ACOUSTICS AND AIR

PROJECT HORIZONS

PRELIMINARY NOISE & VIBRATION ASSESSMENT REPORT

REPORT NO. 17317
VERSION A

NOVEMBER 2017

PREPARED FOR

PRIMARY HEALTHCARE LIMITED
C/- EPM PROJECTS PTY LTD
LEVEL 2, 146 ARTHUR STREET
NORTH SYDNEY NSW 2060

WILKINSON MURRAY

DOCUMENT CONTROL

Version	Status	Date	Prepared By	Reviewed By
A	Draft	16 November 2017	Sean Flaherty	Barry Murray
A	Final	20 November 2017	Sean Flaherty	Barry Murray

Note
All materials specified by Wilkinson Murray Pty Limited have been selected solely on the basis of acoustic performance. Any other properties of these materials, such as fire rating, chemical properties etc. should be checked with the suppliers or other specialised bodies for fitness for a given purpose. The information contained in this document produced by Wilkinson Murray is solely for the use of the client identified on the front page of this report. Our client becomes the owner of this document upon full payment of our **Tax Invoice** for its provision. This document must not be used for any purposes other than those of the document's owner. Wilkinson Murray undertakes no duty to or accepts any responsibility to any third party who may rely upon this document.

Quality Assurance
Wilkinson Murray operates a Quality Management System which complies with the requirements of AS/NZS ISO 9001:2015. This management system has been externally certified and Licence No. QEC 13457 has been issued.

AAAC
This firm is a member firm of the Association of Australasian Acoustical Consultants and the work here reported has been carried out in accordance with the terms of that membership.

Celebrating 50 Years in 2012
Wilkinson Murray is an independent firm established in 1962, originally as Carr & Wilkinson. In 1976 Barry Murray joined founding partner Roger Wilkinson and the firm adopted the name which remains today. From a successful operation in Australia, Wilkinson Murray expanded its reach into Asia by opening a Hong Kong office early in 2006. Today, with offices in Sydney, Newcastle, Wollongong, Orange, Queensland and Hong Kong, Wilkinson Murray services the entire Asia-Pacific region.

TABLE OF CONTENTS

GLOSSARY OF ACOUSTIC TERMS

Most environments are affected by environmental noise which continuously varies, largely as a result of road traffic. To describe the overall noise environment, a number of noise descriptors have been developed and these involve statistical and other analysis of the varying noise over sampling periods, typically taken as 15 minutes. These descriptors, which are demonstrated in the graph below, are here defined.

Maximum Noise Level (L_{Amax}) – The maximum noise level over a sample period is the maximum level, measured on fast response, during the sample period.

L_{A1} – The L_{A1} level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the L_{A1} level for 99% of the time.

L_{A10} – The L_{A10} level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L_{A10} level for 90% of the time. The L_{A10} is a common noise descriptor for environmental noise and road traffic noise.

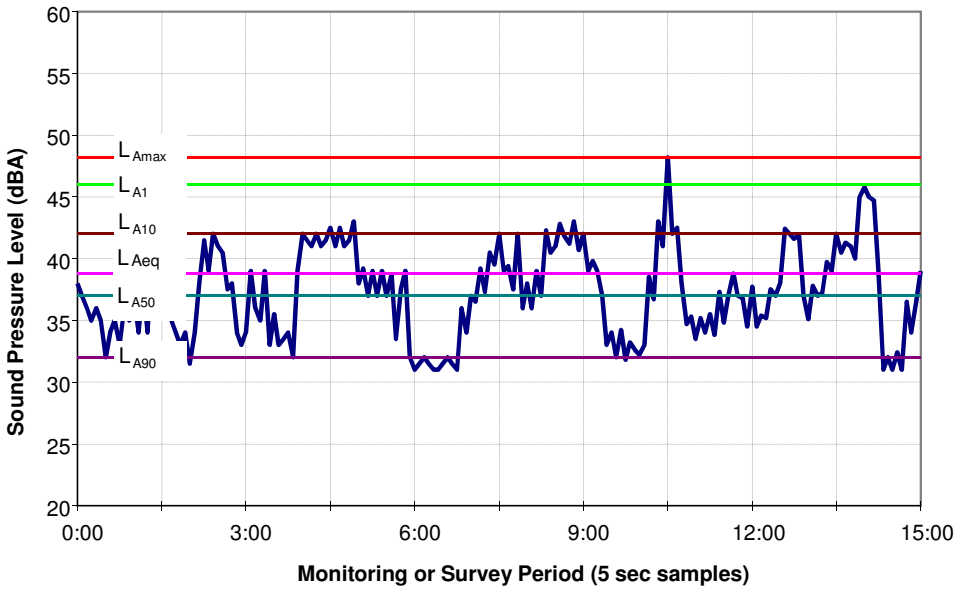
L_{A90} – The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level.

L_{Aeq} – The equivalent continuous sound level (L_{Aeq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.

ABL – The Assessment Background Level is the single figure background level representing each assessment period (daytime, evening and night time) for each day. It is determined by calculating the 10th percentile (lowest 10th percent) background level (L_{A90}) for each period.

RBL – The Rating Background Level for each period is the median value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period – daytime, evening and night time.

Typical Graph of Sound Pressure Level vs Time



1 INTRODUCTION

EPM Project Pty Ltd has been engaged by Primary Health Care Limited (PRY) to manage the project referred to as Project Horizons (the Project). The Project involves the demolition of an existing residential building located at 14 Highfields Circuit, Port Macquarie (the Site) and the design, development and construction of a Radiology Practice on the Site.

Wilkinson Murray (WM) has been engaged to review the design and advise on matters relating to the Project's acoustic design and potential noise and vibration effects arising from the construction and operation of the facility.

In accordance with the Services Brief, this preliminary (Phase 1) assessment, required to accompany the Development Application submission, considerers the *potential noise impacts on properties adjacent to the Project Works during the period when the Project Works are being constructed and upon the Project Works being completed and used for their intended purpose at their intended times.*

The Phase 1 assessment principally considers potential construction noise and vibration impacts and potential operational noise impacts from vehicles accessing the Site and the operation of mechanical services plant.

In assessing Phase 1 noise impacts, reference has been made to the following NSW Environment Protection Authority (EPA) guidelines:

- *NSW Interim Construction Noise Guideline (ICNG);*
- *NSW Industrial Noise Policy (INP)*; and
- *Road Noise Policy* (*RNP*).

During Phase 2 of the assessment this report will be updated to address matters relating to the acoustic design of the proposed Radiology Practice. Matters to be considered during Phase 2 include noise ingress to the subject site buildings, control of internal noise levels due to the operation of HVAC systems and other mechanical plant, acoustic privacy between rooms of the development and inter-room noise control and control of vibration effects on sensitive equipment.

2 PROPOSED DEVELOPMENT

14 Highfields Circuit is located approximately 400 m to the east of the Oxley Highway (B56) and approximately 2.5 km south-west of the centre of Port Macquarie.

Residential properties border the Site to the east (16 Highfields Circuit) and to the south (9, 11, and 13 Kulai Place) with further residential properties located to the north on the opposite side of the road (7 and 9 Highfields Circuit).

Other medical facilities border the Site to the west (Highfields Thoracic and Sleep Specialists and Port Macquarie Cardiology located at 12 Highfields Circuit) and to the north-east on the opposite side of the road (Westside Medical Centre located at 11 Highfields Circuit).

A site location plan is shown Figure 2-1.

A concept site plan, indicative façade concepts and an indicative internal layout are shown in Figures 2-2 to 2-4.

Figure 2-1 Site Location Plan

The radiology practice is to consist of:

- Waiting areas;
- Public amenity reception area(s);
- Administration area(s) including practice manager office;
- Radiology equipment, including X-Rays, PET, Ultrasound, CT, Mammography, MRI, DEXA and SPECT and all associated facilities;
- Staff rooms and staff amenities;
- Meeting rooms;
- Store rooms;
- Data room(s);
- Parking allocation required by relevant Regulations and Authorities; and
- Likely a substation.

Landscaping is to address the local planning controls, particularly filtering of any car parking areas in front of the building line, as well as any ecological constraints relating to koala habitats.

