

GREENFIELDS DEVELOPMENT COMPANY

PONDICHERRY REZONING

NOISE AND VIBRATION ASSESSMENT

FEBRUARY 2021



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Pondicherry Rezoning Noise and Vibration Assessment

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1 PROJECT BACKGROUND

WSP Australia Pty Ltd (WSP) has been engaged by Greenfields Development Company (Greenfields) to undertake a noise assessment of the proposed rezoning of the northern section of Oran Park, NSW known as Pondicherry (the project site).

1.1 PONDICHERRY REDEVELOPMENT AREA

The Pondicherry redevelopment area currently comprises primarily agricultural land with scattered residential dwellings and farm buildings. The Pondicherry redevelopment area comprises a total area of 210 hectares and is marked for the development of residential dwellings supported by community facilities including schools, childcare centres, parks and sport and recreation areas.

The Pondicherry redevelopment area is located to the north of the Oran Park precinct, south-west Sydney, approximately 45 km from the Central Business District of Sydney and is within the South West Regional Growth Centre. It is bounded by the mixed use area of Oran Park to the south and The Northern Road to the west. The eastern border of the site is South Creek which marks the boundary with Catherine Fields, a low density rural residential suburb. The northern limit of the site is agricultural land. The Pondicherry redevelopment area is shown in purple in Figure 1.1.

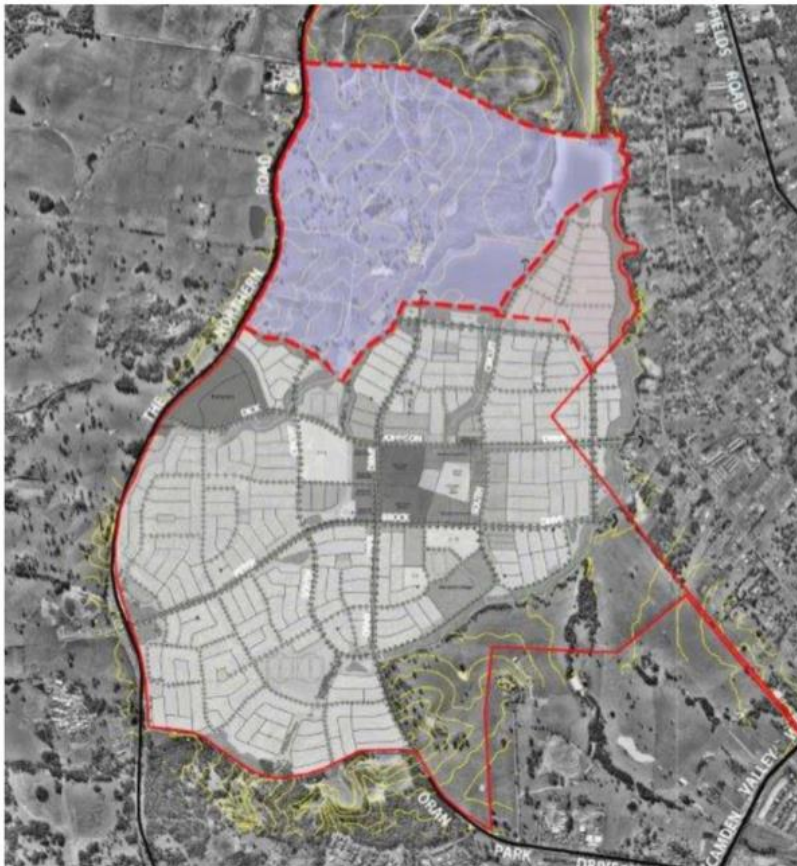


Figure 1.1 Pondicherry rezoning area and surroundings (purple)

Figure 1.2 presents the indicative layout plan for the redevelopment area.

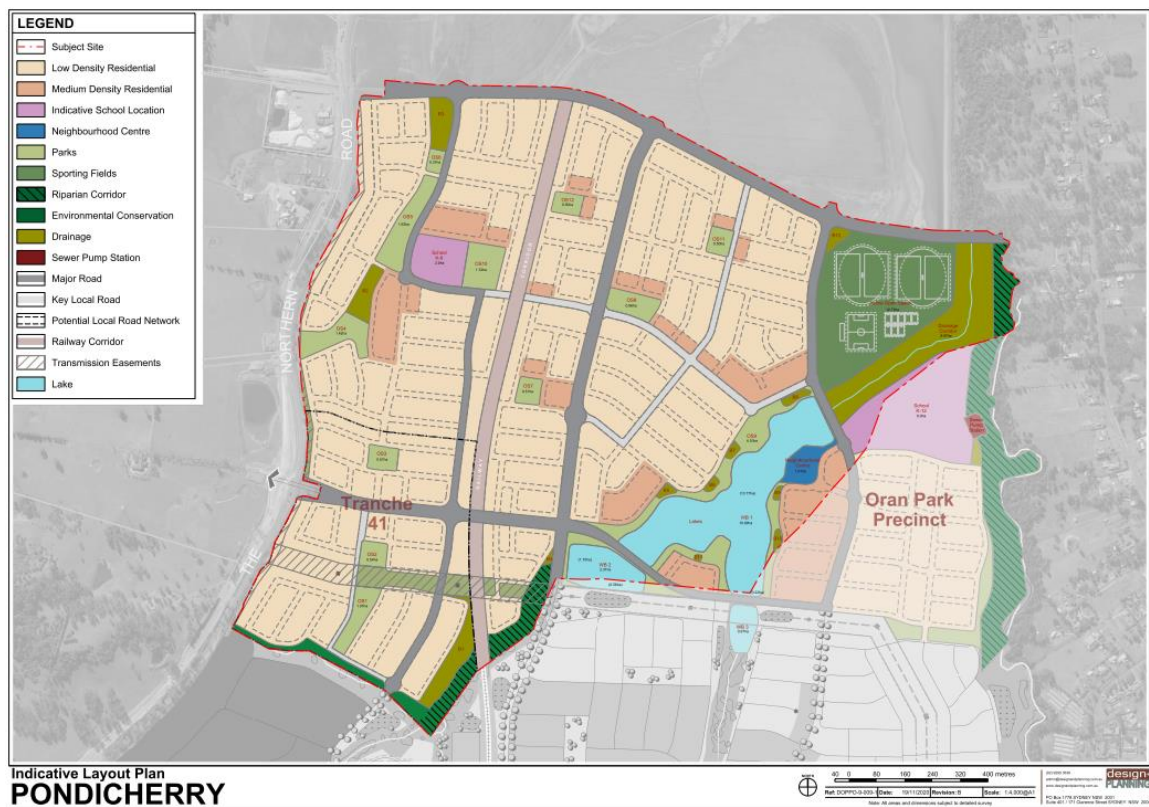


Figure 1.2 Indicative Lot Plan Pondicherry redevelopment

Figure 1.3 presents the indicative staging plan for the rezoning area.

