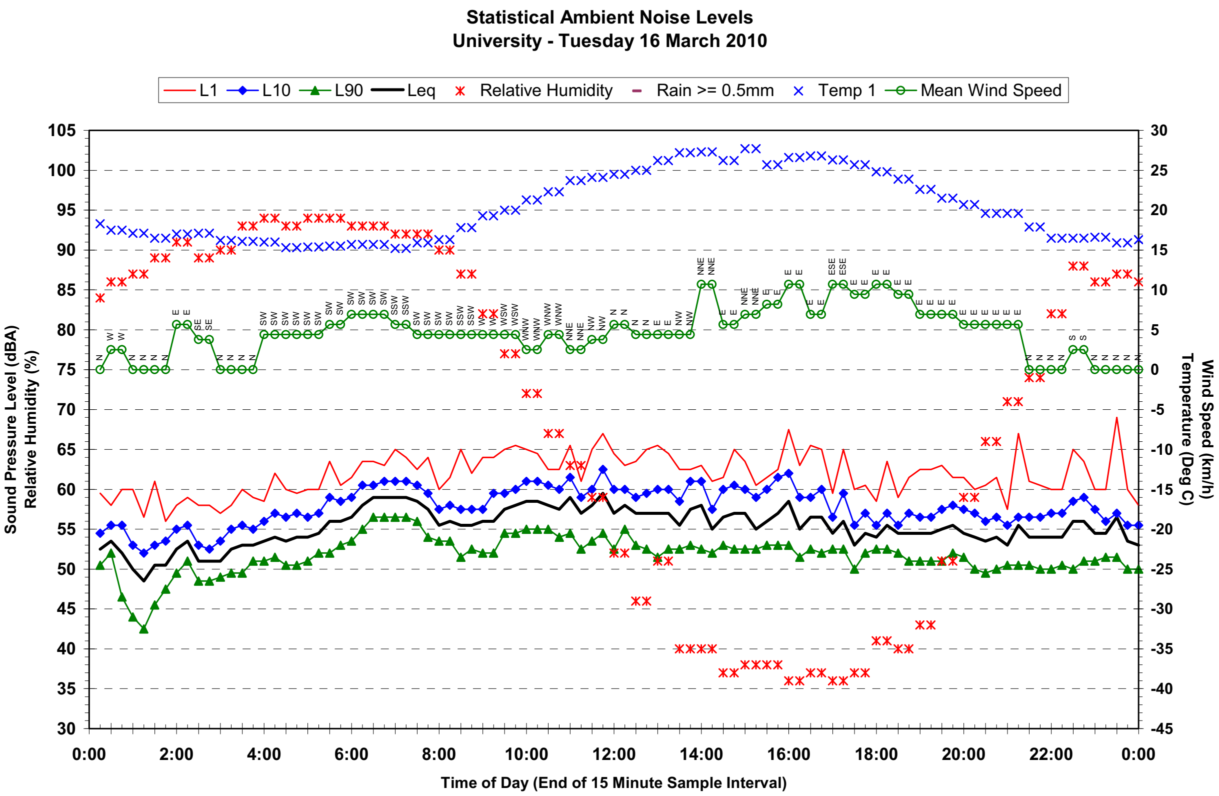
UNATTENDED AMBIENT NOISE AND WEATHER DATA – BG3: UNIVERSITY



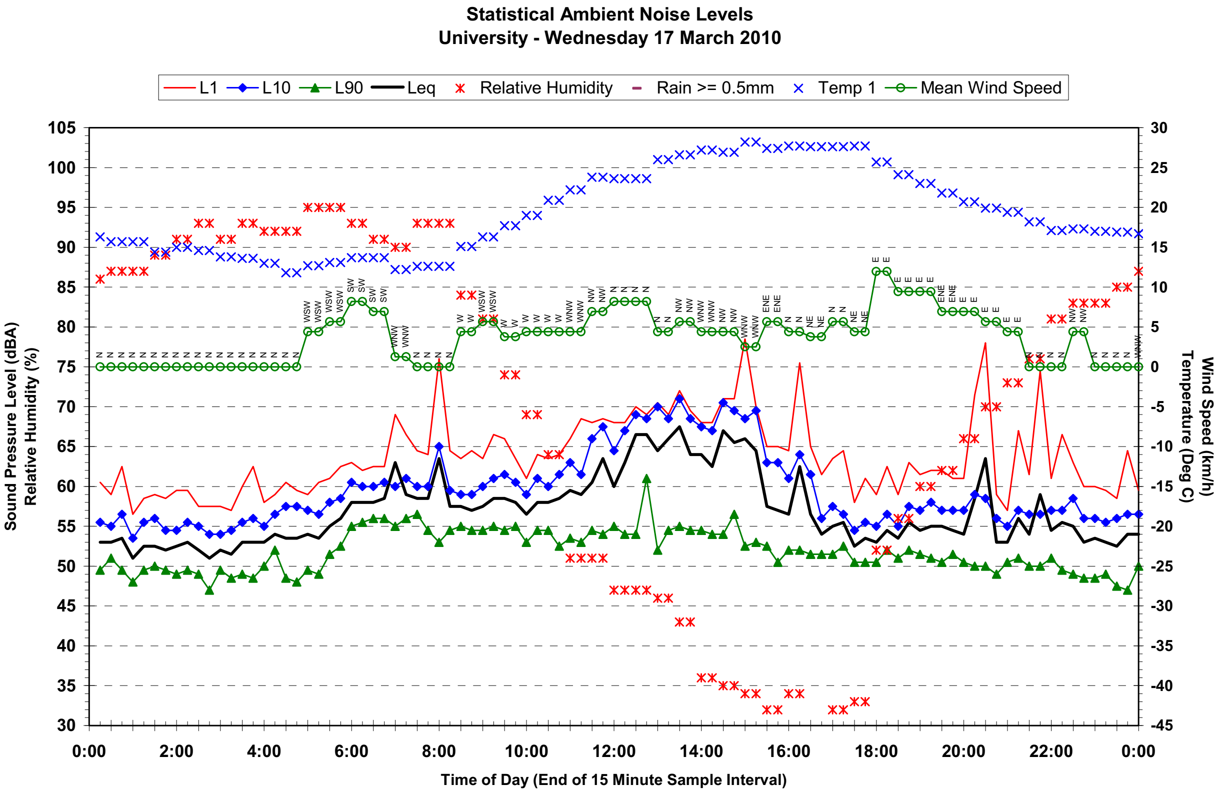


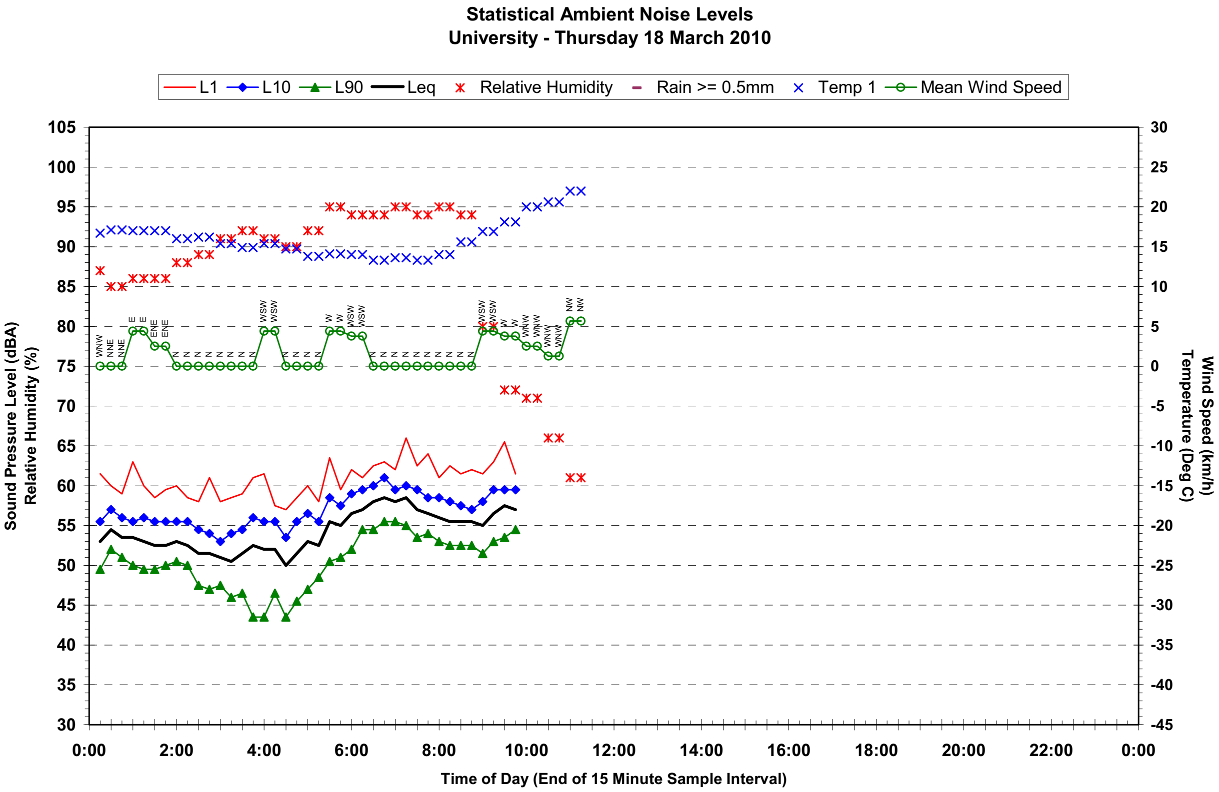