Figure 2-2 Proposed Concept Site Plan

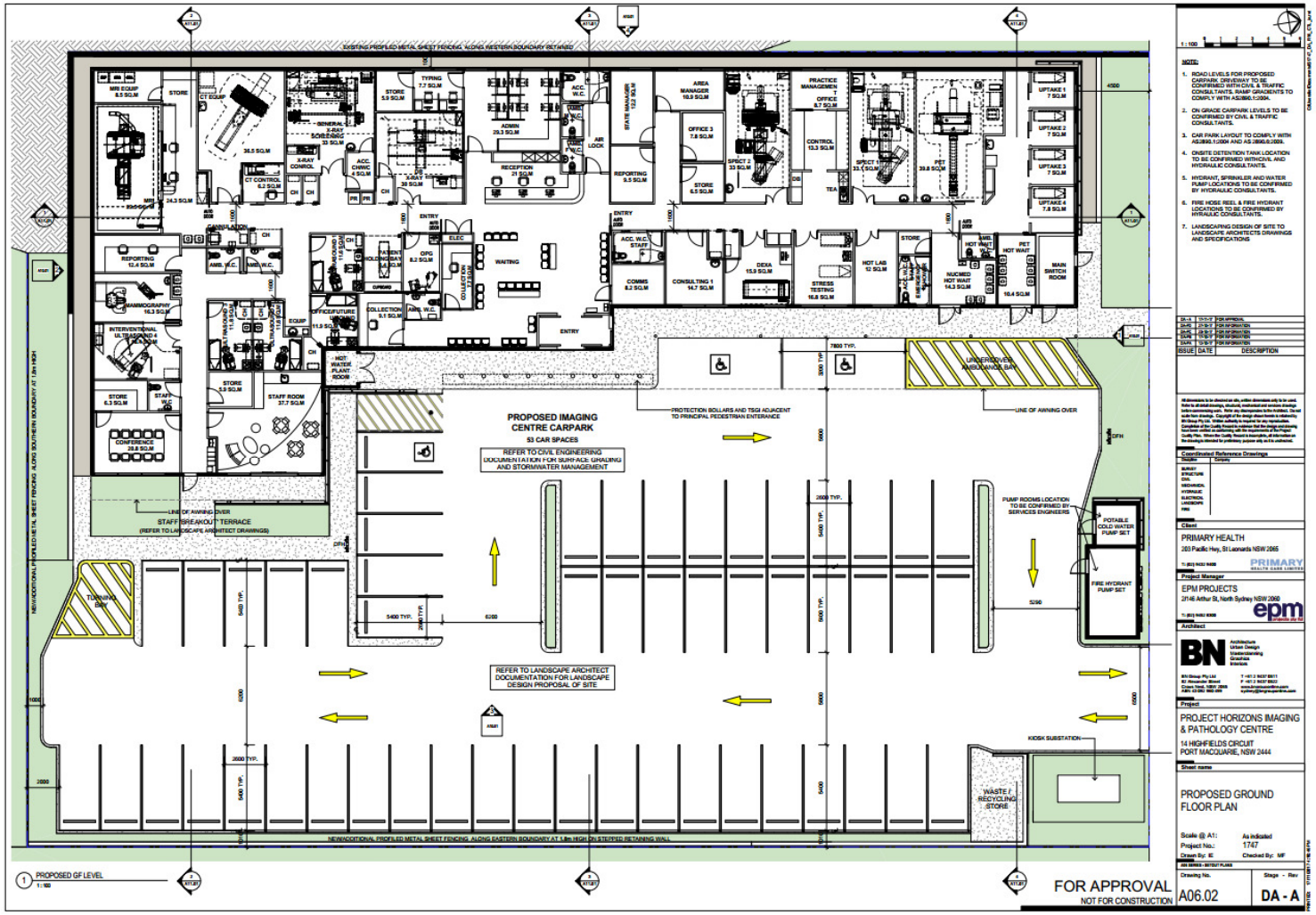


Figure 2-3 Indicative Facade Concept

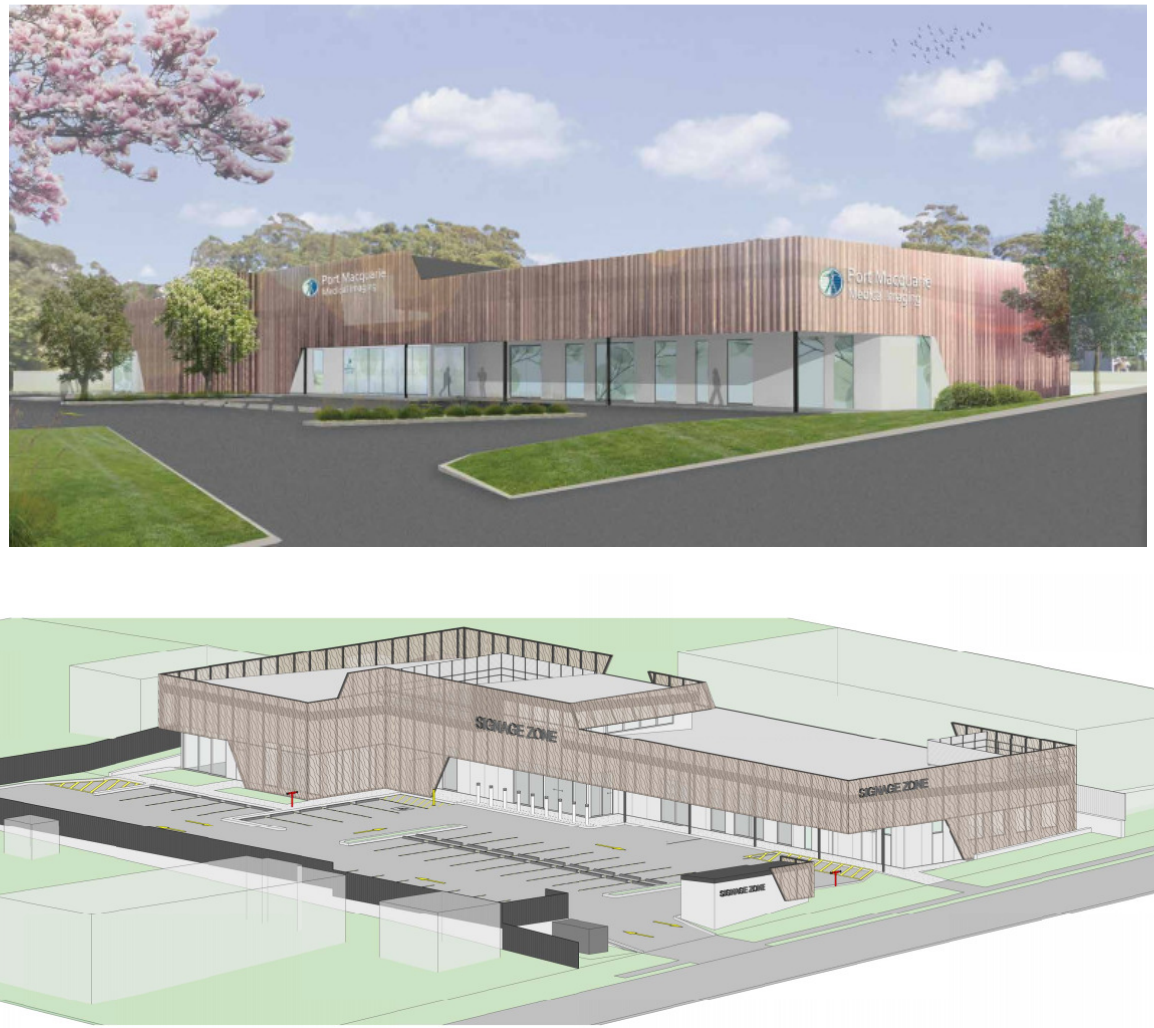
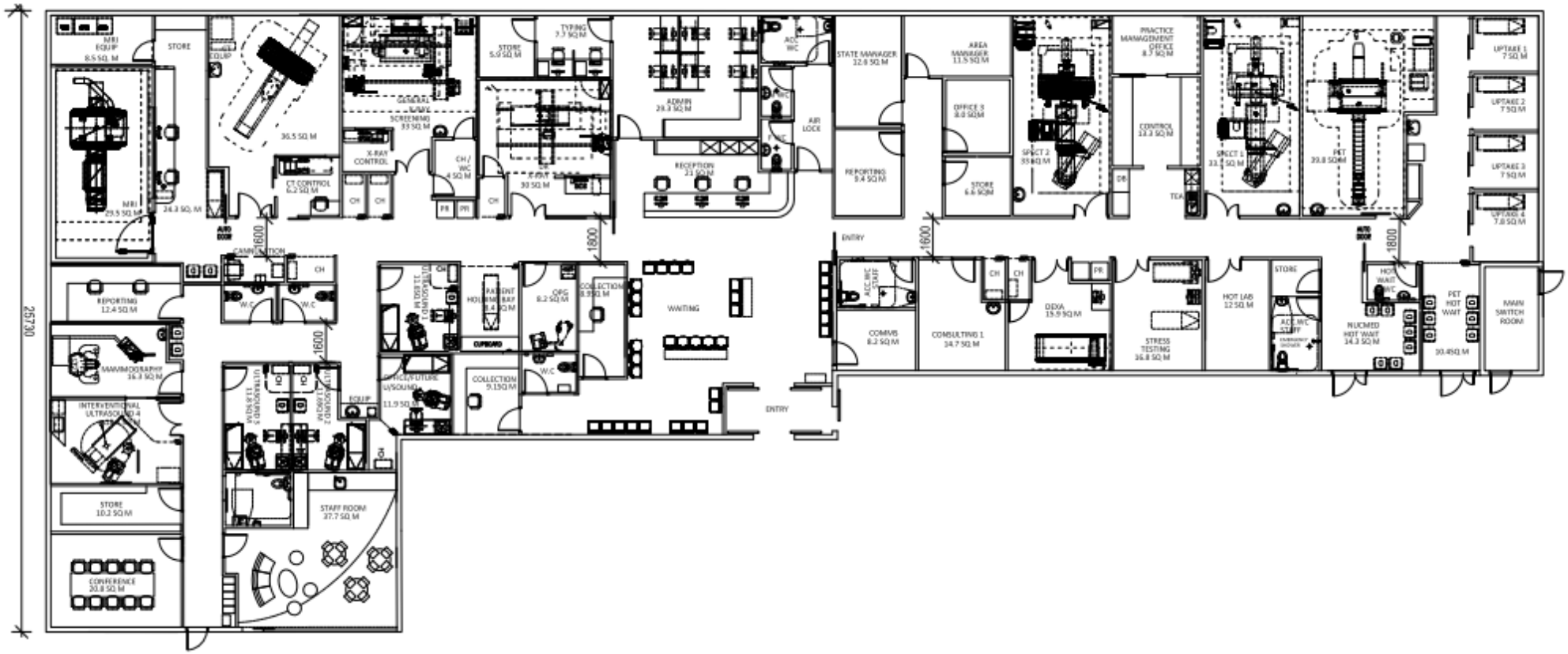


Figure 2-4 Indicative Internal Layout



3 EXISTING NOISE ENVIRONMENT

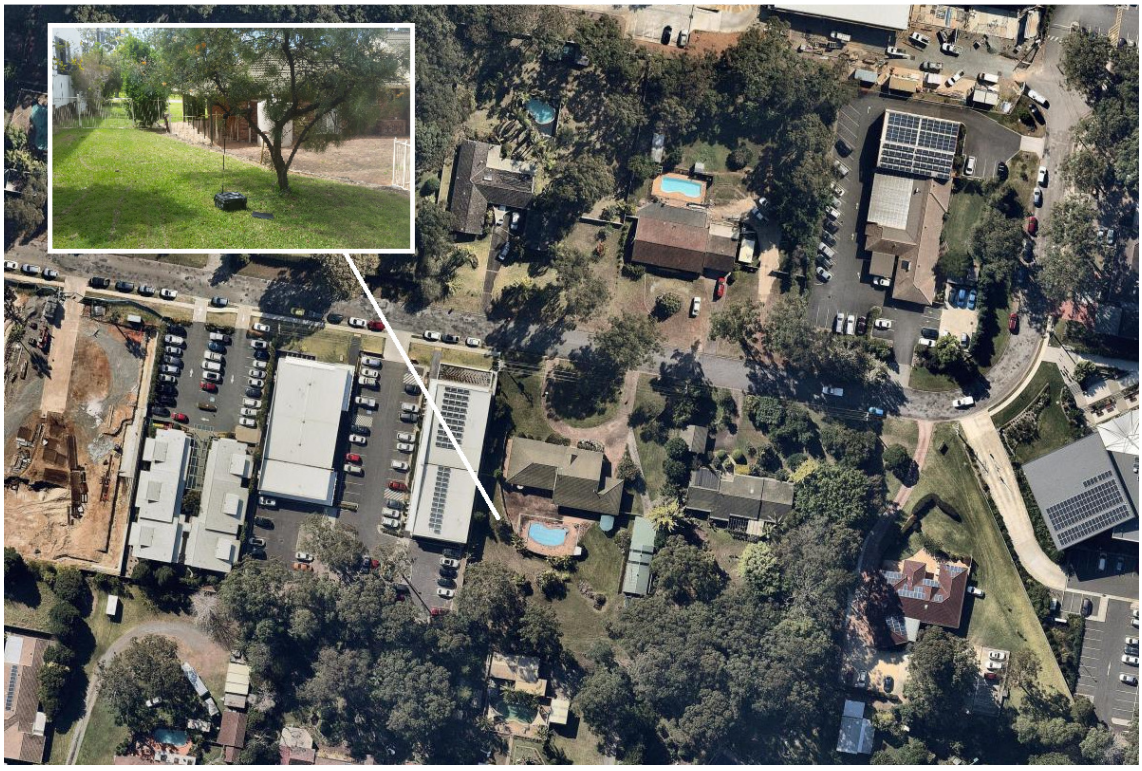
3.1 Noise Monitoring Methodology

In order to quantify the existing ambient noise environment of the area, unattended environmental noise monitoring was conducted on the Site between Friday 27 October and Monday 6 November 2017.