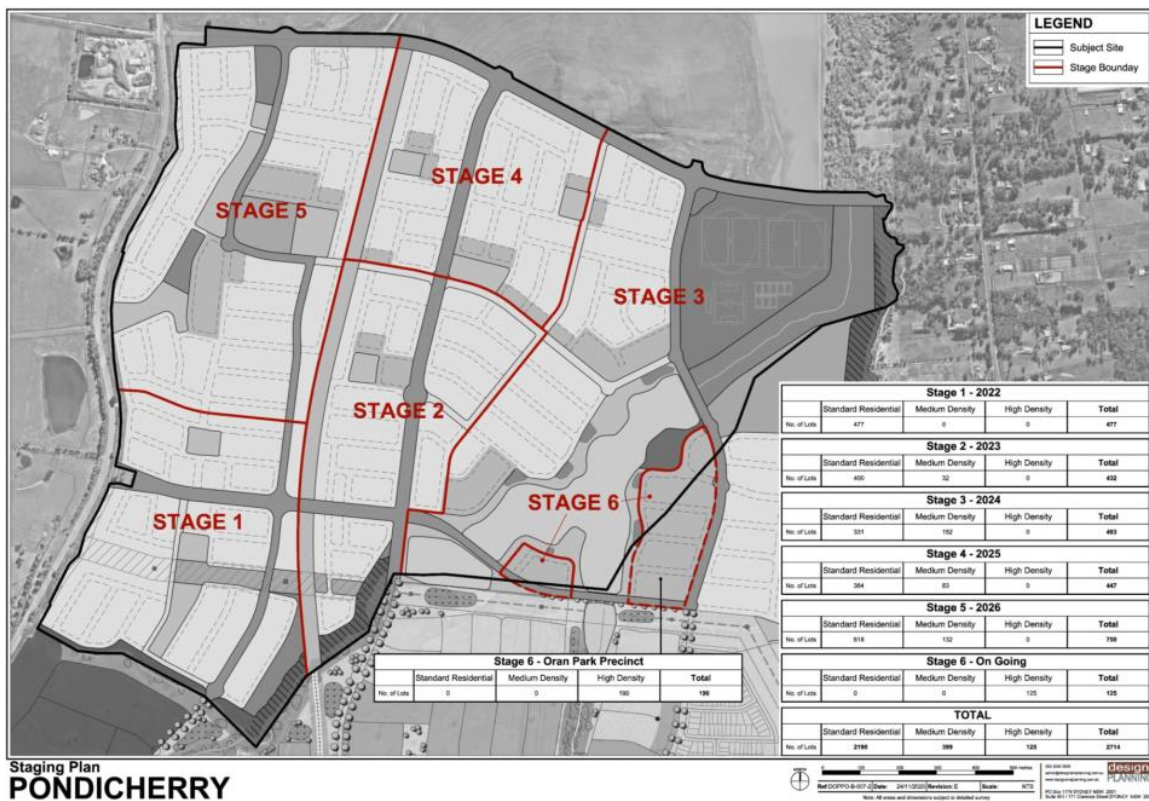


Figure 1.3 Pondicherry redevelopment Staging Plan

1.2 PURPOSE AND SCOPE

The purpose of this report is to conduct an assessment of potential noise impacts associated with the proposed Pondicherry redevelopment area to support a planning proposal to Camden Council.

The aim of this assessment is to identify key noise issues and constraints for the proposed redevelopment area and recommend appropriate planning and design strategies to minimise and manage the impacts.

The potential noise impacts that are relevant to the area include:

- Road traffic noise associated with the upgraded Northern Road and other internal roads
- Rail noise associated with the gazetted North South Rail Line
- Aircraft noise associated with Camden Airport and the future Western Sydney Airport
- Industrial noise associated with existing activities within and adjacent to the Oran Park Precinct.

It is noted that construction noise and vibration generated by the development of Pondicherry are not part of the scope of this assessment and will be addressed during Development Applications for individual subdivisions.

A future rail corridor has been identified as detailed in the draft *North South Rail Line and South West Rail Link Extension Corridors Draft Strategic Environmental Assessment* (Transport for NSW, January 2018), which proposes protection of a future rail corridor through part of the Pondicherry rezoning area. The corridor has been gazetted in the State Environmental Planning Policy (Major Infrastructure Corridors) 2020, which provides statutory controls within the gazetted corridor, and provides requirements applying to land surrounding (generally within 25 metres) of a corridor. Rail noise and vibration impacts associated with the corridor are therefore considered in this document.

WSP completed preliminary noise investigations into the Pondicherry Redevelopment Area in 2017. This involved background noise monitoring for the purpose of road noise model validation. This data has been referenced in relevant sections of this report.

1.3 INFORMATION SOURCES

The assessment has been prepared with reference to the following documents:

- *Australian Standard AS 1055:2015 - Acoustics - Description and measurement of environmental noise*
- *Australian Standard AS 2021:2000 - Acoustics - Aircraft noise intrusion - Building siting and construction*
- *Australian Standard AS 3671:1989 - Acoustics—Road traffic noise intrusion—Building siting and construction*
- *Australian Standard AS/NZS 2107:2016 - Acoustics - Recommended design sound levels and reverberation times for building interiors*
- *Camden Council Environmental Noise Policy (ENP) (2018)*
- *Department of Planning and Environment (DPE), Camden City Council Growth Centre Precincts Development Control Plan (2017)*
- *Department of Planning and Environment (DPE), Oran Park Development Control Plan (2016)*
- *Department of Transport, Welsh Office, Calculation of Road Traffic Noise (CoRTN) (1988)*
- *Development of Rail Alignment for Pondicherry Site, Report of Study* (ref: 2269595A-RAI-REP-001 Rev B) (Parsons Brinckerhoff, April 2017)
- *MR154 The Northern Road Upgrade Between The Old Northern Rd and Mersey Rd, Traffic and Transport Assessment Report*, ref: NB11363-ETR-RP-0068 (Sinclair Knight Merz, August 2012)