UNATTENDED AMBIENT NOISE AND WEATHER DATA – BG3: UNIVERSITY



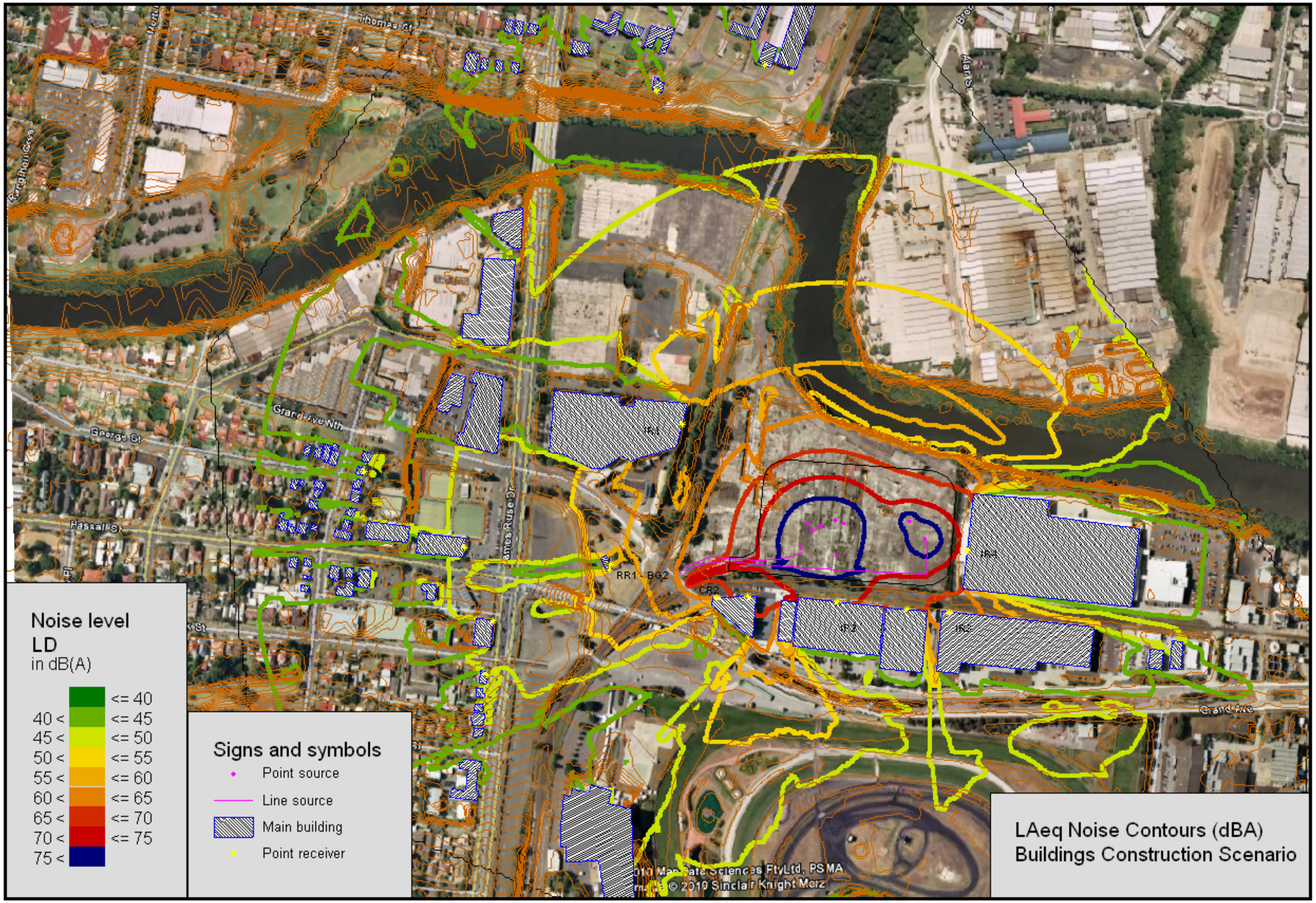


UNATTENDED AMBIENT NOISE AND WEATHER DATA – BG3: UNIVERSITY





NOISE CONTOURS - CONSTRUCTION SCENARIO – BUILDINGS CONSTRUCTION



NOISE CONTOURS - OPERATIONAL SCENARIO - DAYTIME

NOISE CONTOURS - OPERATIONAL SCENARIO – NIGHT-TIME ADVERSE