An ARL Ngara Environmental Noise Logger (serial number 194505) was used, fitted with microphone and windshield and set to A-weighted and fast response. Calibration of the logger was checked prior to and following measurements. Drift in calibration did not exceed ±0.5 dBA. All equipment carried appropriate and current NATA (or manufacturer) calibration certificates.

The noise monitoring location is shown in Figure 3-1.

Figure 3-1 Noise Monitoring Location at 14 Highfields Circuit



The logger continuously sampled noise levels over the entire survey period, and calculated relevant statistical indices for each 15-minute interval. All measurements were undertaken in general accordance with AS 1055:1997: *Acoustics – Description and Measurement of Environmental Noise* and the NSW EPA's *Industrial Noise Policy* (*INP*). Data measured during periods of adverse weather, established through consultation with historical weather reports provided by the Bureau of Meteorology (BOM), has been excluded.

3.2 Noise Monitoring Results

The measured data was processed according to the *INP* assessment time periods. Table 3-1 details the RBL (background) and L_{Aeq} noise levels recorded during the daytime, evening and night time periods.

Table 3-1 Measured Ambient Noise Levels Corresponding to NSW INP Assessment Time Periods

Logger Location	Noise Level - dBA					
	Day 7.00am – 6.00pm		Evening 6.00pm – 10.00pm		Night 10.00pm - 7.00am	
	RBL[1]	L_{Aeq}[2]	RBL[3]	L_{Aeq}	RBL	L_{Aeq}
14 Highfields Circuit	39	56	39	59	35	53

Note 1: The RBL noise level is representative of the average minimum background sound level (in the absence of the source under consideration), or simply the background level.

Note 2: The L_{Aeq} is essentially the average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound.

Note 3: The evening RBL at this location was established at 40 dBA, but reported as 39 dBA. According to *INP Application Notes*, if the evening RBL is found to be higher than the daytime RBL then the latter should be used for the evening assessment period.

4 ASSESSMENT CRITERIA

4.1 Operational Noise Criteria

4.1.1 Port Macquarie-Hastings Local Council

The Port Macquarie-Hastings Development Control Plan 2013 (DCP 2013) defers to the provisions of the NSW *Industrial Noise Policy (EPA, 2000)*. It is generally required that operational noise emissions from mechanical plant and equipment will achieve the recommendations of the *INP.* and that control of external noise from mechanical plant should be in accordance with the *INP*.

4.1.2 NSW Industrial Noise Policy

The NSW *Industrial Noise Policy (EPA, 2000)* provides a framework and process for deriving noise criteria for consents and licences that enable the EPA and others to regulate premises that are scheduled under the Protection of the Environment Operations Act 1997. Whilst specifically aimed at assessment and control of noise from industrial premises, the approaches documented can be used to provide guidance for the assessment of noise from other continuous or semi-continuous operational sources.

The INP criteria for industrial noise sources have two components:

- Controlling the *intrusive* noise impacts for residents and other sensitive receivers in the short term; and

- Maintaining noise level *amenity* for particular land uses for residents and sensitive receivers in other land uses.

Intrusiveness Criterion

For assessing intrusiveness, the background noise level must be measured. The intrusiveness criterion essentially means that the equivalent continuous noise level (L_{Aeq}) of the source should not be more than 5 dBA above the measured background level (L_{A90}). The L_{Aeq} level is measured over 15 minutes and the background noise level is taken as the RBL.

Amenity Criterion

The amenity assessment is based on noise criteria specific to land use and associated activities. The criteria 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. For high-traffic areas the amenity criterion for industrial noise becomes the $L_{Aeq,period(traffic)}$ minus 10 dB.

The amenity criteria recommended by the *INP* for surrounding receivers is set out in Table 4-1.

Table 4-1 Amenity Criteria - Recommended L_{Aeq} Noise Levels from Industrial Noise Sources

Type of Receiver	Indicative Noise Amenity Area	Time of Day[1]	Recommended $L_{Aeq,period}$ Noise Level dBA	
			Acceptable	Recommended Maximum
Residence	Suburban	Day	55	65
		Evening	45	55
		Night	40	50
Hospital Ward	All	Noisiest 1-hour period	50	55
Commercial	All	When in use	65	70

Note 1: Daytime 7.00am–6.00pm; Evening 6.00pm–10.00pm; Night 10.00pm-7.00am.

Project-Specific Noise Levels

The project-specific levels for operational noise emissions from the Site as assessed at the surrounding receivers are shown in bold in Table 4-2. Note that intrusiveness criteria are evaluated over a 15-minute period, while amenity criteria are evaluated over an entire day, evening or night period.

Table 4-2 Assessment Criteria for Operational Noise Emissions, dBA

Location	Area Classification	Period	RBL [2] $L_{A90(15min)}$	Intrusiveness[3] $L_{Aeq(15min)}$	Amenity $L_{Aeq\ (period)}$
Residence	Suburban	Day	39	**44**	55
		Evening	39	**44**	45
		Night	35	**40**	40
Hospital Ward	All	Noisiest 1-hour period	-	-	**55**
Commercial	All	All	-	-	**65**

Note 1: Recommended - ANL Acceptable Noise Level.
Note 2: RBL Rating Background Level.
Note 3: Intrusive criterion only applicable to residential receivers.

During detailed design, the mechanical services and substation should be specified, located and/or acoustically treated to ensure that cumulatively their noise emissions do not exceed the Intrusiveness criteria set out in Table 4-2 at the neighbouring residential sites during the day, evening or night.

Additionally, noise from the use of the car park should be controlled to not exceed these criteria when in use.

4.1.3 Short Duration Events - Sleep Disturbance

Noise sources of short duration and high level that may cause disturbance to sleep if occurring during the night time are not adequately addressed by the long-term-noise assessment procedure required by the *INP*.

The approach currently recommended by the EPA to assess short duration, high level noise sources with the potential to cause sleep disturbance is to apply an initial screening criterion of background plus 15 dBA (as described in the Application Notes to the *INP*), and to undertake further detailed analysis if the screening criterion cannot be achieved. The sleep disturbance screening criterion applies outside bedroom windows during the night time period.

Where the screening criterion cannot be met, the additional analysis should consider the number of potential sleep disturbance events during the night, the level of exceedance and noise from other events. It may also be appropriate to consider other guidelines including the *NSW Road Noise Policy* (RNP) which contains additional guidance relating to potential sleep disturbance impacts.

A review of research on sleep disturbance in the RNP indicates that in some circumstances, higher noise levels may occur without significant sleep disturbance. Based on currently available research results, the *RNP* concludes that:

- "Maximum internal noise levels below 50 dBA to 55 dBA are unlikely to cause awakening reactions."

- "One or two noise events per night, with maximum internal noise levels of 65 dBA to 70 dBA, are not likely to affect health and wellbeing significantly."

It is generally accepted that internal noise levels in a dwelling, with the windows "normally" open, are 10 dB lower than external noise levels. Based on a worst case minimum attenuation, with windows open, of 10 dB, a short-term external noise level of 60 dBA to 65 dBA is unlikely to cause awakening reaction. One or two noise events per night with maximum external noise levels of 75 dBA to 80 dBA are not likely to affect health and wellbeing significantly.

Based on a night time RBL of **35 dBA** (established in accordance with *INP* procedures), the applicable sleep disturbance screening criterion at residential receivers is **50 dBA**. However, levels of up to 65 dBA are considered acceptable for this project.

For short term noise event occurring during the night-time that may potentially cause sleep disturbance to hospital patients, an appropriate external noise limit of 65 dBA at the building facade is recommended.

4.2 Road Traffic Noise Criteria

The NSW *Road Noise Policy (RNP)* (2011) was released by the EPA to replace the *Environmental Criteria for Road Traffic Noise* (1999) from 1 July 2011. A key provision of the new policy is an emphasis on the use of land use planning, better road design and vehicle noise emission control to avoid or minimise road traffic noise impacts. The assessment criteria for residences potentially affected by additional traffic generated by land use developments on local roads are summarised in Table 4-3.

Table 4-3 NSW Road Traffic Noise (*RNP*) Assessment Criteria for Residences

Road Category	Type of Project / Land Use	Assessment Criteria	
		Day (7am-10pm)	Night (10pm-7am)
Local roads	Existing residences affected by **additional traffic** on existing local roads generated by land use developments	$L_{Aeq,(1hr)}$ 55 dBA	$L_{Aeq,(1hr)}$ 50 dBA

The criteria are for assessment against facade noise levels when measured at 1 metre in front of a building facade.

The *RNP* states that *an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person*.

4.3 Construction Noise Criteria

4.3.1 NSW *Interim Construction Noise Guideline*

The noise criteria set out in the NSW *Interim Construction Noise Guideline* (*ICNG*) have been used to assess the potential impacts from construction noise. This document guides the EPA in setting statutory conditions in licences or other regulatory instruments for construction noise.

Table 4-4 and Table 4-5 summarise the relevant construction noise criteria specified in the Guideline.

Table 4-4 Construction Noise Criteria – Noise at Residences

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

Table 4-5 Construction Noise Criteria – Noise at Other Sensitive Land Uses

Land Use	Management Level, $L_{Aeq, 15min}$ dB(A)
Commercial Premises	External noise level: 70 dB(A)
Hospital Wards	Internal noise level: 45 dB(A)

4.3.2 Project-Specific Construction Noise Management Levels

Construction would be constrained to within the *ICNG* recommended standard hours. With consideration of the determined daytime RBL, Table 4-6 sets out the applicable Construction Noise Management Levels.

Table 4-6 Project-Specific Construction Noise Management Levels

Receptor Location	RBL L_{A90} dB(A)	Noise Affected Level $L_{Aeq,15min}$ dB(A)	Highly Noise Affected Level $L_{Aeq,15min}$ dB(A)
Residential Receivers	39	49	75
Commercial Receivers	-	70	-
Hospital Wards*	-	55	-

Note: * The Hospital Ward NML of 55 dBA is conservatively based on the reduction of 10 dB readily achieved through an open window. It is expected that higher noise levels external to the medical facility located at 12 Highfields Circuit would be tolerable.

4.3.3 Construction Traffic Noise Levels

The interim construction noise guideline does not include any criteria to assess off-site traffic noise associated with the construction. Off-site construction traffic noise would be minimised as much as practical by limitations on construction hours and Australian Design Rules, which apply to road-registered vehicles.

4.4 Construction Vibration Criteria

When assessing vibration there are two components that require consideration:

- human exposure to vibration; and
- the potential for building damage from vibration.