- *The Northern Road Upgrade, Narellan to Bringelly Noise and Vibration Assessment, ref: NB11363-NNA-RP-0159 - Noise Assessment_Final 18102012* (Sinclair Knight Merz, October 2012)
 - *North South Rail Line and South West Rail Link Extension Corridors Draft Strategic Environmental Assessment* (Transport for NSW, January 2018)
 - *North West Rail Link Noise and Vibration Technical Paper for Operations and Additional Construction Works* (SLR, 17 October 2012)
 - *NSW Department of Environment and Climate Change (DECC) – Road Noise Policy (RNP)* (2011)
 - *NSW Department of Planning (DoP) – Development near rail corridors and busy roads – interim guideline (DRCBR)* (2008)
 - *NSW Environment Protection Authority (EPA) – Noise Policy for Industry (NPfI)* (2017)
 - *Pondicherry Tranche 41 Rezoning Noise and Vibration Assessment ref: PS118563-ACO-REP-RW Rev1a* (WSP March 2020)
 - *NSW Environmental Protection Authority (EPA) Rail Infrastructure Noise Guideline* (2013)
 - *State Environmental Planning Policy (Infrastructure) 2007*
 - *Transport for NSW - Draft North-South Rail Line and South West Rail Link Extension Corridors Strategic Environmental Assessment (2018a)*
-

1.4 PROJECT INFORMATION

The assessment has been prepared with reference to the following project information supplied by Greenfields:

- DOPPO-9-009-Indicative Layout Plan Pondicherry, revision B (Design + Planning, 19/11/2020)
- DOPPO-B-007-2 Staging Plan, Pondicherry Revision E (Design + Planning, 24/11/2020)
- *Report for Pondicherry Future Condition Traffic Assessment - Pondicherry Precinct Traffic Study, ref: 2127552* (GHD 2020)
- Pondicherry Precinct Team meeting – Meeting notes (29 June 2020)
- *Review of metro horizontal and vertical rail alignment for the Pondicherry Precinct (ref: PS118563_revC)* (WSP 31 August 2020)
- Industrial Land Expansion DA rezoning (email correspondence from Greenfields, December 2020)

2 EXISTING ENVIRONMENT

2.1 OVERVIEW OF EXISTING ENVIRONMENT

Generally, the surrounding area is a mixture of rural property and low density residential areas. The Northern Road, situated on the project site's western boundary, is the primary road in the vicinity of the site. It is identified as an arterial road and links south-west Sydney suburbs (such as Campbelltown and Narellan) with western Sydney (areas such as Penrith and Badgerys Creek). The Northern Road is being upgraded and varies between two lanes (one lane each way) and four lanes (two lanes each way) near the project site, with a posted speed limit of 80 km/h and a dense graded asphalt (DGA) pavement surface. At Project opening year for the Pondicherry redevelopment (2026), The Northern Road will be upgraded to two lanes in either direction. The upgraded road alignment and configuration has been used for the consideration of road noise.

Previous investigations completed by WSP in 2017 for this project involved the completion of background noise monitoring for the purpose of road noise validation. The 2017 data has been used for this assessment.

2.2 UNATTENDED NOISE MONITORING METHOD (2017)

2.2.1 METHODOLOGY

Unattended noise measurements were taken in May and June 2017 to quantify the existing noise environment of the study area. The noise monitoring was undertaken in general accordance with Australian Standard AS:1055 and RNP (EPA, 2011).

2.2.2 MONITORING LOCATIONS

Noise monitoring was conducted at three locations near the Pondicherry redevelopment area in 2017. The purpose of the noise monitoring was to establish both the existing background noise levels and existing road traffic noise levels at potential sensitive receivers. Table 2.1 summarises the equipment used and Figure 2.1 presents the noise monitoring locations.

Table 2.1 Noise monitoring equipment

ID	Dates	Equipment Description	Location	Reflection	Manufacturer & Type No.	Serial No.
NM01	16/05/17 to 26/05/17	Environmental Noise Monitor	Project site, 1km east of The Northern Rd and 1.5km north of Oran Park	None (free-field)	Svan 957	23294
NM02	16/05/17 to 26/05/17	Environmental Noise Monitor	Project site, 600 east of The Northern Rd and 400m north of Oran Park	None (free-field)	Svan 958A	36693
NM03	2/06/17 to 15/06/17	Environmental Noise Monitor	Project site, 10m east of The Northern Rd and 1.7km north of Oran Park	None (free-field)	Svan 958A	36693
All	All	Calibrator	All	-	Pulsar Model 105	55041