Construction work is generally considered an intermittent source of vibration.

4.4.1 Human Exposure to Vibration

Assessing Vibration: A Technical Guideline provides guidance for assessing human exposure to vibration. The publication is based on British Standard BS 6472:1992. Intermittent vibration is assessed by the Vibration Dose Value (VDV) which is based on the *weighted* root mean quartic (rmq) acceleration in each component.

Table 4-7 sets out VDV values as specified by *Assessing Vibration: A Technical Guideline.*

Table 4-7 Human Comfort Vibration Goals – VDV ($m/s^{1.75}$)

Place	Day (7am-10pm)		Night (10pm-7am)	
	Preferred	Maximum	Preferred	Maximum
Residences	0.20	0.4	0.13	0.26

4.4.2 Building Damage from Vibration

There are currently no Australian Standards or guidelines to provide guidance on assessing the potential for building damage from vibration. It is common practice to derive goal levels from international standards.

British Standard BS 7385:1993 and German Standard DIN 4150:1999 both provide goal levels, below which vibration is considered insufficient to cause building damage. Of these, DIN 4150 is the more stringent. DIN 4150 bases the goal levels on the highest vibration level in each component (Peak Component Particle Velocity – PCPV). Table 4-8 summarises the goal levels specified in DIN 4150.

Table 4-8 Guideline Values for Vibration Velocity to be used when Evaluating the Effects of Short-Term Vibration on Structures (DIN 4150-3:1999)

Type of Structure	Guideline Values for Velocity – PCPV (mm/s)		
	1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz
Buildings used for commercial purposes, industrial buildings, and buildings of similar design	20	20 to 40	40 to 50
Dwellings and buildings of similar design and/or occupancy	5	5 to 15	15 to 20
Structures that, because of their particular sensitivity to vibration, cannot be classified under either of the other classifications and of great intrinsic value	3	3 to 8	8 to 10

With regard to these levels DIN 4150 states, *"experience has shown that if these values are complied with, damage that reduces the serviceability of the building will not occur. If damage nevertheless occurs, it is to be assumed that other causes are responsible. Exceeding [these] values does not necessarily lead to damage; should they be significantly exceeded, however, further investigations are necessary."*

For general construction vibration, the dominant frequency is typically greater than 50 Hz. However, because the dominant frequency of vibration cannot be determined with certainty at this stage, this assessment has adopted conservative goals of 5 mm/s for residential buildings and 20 mm/s for industrial buildings.

5 OPERATIONAL NOISE ASSESSMENT

The principal operational noise emissions from the Site would be expected to be from:

- Mechanical Services;
- On-Site Substation; and
- On-site vehicle movements.

5.1 Mechanical Services Noise & Substation

Future development on the site will include mechanical plant and potentially an on-site substation which will generate noise emissions to the surrounding area and other buildings on the site. Therefore, noise may need to be mitigated to protect the acoustic amenity of existing and future receivers.

Appropriate site-specific noise criteria have been determined based on the stipulations of the NSW *Industrial Noise Policy (INP)*, as set out in Table 4-2. These criteria would apply at the most affected point on or within the receiver property boundary. Criteria applicable at the commercial sites apply only when those sites are in use.

These criteria should be considered during the specification of mechanical services and substation that may be installed on the site. As a general guide, to ensure compliance, it would be recommended that all plant be specified and located to ensure that cumulative operational noise from the site does not exceed $L_{Aeq,15\ min}$ 44 dBA during daytime and evening hours or $L_{Aeq,15\ min}$ 40 dBA at night at the site boundaries.

During detailed design, noise emission allowances for each mechanical plant item may be calculated to ensure compliance with the criteria identified in Table 4-2.

The adoption of standard engineering noise controls, such as silencers, barriers and lined ducts, can be adopted to mitigate any future noise emissions associated with services.

5.2 On-Site Traffic Noise

Noise emissions will be generated by vehicles entering and leaving the carpark and vehicle-related activities, such as opening and closing of doors, vehicles starting, manoeuvring and the like.

The site plan shows parking spaces for 53 vehicles plus an ambulance bay to accommodate staff and visitors within the carpark area accessed directly from Highfields Circuit.

According to the traffic report prepared by TTM Consulting, there could be up to 29 vehicle movements in the worst/peak hour. On this basis, up to an average of 8 vehicle movements may be expected over a 15-minute peak period.

Calculations based upon the BayLfU method (Bavarian State Agency for the Environment 2007) indicate that with the inclusion of a barrier of no less than 2 m in height, extending along the eastern and southern site boundaries, car park noise from the site would not exceed the daytime operational noise criterion of $L_{Aeq,15\ min}$ 44 dBA.

It is expected that during the evening and night, the use of the car park would be limited and that compliance with the evening operational noise criterion of $L_{Aeq,15\ min}$ 44 dBA and night criterion of $L_{Aeq,15\ min}$ 40 dBA would not be readily achieved.

5.3 Off-Site Traffic Noise

The traffic engineering report prepared by TTM Consulting notes that the existing AM/PM peak hour traffic volumes on Wrights Road leading to the subject site are in the order of 400vph / 200vph. Additionally, it notes that the proposed development would generate a further 29 movements in the AM/PM peak hours.

TTM Consulting considers that approximately 15% of the existing traffic may turn onto Highfields Circuit, whilst 85% may take the other route to the Port Macquarie Base Hospital. Therefore, existing AM/PM peak hour traffic volumes of 60vph / 30vph may be expected on Highfields Circuit.

Considering the existing and project related peak hour volumes identified above, the peak hour total traffic noise levels have been calculated using the CoRTN (Calculation of Road Traffic Noise) method. Calculations indicate that traffic noise levels would be within the relevant daytime criteria for local roads of $L_{Aeq,1hour}$ 55 dBA (applicable between 7.00am-10.00pm) as recommended by the RNP.

It is expected that during the night (between 10.00pm-7.00am), the development would generate substantially lower traffic movements and existing traffic volumes would also be appreciably lower. On this basis it is predicted that the night criterion of $L_{Aeq,1hour}$ 50 dBA, as recommended by the RNP, would also be readily met.

6 CONSTRUCTION NOISE ASSESSMENT

On Site construction works may be expected to take approximately eight months to complete.

In accordance with the Interim Construction Noise Guideline (DECC, 2009) construction on the site will only be undertaken between 7.00am to 6.00pm Monday to Friday, and 8.00am to 1.00pm on Saturdays. No construction will be undertaken on site on Sundays or public holidays.

Whilst the exact construction methodology is yet to be determined, it is likely that the following activities would be undertaken:

- Site preparation and installation of boundary hoardings;
- Demolition of existing dwelling;
- Clearing of the site and earthworks;
- Construction of buildings and other infrastructure;
- Construction of access roads, vehicle parking areas;
- Connecting the new infrastructure to services and utilities;
- Internal fit-out;
- Finalising pavements and landscaping; and
- Commissioning activities.

6.1 Construction Equipment

The equipment and plant required during the construction of the Project are yet to be identified. Typical plant is shown in Table 6-1.

Table 6-1 Construction Equipment

Plant and Mobile Equipment	Sound Power Level per Item $L_{Aeq,15min}$ dB(A)	Duty Factor (mins operating per 15-min period)	Sound Power Level per Item Considering Duty Factor
30t Excavator	110	15	110
Piling Rig	116	5	111
6t smooth drum roller	108	10	106
Franna Crane	105	5	100
Large Mobile Crane	106	5	101
Grader	116	10	114
Sheeps Foot Roller	108	10	106
Bobcat	100	5	95
Material delivery trucks with Hyab	105	10	103
Delivery truck	105	10	103
Concrete Trucks	105	15	105
Hot mix asphalt machine	105	15	105

Note: Equipment sound power levels sourced from Wilkinson Murray's internal database.

6.2 Traffic, Parking and Access during Construction

The demolition and construction phase of the Project would result in an increase in traffic as a result of additional staff coming to and from the Site. In addition to demolition and construction worker movements, a number of light and heavy vehicle movements would be required during each stage for deliveries and disposal of materials.

6.3 Construction Noise Predictions

Noise emissions would vary as construction progresses. It is to be expected that construction noise emissions may at times exceed the *ICNG* $L_{Aeq,15min}$ 49 dBA noise management level during the construction at the closest residential receiver locations (within approximately 100 m from the site). During the works there may also be potential for some intermittent exceedances of the *ICNG* $L_{Aeq,15min}$ 75 dBA highly affected noise management level at the closest residential receiver locations, neighbouring the Site.

To limit potential noise impacts, the works should be closely managed and appropriate management strategies be put in place. These measures are set out in Section 8.

In particular, it is recommended that receivers within 100 m of the works are kept informed with respect to the construction schedule and the timing of any particularly noisy activities. As construction progresses, where practicable, consideration should be given to providing quiet respite periods for these receivers, should this be required.

7 CONSTRUCTION VIBRATION ASSESSMENT

Activities undertaken during the construction of the Project may generate ground vibration. With respect to the construction plant identified in Table 6-1, the highest levels of vibration would be expected to occur during works requiring the use of a vibratory roller. Somewhat lower levels of vibration may also arise with the use of an auger piling rig.

The NSW Transport Construction Authority's *Construction Noise Strategy (CNS)* provides guideline safe working distances for typical items of vibration intensive plant. These are reproduced in Table 7-1. The safe working distances are quoted for both "cosmetic" damage to buildings (refer BS 7385) and human comfort (refer DECCW's *Assessing Vibration – A Technical Guideline*).

Table 7-1 Recommended Safe Working Distances for Vibration Intensive Plant

Plant Item	Rating/Description	Safe Working Distance	
		Cosmetic Damage (BS 7385)	Human Response (DECCW Vibration Guideline)
Vibratory Roller	< 50 kN (Typically 1-2 tonnes)	5 m	15 m to 20 m
	< 100 kN (Typically 2-4 tonnes)	6 m	20 m
	< 200 kN (Typically 4-6 tonnes)	12 m	40 m
	< 300 kN (Typically 7-13 tonnes)	15 m	100 m
	> 300 kN (Typically 13-18 tonnes)	20 m	100 m
	> 300 kN (> 18 tonnes)	25 m	100 m
Small Hydraulic Hammer	(300 kg - 5 to 12t excavator)	2 m	7 m
Medium Hydraulic Hammer	(900 kg – 12 to 18t excavator)	7 m	23 m
Large Hydraulic Hammer	(1600 kg – 18 to 34t excavator)	22 m	73 m
Vibratory Pile Driver	Sheet Piles	2-20 m	20 m
Pile Boring	800 mm	2 m (nominal) N/A	n/a
Jackhammer	Hand Held	1 m (nominal)	Avoid Contact with Structure

The *CNS* notes that the identified safe working distances are indicative and will vary depending on the particular item of plant and local geotechnical conditions. They apply to cosmetic damage of typical buildings under typical geotechnical conditions.

In relation to human comfort (response), the safe working distances relate to continuous vibration. For most construction activities, vibration emissions are intermittent in nature and for this reason higher vibration levels occurring over shorter periods may be considered tolerable.

7.1 Human Comfort

For the equipment proposed for use on site, and the relevant distances to adjacent residential

receivers, Table 7-1 indicates that human comfort criteria will most likely be met. Note that it is not proposed to use a vibratory roller larger than 6 tonnes on the site.

Compliance with the human comfort vibration goals set out in Table 5-8 is predicted.

7.2 Structural Damage

Table 7-1 indicates that there would be no material risk of structural damage to buildings during the Project, as the predicted vibration levels are substantially below the identified conservative structural damage criteria adopted.

8 NOISE AND VIBRATION MITIGATION MEASURES

8.1 Operational Noise and Vibration

In order to control operational noise to satisfactory levels, the following noise management measures should be applied:

- All mechanical plant items are to be specified (or otherwise acoustically treated) to ensure that they cumulatively contribute no more than 44 dBA (during daytime and evening hours) or 40 dBA (during night hours) at the closest sensitive boundary; and
- An acoustic fence should be established along the eastern and southern site boundaries. The fence should be of at least 2 m in height and should break the acoustic line of sight between the car park and the dwellings located on the adjoining properties. It should be contiguous with no gaps between panels or between itself and the ground and should be formed of material possessing a surface mass of no less than 10 kg/m^2, such as 25 mm timber.

8.2 Construction Noise and Vibration

The following matters and best practice noise management strategies shall be considered and implemented as necessary throughout the construction works to minimise any potential noise and vibration impacts. It is recommended that these matters are set out in a Construction Noise and Vibration Management Plan (CNVMP):

- All noise generating works will be confined to standard construction hours, between 7.00am-6.00pm Monday to Friday; and 8.00am-1.00pm Saturday, with no work on Sundays or public holidays;
- All contactors will be briefed as to the importance of minimising noise and vibration effects;
- Communication with neighbouring property owners/occupiers will be maintained with respect to the timing of the major works. Previous experience on similar projects has demonstrated that affected noise sensitive residents may be willing to endure higher construction noise levels for a shorter duration if they have been provided with sufficient warning in the place of intermittent but extended periods of construction noise at lower levels;
- Portable temporary acoustic screens will be used as practicable to reduce off-site noise levels as much as possible;
- Offset distance between noisy plant items and sensitive receivers will be maximised as much as possible;
- Equipment will be orientated away from sensitive receivers as much as practicable;
- Machinery will be turned off when not in use;
- Noise source controls, such as the use of residential class mufflers will be used where practicable, to reduce noise from all plant and equipment including cranes, excavators and trucks;
- Procedures for dealing with and responding to complaints and incidents will be considered;
- In the case of any unresolved dispute concerning noise and/or vibration impacts on

neighbouring properties, the proponent will engage a suitably qualified acoustic consultant to undertake further assessment.

9 CONCLUSION

EPM Project Pty Ltd has been engaged by Primary Health Care Limited (PRY) to manage Project Horizons. The Project involves the demolition of an existing residential building located at 14 Highfields Circuit, Port Macquarie and the design, development and construction of a Radiology Practice on the Site.

Wilkinson Murray Pty Limited (WM) has been engaged to review the design and advise on matters relating to the Project's acoustic design and potential noise and vibration effects arising from the construction and operation of the facility.

Based on the currently available information, this report summarises WM's preliminary (Phase 1) construction and operational noise and vibration assessment for the Project.

Whilst some intermittent impacts may be expected during the construction phase, it is expected that these can be managed through effective community consultation. Based on the findings of this assessment, WM sees no material noise or vibration issues that could not be mitigated or managed.

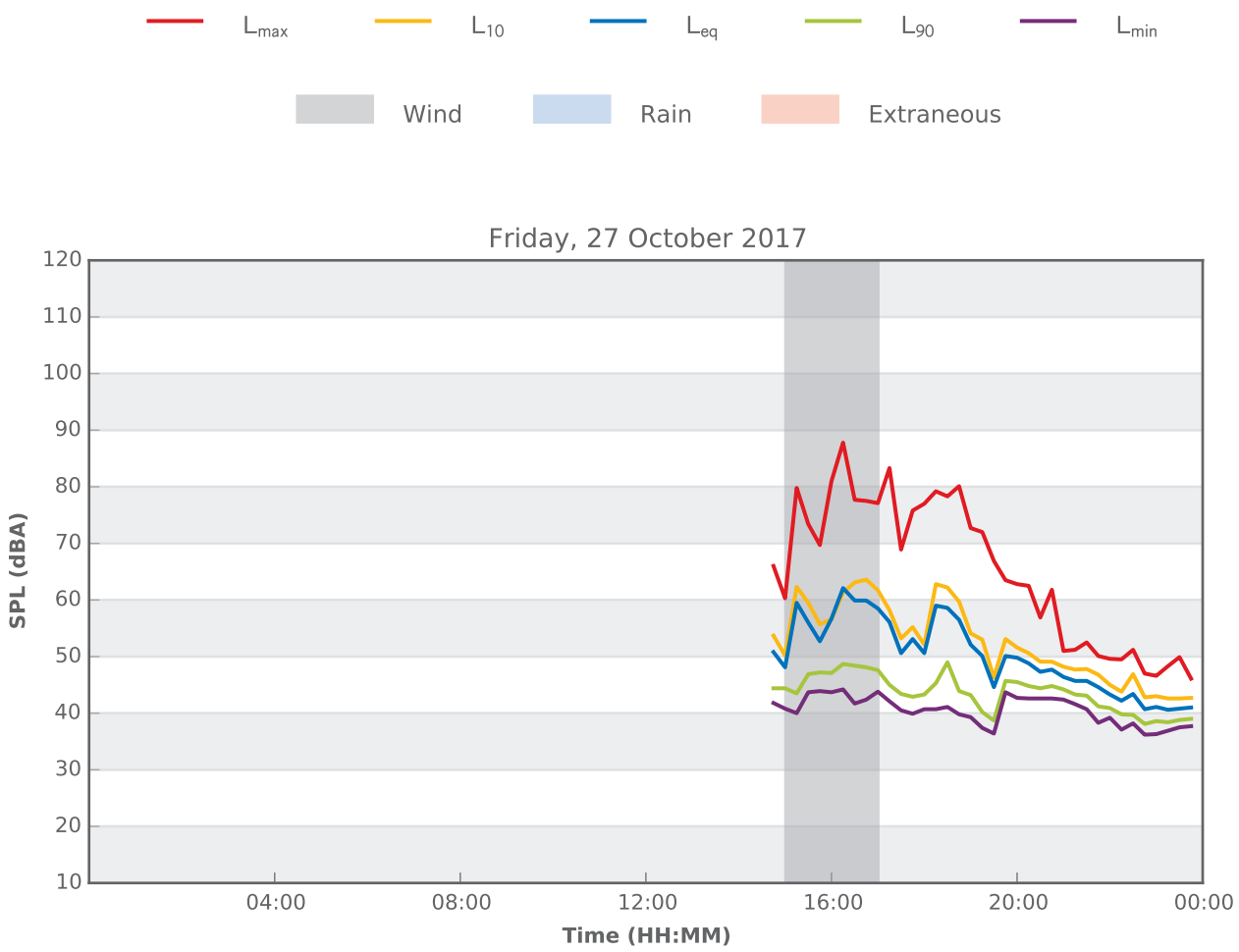
The findings of this assessment will be updated during the Phase 2 assessment, based on further design information.

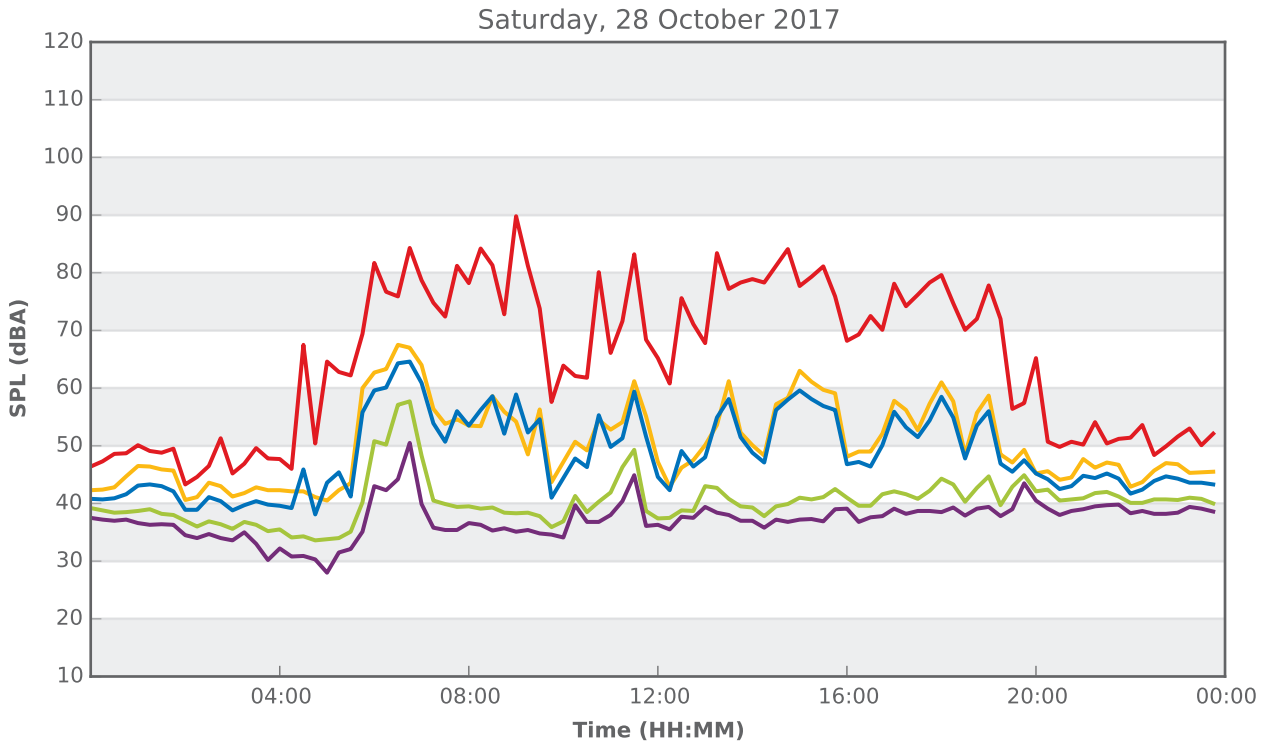
During Phase 2 of the assessment this report will also be updated to address matters relating to the acoustic design of the proposed Radiology Practice. Matters to be considered during Phase 2 include noise ingress to the subject site buildings, control of internal noise levels due to the operation of HVAC systems and other mechanical plant, acoustic privacy between rooms of the development and inter-room noise control and control of vibration effects on sensitive equipment.