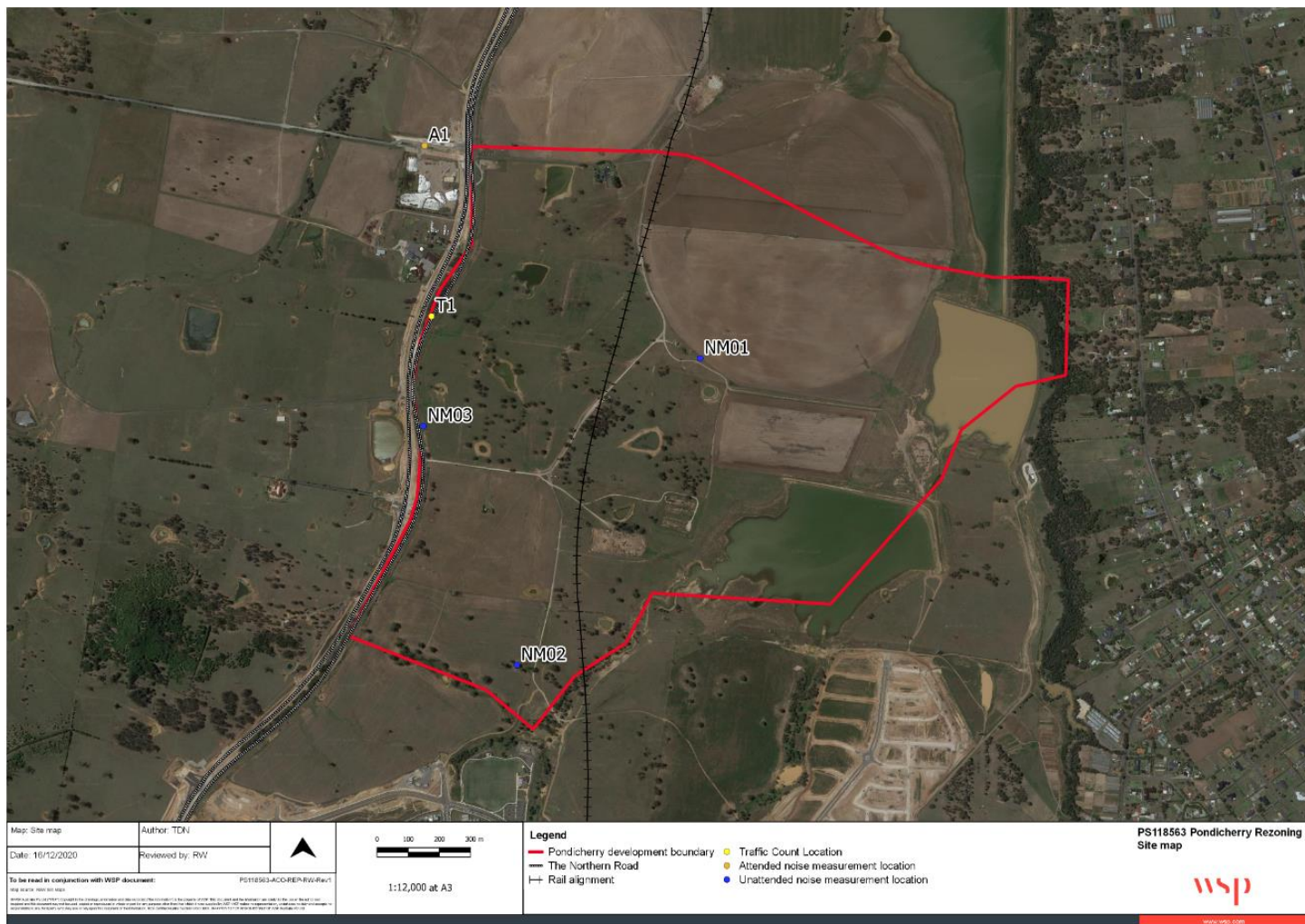


Figure 2.1 Noise monitoring locations and traffic count location

The data were gathered during a period of typical traffic movement and activity in the area (i.e. outside of school holiday periods or major festivities). Data collected on 12 June 2017 (a public holiday) were excluded from the calculation of background and ambient noise levels.

Observations made on site during the 2017 monitoring period and again during a site visit in February 2020 (refer Section 2.3), confirmed that the existing wood processing operations at 761 The Northern Road did not influence the background noise levels at the noise monitoring locations.

The monitoring equipment was fitted with windshields and was field calibrated before and after monitoring. No significant drifts in calibration (± 1.0 dB) were noted.

The weather conditions at the time of monitoring were recorded at Camden Airport (Bureau of Meteorology station number 068192), which is located approximately 6.5 kilometres south-west of the proposal.

Monitoring data were excluded during periods of weather that adversely affected the results, where wind speeds were greater than 5 metres per second and during significant rainfall, as recorded at the nearest meteorological station. Monitoring data were also excluded where extraneous noise was identified to be adversely affecting the long-term average.

2.2.3 MONITORING RESULTS

Table 2.2 summarises the unattended long-term noise monitoring results. The results are reported as the average equivalent continuous average sound levels ($L_{eq, 15min}$) and Rating Background Levels (RBL) as defined in the NPfI. Appendix A presents the daily graphs of the noise monitoring.

Table 2.2 Unattended noise monitoring results

Location ID	Measured noise level, dBA					
	Day		Evening		Night	
	$L_{eq, 15min}$	RBL	$L_{eq, 15min}$	RBL	$L_{eq, 15min}$	RBL
NM01	50	35	44	36	44	30
NM02	48	37	45	36	44	31
NM03	69	50	66	45	63	36

Table 2.3 presents the monitoring of ambient road traffic noise at the monitoring location near The Northern Road (NM03).

Table 2.3 Unattended measured road traffic noise levels

Location ID	Measured traffic noise level dBA			
	Day		Night	
	$L_{eq, 15hr}$	$L_{eq, 1hr}^1$	$L_{eq, 9hr}$	$L_{eq, 1hr}^1$
NM03	71	74	65	69

(1) $L_{eq, 1hr}$ calculated using the 10th percentile method as described in Appendix B of the RNP.

Noise levels are façade corrected noise levels using a +2.5 dB façade correction.

2.2.4 TRAFFIC COUNTING SURVEY

The traffic counting survey was conducted for one week between 16 May and 6 June 2017 by Trans Traffic Consultants. Traffic counts were undertaken on The Northern Road at one location presented in Figure 2.1. Data collected during this traffic counting survey was used to assist in validating the road noise model, discussed further in Section 4.1.4 of this report. These volumes are not considered representative of average daily traffic flows in the future and were used solely for the purpose of noise model validation of existing conditions.

Table 2.4 summarises the traffic volumes and speeds observed during the noise monitoring period and included in the noise model for validation.

Table 2.4 Measured traffic volumes during background noise monitoring, Year 2017

Road	Direction	Day ¹			Night ¹		
		Vehicles per hour	Percent heavy vehicles	85th percentile speed	Vehicles per hour	Percent heavy vehicles	85th percentile speed
The Northern Road	Northbound	458	11.8	85.5	151	12.5	91.3
	Southbound	488	9.4	82.1	98	16.3	86.6

(1) Day (7am to 10pm), night (10pm to 7am).

Source: Trans Traffic (2017).

2.3 ATTENDED NOISE MONITORING RESULTS (2020)

To validate the findings of the previous monitoring and identify the potential industrial influence of noise sources identified in the 2017 unattended noise monitoring program, attended measurements were conducted with the aim of quantifying the noise levels associated with existing wood processing operations at 761 The Northern Road, Bringelly (presented in Figure 2.1).

Attended noise measurements were undertaken on 29 January 2020 to determine the magnitude and source of existing industrial noise levels within the proposal site. Table 2.1 summarises the equipment used for short term monitoring and Figure 2.1 presents the monitoring location.

Table 2.5 Noise monitoring equipment

ID	Dates	Equipment Description	Location	Reflection	Manufacturer & Type No.	Serial No.
A1	25/01/20	Sound level meter	Hi Quality Recycling Centre boundary, 761 The Northern Road	None (free-field)	Norsonic Nor140	1406503
A1	25/01/20	Calibrator	All	-	Rion	11248319

The calibration of the sound level meter was confirmed immediately prior to and following measurements and the deviation was observed to be less than 1 dB and no noticeable drift was noted.

Observations during the attended noise monitoring program included that the site formerly used for wood processing operations has changed operations to a recycling facility. Measurements were undertaken during operational hours of the site, and operations were inaudible at the site boundary of the Pondicherry site, and inaudible from the boundary of the recycling facility itself with the site contribution estimated at < 30dBA. Table 2.6 summarizes the results of the attended measurements.