APPENDIX A

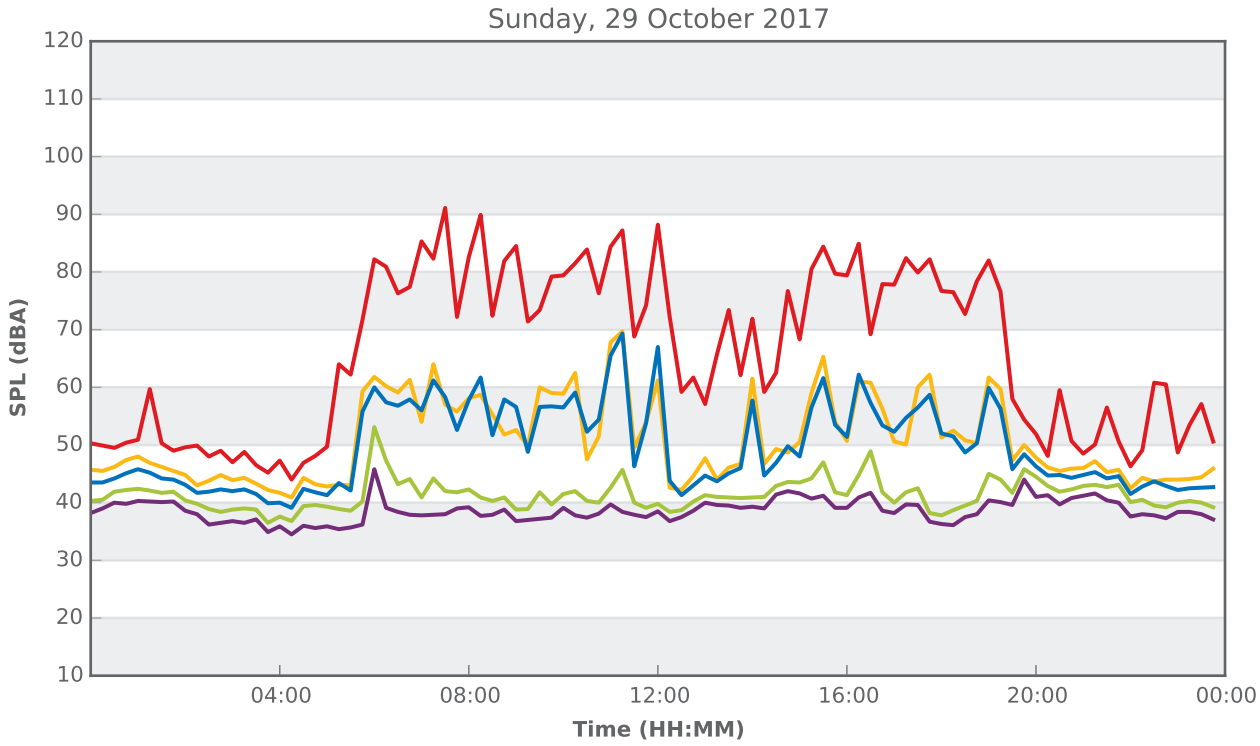
NOISE MEASUREMENT RESULTS

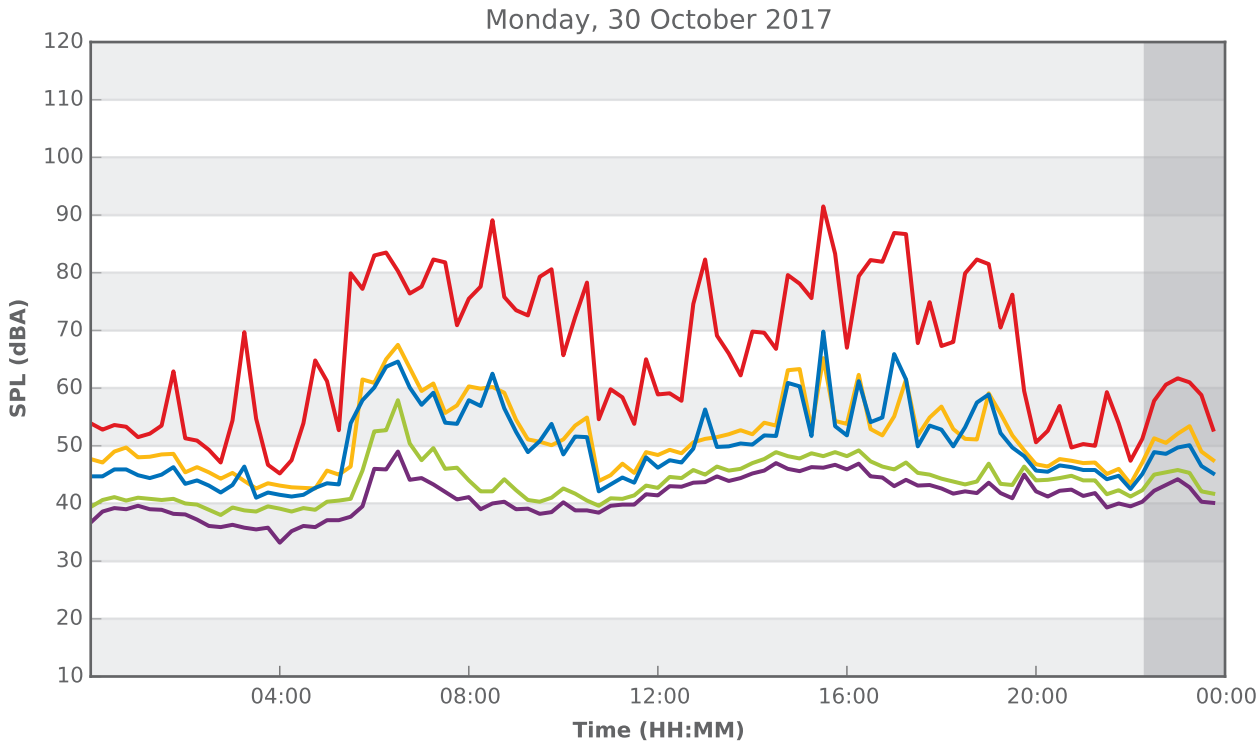
14 Highfields Circuit, Port Macquarie



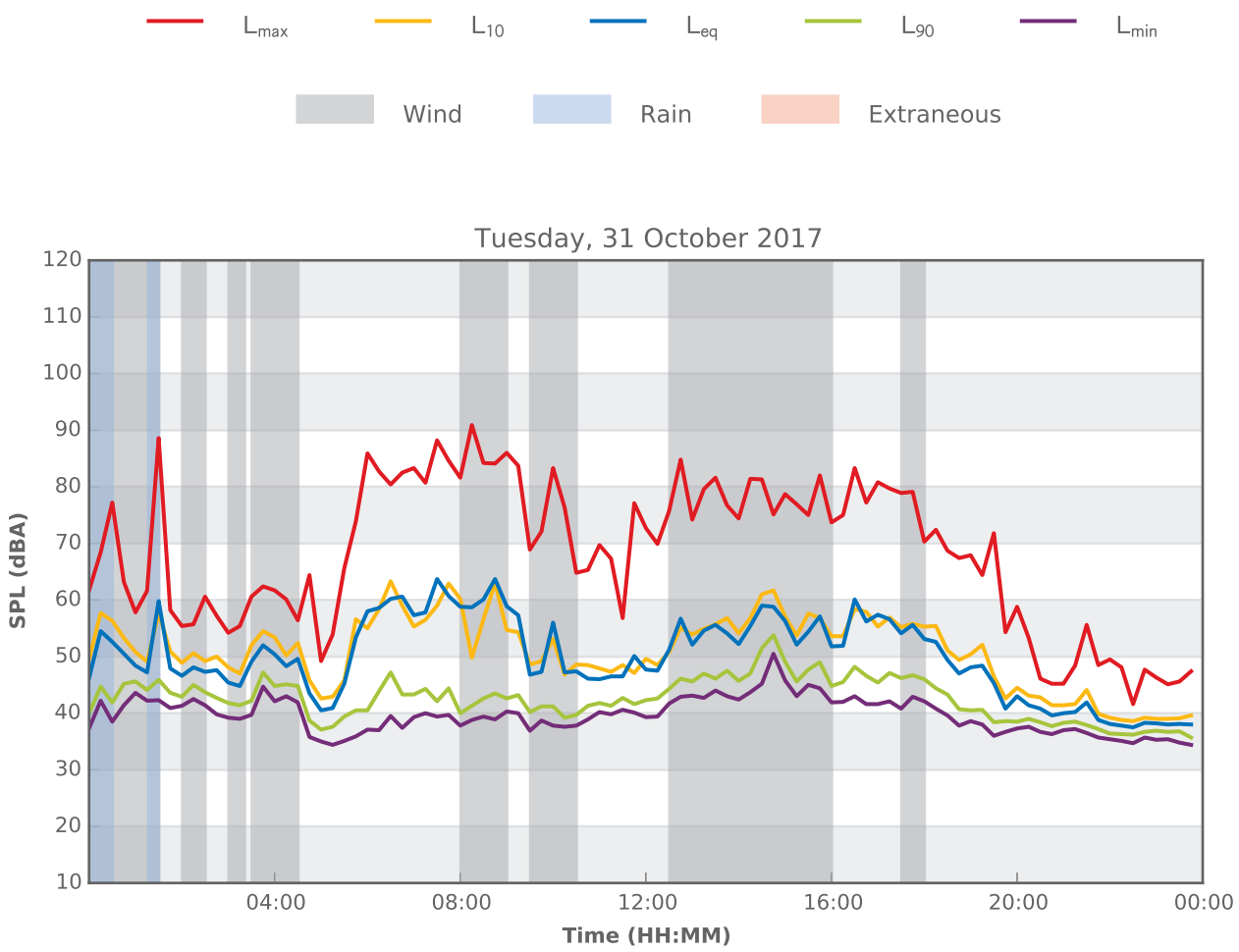


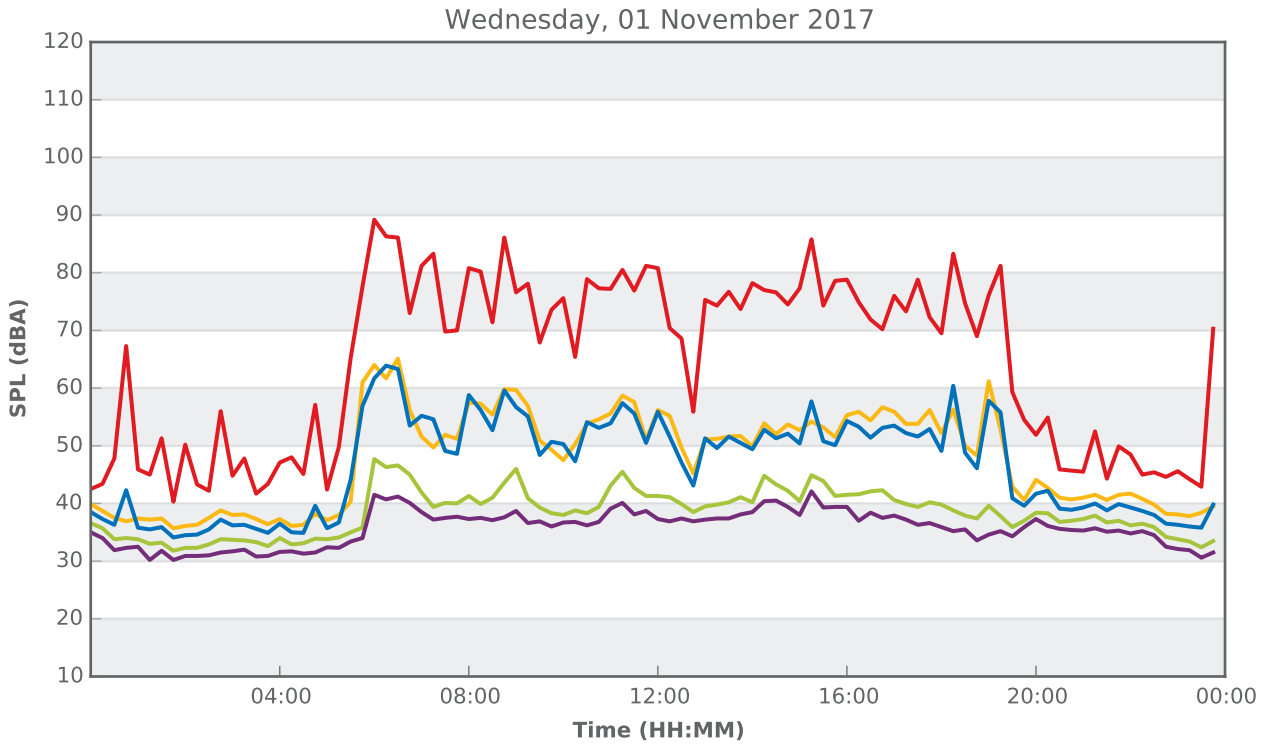
14 Highfields Circuit, Port Macquarie



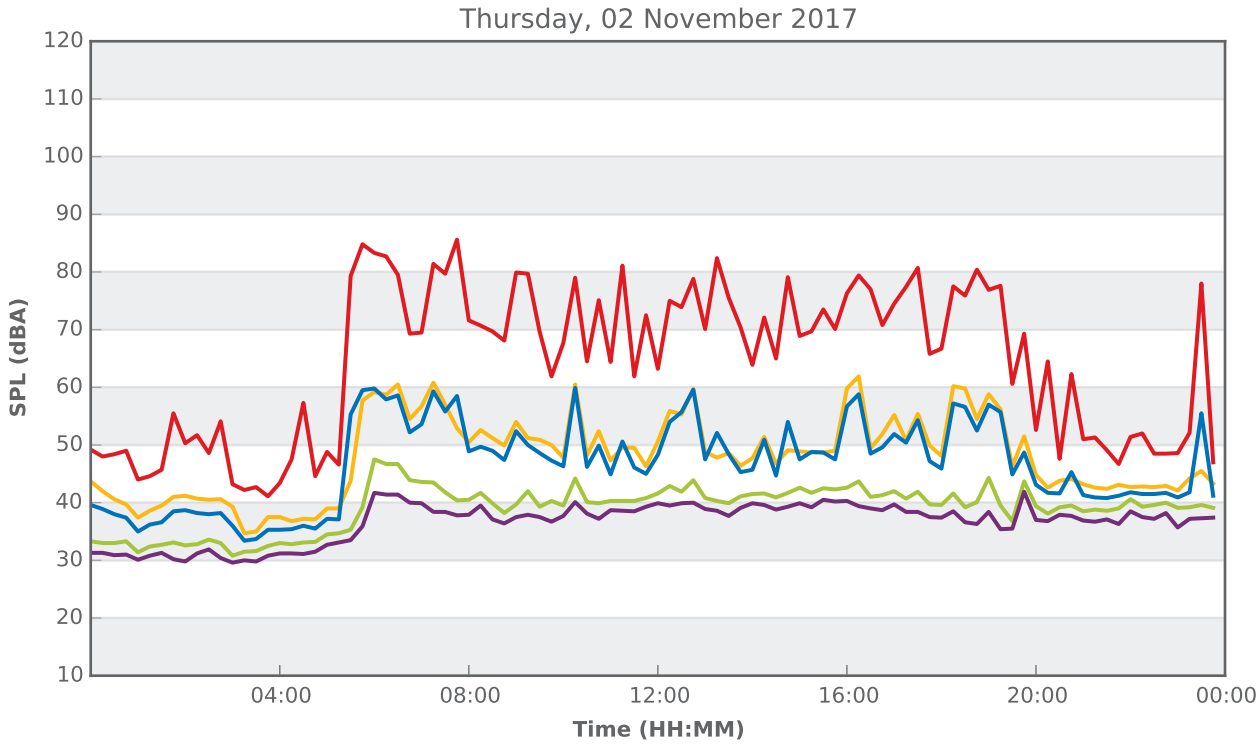


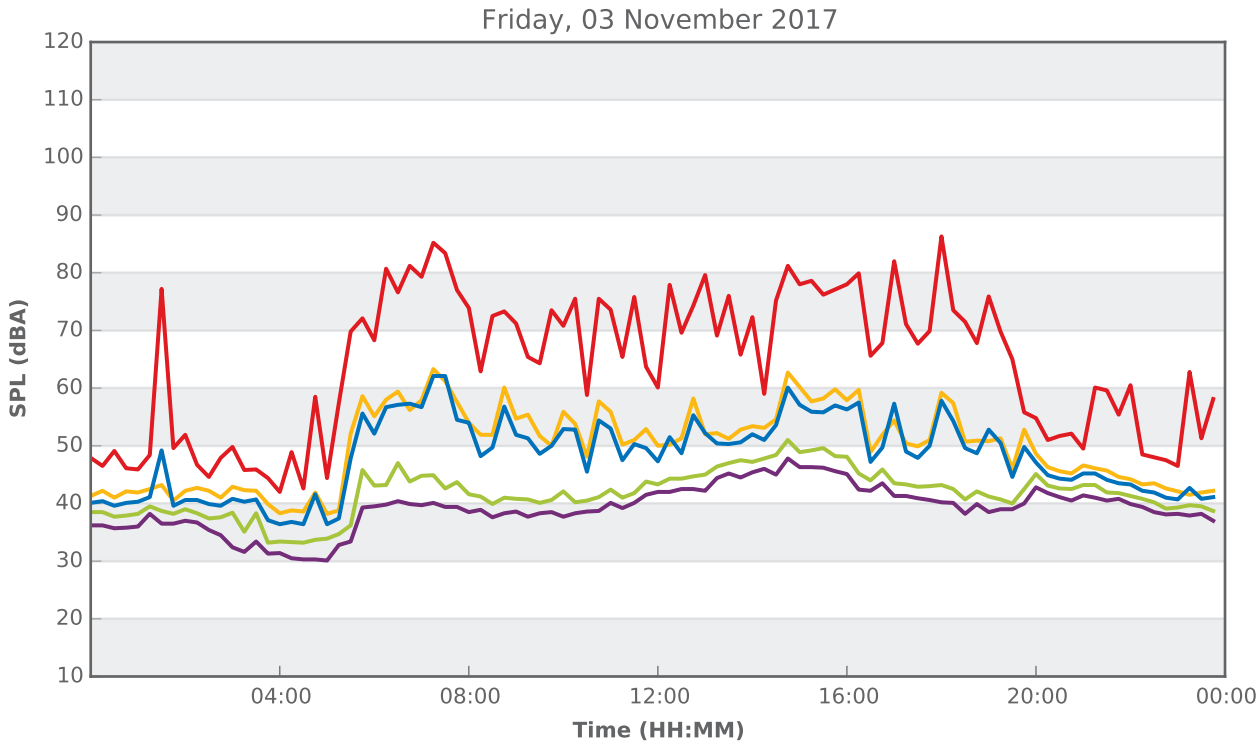
14 Highfields Circuit, Port Macquarie



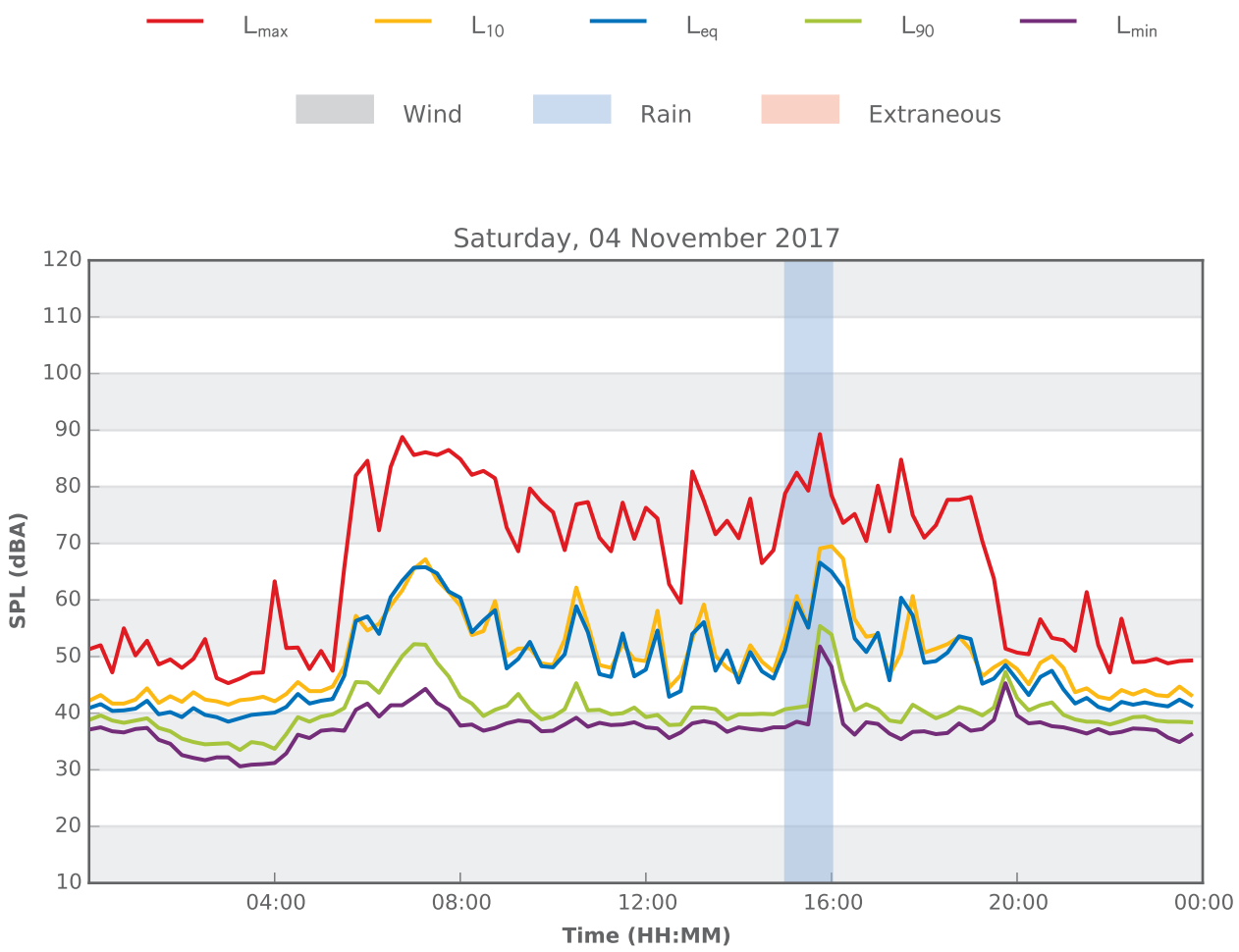


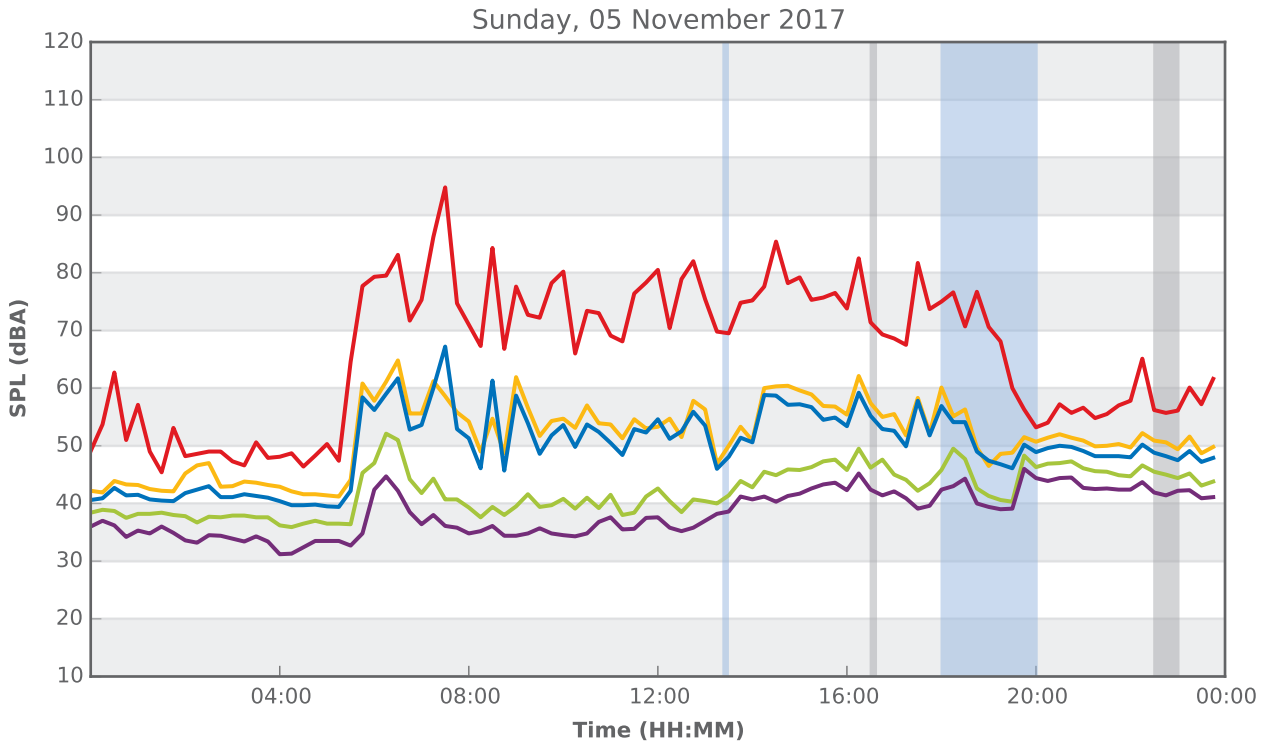