Table 2.6 Attended measured noise levels

Location ID	Description	Time	Measured noise level dBA		Notes
			L _{EQ,15MIN}	L _{90,15MIN}	
A1	Site boundary (north)	12:46	49	39	Background noise dominated by natural environment, including intermittent traffic on The Northern Road and Construction traffic associated with Northern Road upgrade. Occasional plane flyover. Hi Quality Recycling Centre operations inaudible. Estimated contribution of <30 dBA.

The background environment was dominated by rural noises including trees and bird noise. Intermittent traffic flows on The Northern Road were audible and dominant, particularly associated with construction traffic. The Hi Quality Recycling Facility, located at the former woodchipping site, was inaudible at the boundary of the site (refer to Figure 2.1). The contribution of the site was estimated at <30 dBA. Based on these results it is anticipated that no industrial noise contribution would be audible within the site boundary of the Pondicherry site.

3 ASSESSMENT CRITERIA

This section presents the noise criteria relevant to this assessment.

3.1 ORAN PARK DEVELOPMENT CONTROL PLAN

The Oran Park Development Control Plan (DCP) outlines a range of requirements to manage the impacts of various land use interfaces in the overall Oran Park Precinct. While the DCP only partially covers Pondicherry the principles have been applied to the precinct as a whole as best practice. As it relates to noise, the plan aims to “achieve an acceptable residential noise environment” and minimize heavy vehicle use on local streets.

The DCP requires that residential developments within the Oran Park Precinct area should be designed to comply with Camden Council’s Environmental Noise Policy (2018) and the DECC’s Environmental Criteria for Road Traffic Noise (this has been superseded by the Road Noise Policy (refer Section 3.7)).

The DCP requires that residential development be designed to comply with Council’s Environmental Noise Policy. This policy incorporates DECC’s Environmental Criteria for Road Traffic Noise. However Section 6.9 (1) states the following:

“for residential development adjoining sub-arterial and collector roads, where external traffic noise level limits will be exceeded at the façade of the residential premises nearest to the noise source, the development will be deemed to comply with Council’s Environmental Noise Policy if:

- *the principal private open space area of the residential premises complies with the relevant noise limit; and*
- *the internal noise levels identified in sub-clause (2) are achieved.”*

Section 6.9 (2) states the following:

“The internal noise level limits for residential development are:

For residential premises impacted by traffic noise from arterial, or sub-arterial roads;

- In a naturally ventilated - windows open condition (i.e. windows open up to 5% of the floor area, or attenuated natural ventilation open to 5% of the floor area), or mechanically ventilated windows closed condition:

Sleeping areas

- *L_{Aeq} 15 hour, Day 40dB*
- *L_{Aeq} 9 hour, Night 35dB*

Living areas

- *L_{Aeq} 15 hour, Day 45dB*
- *L_{Aeq} 9 hour, Night 40dB*

Where a naturally ventilated - windows open condition cannot be achieved, it is necessary to incorporate mechanical ventilation compliant with AS1668 and the Building Code of Australia. The noise levels above shall be met with mechanical ventilation or air-conditioning systems not operating. The following L_{Aeq} noise levels shall not be exceeded when doors and windows are shut and mechanical ventilation or air conditioning is operating:

Sleeping areas

- *LAeq 15 hour, Day 43dB*
- *LAeq 9 hour, Night 38dB*

Living areas

- *LAeq 15 hour, Day 46dB*
- *LAeq 9 hour, Night 43dB*

Section (5) states the following with regard to noise mitigation and management within the Oran Park Precinct:

“Noise walls are not permitted on any sub-arterial road, collector street or local street. Arterial roads require an innovative solution that maintains a quality landscape and streetscape. Options for arterial roads can include, but may not be limited to landscaped mounds, a combination of mounds and walls or well-designed walls that have interesting materials, colours, patterns and an openness through use of transparent materials or outwardly angled walls.”

This document outlines mitigation measures to consider in lieu of noise wall construction, which is consistent with the Camden Council Environmental Noise Policy (Section 3.3). Section (6) states:

“A combination of the following measures (described in Figure 29) is to be used to mitigate the impacts of traffic noise on sub-arterial roads and collector streets:

- setbacks and service roads;*
- internal dwelling layouts that are designed to minimise noise in living and sleeping areas;*
- changes in topography;*
- using attached dwellings;*
- using higher than standard fencing between separate buildings constructed with a suitably solid mass; and*
- site layouts that locate principal private open space areas away from the noise source.”*

This document also outlines noise levels for noise impacts from collector roads, which would be an applicable to subsequent subdivision noise assessments.

3.2 CAMDEN GROWTH CENTRE PRECINCTS DEVELOPMENT CONTROL PLAN

The *Camden Growth Centre Precincts Development Control Plan* (DCP) outlines a range of measures for development in areas including the Pondicherry site. It provides guidance to applicants on measures to mitigate the impacts of rail and traffic noise within the Precinct, including noise mitigation and layout recommendations consistent with the *Camden Council Environmental Noise Policy* (Section 3.3).

Section 2 requires a noise report for DAs where development is:

- adjacent to a railway line, arterial road, sub-arterial road, transit boulevard or other road with traffic volumes predicted to exceed (or currently exceeding) 6,000 vehicles per day;
- potentially impacted upon by a nearby industrial / employment area; or

- potentially impacting upon sensitive receivers such as residences within the precinct and outside the precinct.

The DCP requires assessment in relation to the noise criteria in *Development Near Rail Corridors and Busy Roads-Interim Guideline* (Department of Planning 2008) and *Council's Environmental Noise Policy*. Sections 4 and 5 state:

"Subdivision design on land adjacent to significant noise sources is to consider and implement measures to attenuate noise within dwellings and in external areas that are classified as Principle Private Open Space.

Physical noise barriers (i.e. Noise walls or solid fencing) are not generally supported, and measures to attenuate noise through subdivision layout, such as service roads, setbacks, building orientation, and building design and materials selection should be implemented to achieve appropriate internal noise standards."

3.3 CAMDEN COUNCIL ENVIRONMENTAL NOISE POLICY

The *Camden Council Environmental Noise Policy* (ENP) (2018) provides a framework and criteria for the assessment of noise impacts from development within the Camden Local Government Area (LGA) with the potential to generate noise that may unreasonably and detrimentally impact the acoustic amenity of sensitive receivers. Further, the ENP recognises community noise within residential communities that can give rise to significant levels of noise generation and establishes criteria or management techniques by which noise impact can be regulated and minimised.

The ENP is guided by and refers to much of the information that is contained within relevant NSW noise publications and regulations.

3.3.1 ACOUSTIC AMENITY

The ENP states the following with regard to general acoustic amenity controls:

"1. Acoustic reports (where required), must be prepared by a suitably qualified consultant. As a minimum an acoustic report must: identify receivers; determine background noise levels (where required); establish noise criteria; provide predicted noise levels (including relevant assumptions); assess potential impacts; and consider reasonable and feasible mitigation measures. Council may consider a preliminary assessment from a suitably qualified acoustic consultant, justifying why an acoustic report is not required.

2. Where possible bedrooms, main living areas and principal private open spaces are to be located away from noise sources (Refer to Figure B3a).

3. Noise attenuation measures must not adversely impact upon passive surveillance, active street frontages and energy efficiency.

4. Residential plant and equipment must not generate a noise level greater than 5dBA above background noise level as measured at the boundary of a noise sensitive property during the hours of 7.00am to 10.00pm. Noise from plant and equipment must not be audible in habitable rooms of adjoining noise sensitive properties during the hours of 10.00pm to 7.00am.

5. Physical noise barriers such as noise walls or solid fencing (other than earth mounds) are not generally supported along sub-arterial, transit boulevards or collector roads. Measures to attenuate noise through subdivision layout, building setbacks, building orientation, building design and materials selection should be implemented to achieve compliant noise levels.

6. The use of physical noise barriers (i.e. noise walls or solid fencing) may be supported on arterial roads where it can be demonstrated that the following mitigation measures, in the listed order, are not able to adequately attenuate the noise source:

- Locating less sensitive land uses between the noise source and the sensitive receivers;
- Using the built form to act as noise barriers;
- Optimising the subdivision layout to maximise shielding of principle private open space;
- Incorporating noise mitigating building façade treatments and locating bedrooms, main living areas and principle private open space areas away from the noise source;

7. Where noise barriers are required, they shall be of a neutral recessive colour and design which blends in with the natural environment. In addition, barriers are to be screened from the road by a landscape strip of at least 1m.”

Figure 3.1 reproduces Figure B3a of the ENP provides a graphical representation of the preferred method to achieve noise mitigation for road and rail impacts via the built form which will be considered in this report.

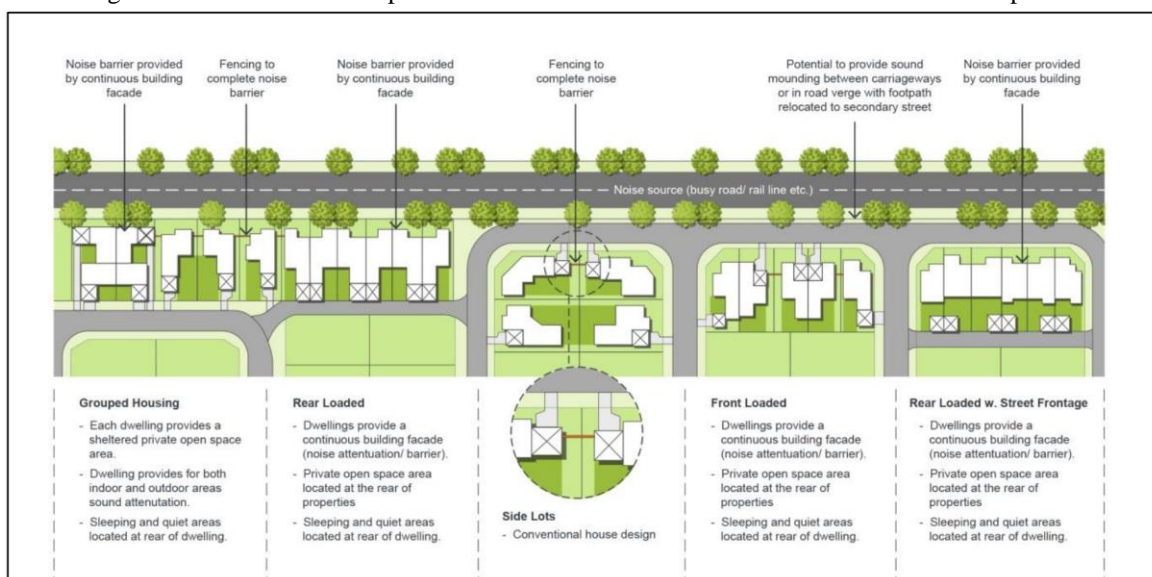


Figure 3.1: Figure B3a - How to Mitigate Impacts from Road and Rail (extract)

Source: Camden Council ENP (2018)

3.3.2 INDUSTRIAL NOISE

The ENP states the following with regard to industrial noise influences:

“1. An acoustic assessment will be required for industrial and commercial development where the development:

- *Has the potential to impact on residences or noise sensitive receivers (defined as a LAeq, 15min level of more than background or more than the recommended amenity criteria within the NSW Environmental Protection Authority's Noise Policy for Industry (NPfI) minus 10 dB); or*
- *Is located within a 100m radius from, or has a direct line of site of a distance of 150m to, residences or noise sensitive receivers; or*
- *Proposes to operate anytime between 10pm and 6am.*

2. Noise emissions from industrial development must be assessed in accordance with the NSW EPA Noise Policy for Industry (NPfI)."

3.3.3 ROAD AND RAIL NOISE

The ENP outlines the following requirements relating to road and rail noise:

"1. Development applications for residential development and other noise sensitive uses such as places of public worship, hospitals, child care centres and educational establishments must be accompanied by an acoustic report where the development is:

- adjacent to existing (or proposed) railway line, arterial, sub-arterial roads, transit boulevards; or*
- adjacent to a collector road that is within a 100m radius of the centre of the intersection the above roads (Refer to Figure B3b).*

Note: For all road developments the criteria should apply on the basis of the road traffic volumes projected for 10 years time.

2. Residential dwellings adjacent to an existing (or proposed) railway line, arterial road, sub-arterial road or transit boulevards, or collector roads that are within 100m of the centre of the intersection of those roads, are to be designed to minimise the impact of noise. Non-residential buildings such as educational institutions, child care centres, places of worship, and hospitals are also required to be designed to minimise the impact of noise.

Both 'residential dwellings' and 'non-residential buildings' must comply with the internal noise criteria in 'Table 3.1' from the 'Department of Planning: Interim Guideline – Development Near Rail Corridors and Busy Roads'

Ventilation Requirements: If internal noise levels with windows or doors open exceed the criteria by more than 10dBA, the design of the ventilation for these rooms should be such that the occupants can leave windows closed, and also to meet the ventilation requirements of the Building Code of Australia.