14 Highfields Circuit, Port Macquarie



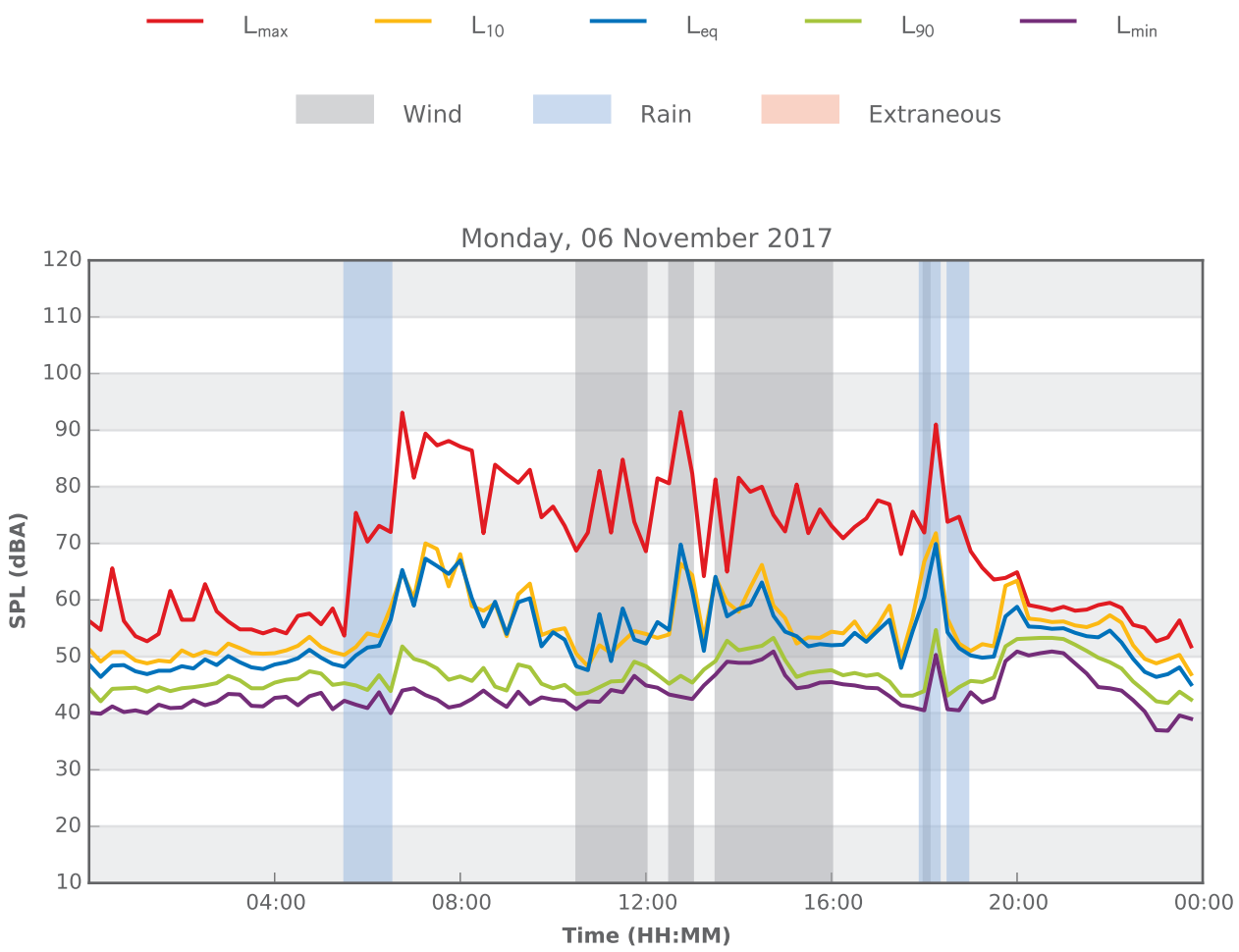


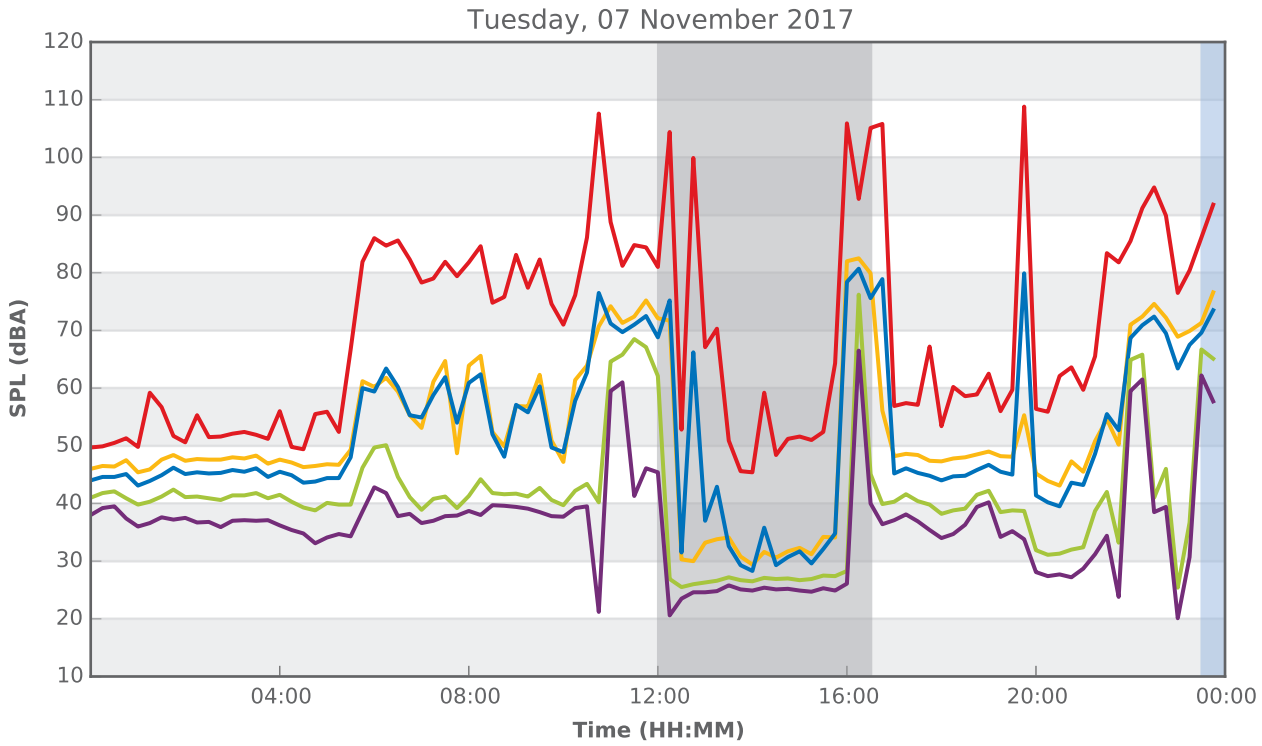
14 Highfields Circuit, Port Macquarie





14 Highfields Circuit, Port Macquarie





14 Highfields Circuit, Port Macquarie