*3. The principle private open space or an equivalent area of useable open space of a dwelling within a new release area is **not to exceed 57dBA LAeq (15hr) from 7am to 10pm.***

Note: For clarification purposes, a new release area, includes land mapped as Urban Release Area within the Camden LEP 2010 and includes Growth Area Precincts that have been rezoned.

*For dwellings in areas outside of the new release areas, the principle private open space area is to be **attenuated to 55dBA LAeq (15hr) from 7am to 10pm.***

Council may consider an increased decibel level where it can be demonstrated that the objectives of this policy are met and the above criteria is not able to be reasonably or feasibly achieved.

*Note: The residential noise level criterion includes + **2.5 dBA allowance** for noise reflected from the façade ('facade correction').*

4. Residential flat building developments are to meet the objectives of Part 4J of the NSW Department of Planning and Environment - Apartment Design Guide to minimise potential impacts of road and rail noise through appropriate siting and layout of buildings, noise shielding and attenuation.

Development applications for residential flat buildings are to document the noise mitigation measures that have been incorporated into the design.

An area of communal open space is to be attenuated to 57dBA LAeq (15hr) from 7am to 10pm.”

3.3.4 NEW AND UPGRADED ROADS / RAILWAY LINES AND TRAFFIC GENERATING DEVELOPMENT NEAR RESIDENTIAL AND OTHER SENSITIVE LAND USES

The ENP states the following with regard to new roads and traffic generating developments:

“1. Where new and upgraded roads or traffic generating developments are proposed near residential and other noise sensitive land uses, acoustic assessments are to be undertaken in accordance with the NSW EPA Road Noise Policy.

2. Where new and upgraded railway lines are proposed near residential and other noise sensitive land uses, acoustic assessments are to be undertaken in accordance with the NSW EPA Rail Infrastructure Noise Guideline (2013).”

3.3.5 AIRCRAFT NOISE

The acceptability of land in the vicinity of airports for development is assessed using the Australian Noise Exposure Forecast (ANEF) systems which is endorsed by Air Services Australia.

Australian Standard AS 2021:2000 - Acoustics - Aircraft noise intrusion - Building siting and construction, provides recommendations regarding land use acceptability in consideration of the various zones on the ANEF chart. Developments outside the ANEF 20 contour do not require assessment for aircraft noise (unless specifically requested by Council).

Depending on the ANEF value at a specific location, certain building types are described by AS 2021 as either “acceptable”, “conditionally acceptable”, or “unacceptable” with reference to the ANEF value and specific building constructions are required.

3.3.6 PUBLIC OPEN SPACES

The ENP states the following with regard to noise attenuation of public open spaces:

“Public open space areas are to be designed to sensitively locate passive recreation areas away from noise sources without compromising the overall functionality of the area. Physical noise barriers (other than earth mounds) for public open space areas will not be supported.”

3.4 INDUSTRIAL NOISE

The ENP refers to the NSW Environment Protection Authority (EPA) Noise Policy for Industry (NPfI) in relation to industrial noise sources and criteria. The NPfI prescribes methods for determining the statutory environmental noise limits that apply to noise sensitive receivers (i.e. residences) with regards to noise due to individual noise sources only.

The assessment procedure for industrial noise sources has two components:

- Controlling intrusive noise impacts in the short term for residences.
- Maintaining noise level amenity for particular land uses for residences and other land uses.

In assessing the noise impact of industrial sources, both components must be considered for residential receivers. In most cases, only one will become the limiting criterion and form the project-specific noise levels for the industrial source

under assessment. The intrusive noise criteria do not apply to non-residential receivers, instead an amenity criteria are applicable to these receivers.

3.4.1 TIME PERIODS

Time periods defined by the NPfI are presented in Table 3.1.

Table 3.1 NSW NPfI Time Periods

NSW NPfI Time Period	Time
Day	7am to 6pm Monday to Saturday 8am to 6pm Sundays and Public Holidays
Evening	6pm to 10pm all days
Night	All other times

3.4.2 INTRUSIVENESS CRITERION

A noise source would be deemed to be non-intrusive if the monitored $L_{Aeq}(\text{period})$ noise level of the development does not exceed the RBL by more than 5 dBA at residential receivers. The RBL is the median of the measured L_{A90} noise level during the day, evening and night periods during periods when the development is not in operation.

Based on the background noise level measured during the day, evening and night periods, the RBL and intrusiveness criterion has been established for the proposed development in accordance with the NPfI.

3.4.3 AMENITY CRITERIA

To limit continuing increases in noise levels, the amenity noise level within an area from industrial noise sources should not normally exceed the recommended amenity noise levels prescribed in the NPfI.

The recommended amenity noise levels represent the objective for **total** industrial noise at a receiver location, whereas the **proposal amenity noise level** represents the objective for noise from a **single** industrial development at a receiver location, defined as the **recommended noise levels** listed below (Table 2.2 of NPfI) **minus 5 dB(A)**. To standardise the time periods, the $L_{Aeq}(15, \text{min})$ project amenity noise level is derived by the **addition of 3 dB(A)** to the $L_{Aeq}(\text{period})$ noise level, as discussed in Section 2.2 of NPfI. The established amenity criteria applicable to the proposal are presented in Table 3.2.

The amenity criteria have been established at the identified receivers based on the results of the unattended noise survey. Residential receivers with a similar noise environment to that observed across the proposal site have been classified as a suburban noise environment based on existing noise levels in the immediate surrounding area during the more sensitive night-time hours and the description of noise environments in the NPfI.

Table 3.2 Proposal Amenity Noise Levels

TYPE OF RECEIVER ¹	RECOMMENDED AMENITY NOISE LEVEL (ANL) DBA L _{EQ} , PERIOD	PROPOSAL AMENITY NOISE LEVEL (ANL -5DB) DBA L _{EQ} , PERIOD	PROPOSAL ADJUSTED ANL ^{2,3}		
			DBA L _{EQ} PERIOD		
			Day	Evening	Night
Residential (Urban) (NML01, NML02)	Day: 55 Evening: 45 Night: 40	Day: 50 Evening: 40 Night: 35	53	43	38
Industrial	70	70	70	70	70

- (1) Amenity levels for non-residential receivers apply when the premises are in use.
- (2) Day: the period from 7:00 am to 6:00 pm Monday to Saturday; or 8:00 am to 6:00 pm on Sundays and public holidays; evening: the period from 6:00 pm to 10:00pm; night: the remaining periods.
- (3) Proposal ANL is suburban ANL (Table 2.1 of NPfI) minus 5 dB(A) plus 3 dB(A) to convert from a period level to a 15-minute level.

When the measured existing noise level $L_{Aeq\ 15\ min}$ at a residential receiver is close to the ANL in Table 3.2 due to industrial noise sources, noise from the new source must be controlled to preserve the amenity of the area in accordance with the requirements of the NPfI. The applicable modifications to the ANL are summarised in Table 2.2 of the NPfI.

3.5 NOISE INTRUSION - ROAD AND RAIL

3.5.1 DEVELOPMENT NEAR RAIL CORRIDORS AND BUSY ROADS – INTERIM GUIDELINE

The ENP refers to the internal noise criteria in Table 3.1 from the *Department of Planning: Interim Guideline – Development Near Rail Corridors and Busy Roads* (DNRCBR).

This document provides guidance for development near major rail corridors and busy roads, supporting the relevant provisions of the *State Environmental Planning Policy (Infrastructure) 2008* (“the Infrastructure SEPP”). It aims to protect the safety and integrity of key transport infrastructure from adjacent development, and ensure these developments maintain appropriate acoustic amenity by meeting internal criteria specified in the Infrastructure SEPP.

3.5.1.1 ROAD NOISE

The guideline classifies a major road as freeway, tollway or a transitway or any other road with an annual average daily traffic (AADT) volume of more than 40,000 vehicles, and that the consent authority considers is likely to be adversely affected by road noise or vibration. For roads with an AADT of 20,000–40,000 vehicles this guideline provides best practice advice.

Based on the corresponding traffic assessment from SKM (2012), the average daily traffic on The Northern Road was in the order of 10,000 to 15,700 vehicles per day (2012 levels). As a result, current AADT values are anticipated to be in the order of 20,000 vehicles per day and therefore this guideline has been applied as best practice.

Relevant criteria as applicable to the project sourced from Table 3.1 from the DNRCBR are reproduced in Table 3.3.

Table 3.3 Noise criteria for proposed road for residential land-use developments

Residential buildings		
Type of occupancy	Noise level dBA	Applicable time period
Sleeping areas (bedroom)	35	Night 10 pm to 7 am

Other habitable rooms (excl. garages, kitchens, bathrooms & hallways)	40	At any time
Non-residential buildings		
Type of occupancy	Recommended max level dBA	
Educational Institutions including child care centres	40	
Places of Worship	40	

Source: Department of Planning: Interim Guideline – Development Near Rail Corridors and Busy Roads

Section 3.5.2 provides screening tests for single and dual occupancy residential dwellings which define relevant categories of noise control treatments required, depending on distance to the road and traffic volumes. The noise control treatments for dwellings are grouped into six categories which are outlined in Appendix D.

It is noted that The Northern Road is generally signposted at 80 km/h however portions are signposted at 60 km/h. The screening test for 60/70 km/h zones, as relevant to this assessment, is presented in Figure 3.2.

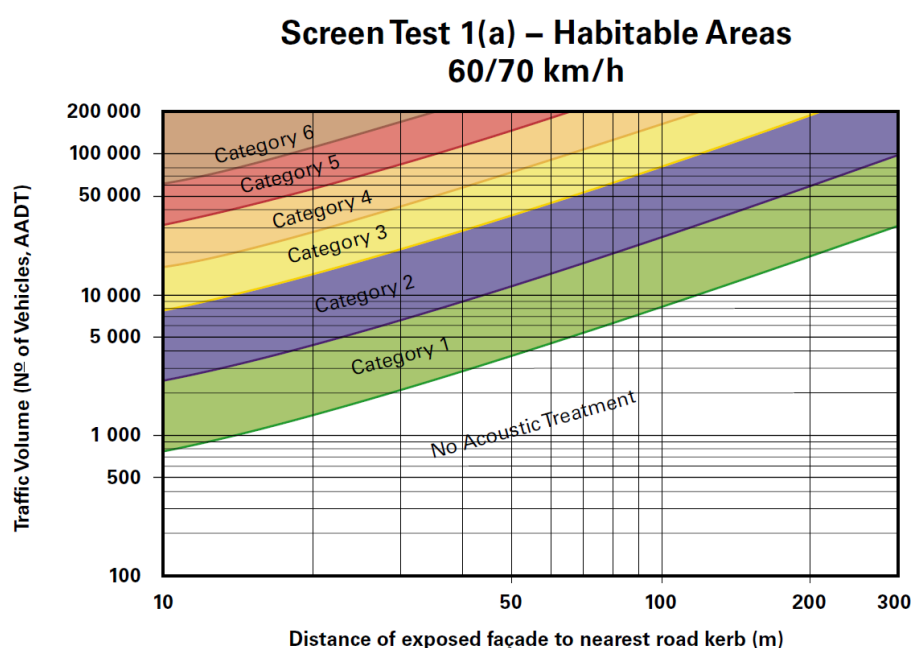


Figure 3.2 DNRCBR Screening test for habitable areas (if any exposed façade is direct line-of-sight)

Source: NSW Government's Development Near Rail Corridors and Busy Roads – Interim Guideline 2008

Based on an AADT volume of 20,000 vehicles and vehicle speeds up to 70 km/h, dwellings constructed over 200m from The Northern Road alignment would not require noise control treatment under the provisions of the guideline.

With reference to the proposed layout in Figure 1.2, residences within 200 m of the alignment require Category 1 treatment, within 80 m would require Category 2 treatment, and residences within 30 m would require Category 3 treatments. No residences are proposed within 15 m of the alignment, requiring Category 4 treatment. The treatments for each category are contained within Appendix D. As a result, dwellings within the eastern portion of the Pondicherry development area would not require noise control.

It is noted that the signposted speed is 80 km/h and the above screening test does not account for the screening impacts of intervening buildings, and represents guidance only based on certain assumptions, therefore the identified speeds present a guideline for further investigation. The DNRCBR outlines a two-step process for the assessment of road noise on a new development; this assessment is presented later in Section 4 of this report.

3.5.1.2 RAIL NOISE

The DNRCBR provides a distance-based assessment for the requirement to assess rail noise on noise sensitive developments, and would apply to the North South Rail Line corridor.

As presented in Figure 3.3, the DNRCBR presents distance based triggers as indicative acoustic assessment zones (Zones A and B) where sensitive land-uses are likely to be adversely affected. Noise sensitive developments located within Zone A would necessitate a full acoustic assessment, and within Zone B would require specific acoustic treatments to manage noise levels. This is discussed further in Section 3.6.

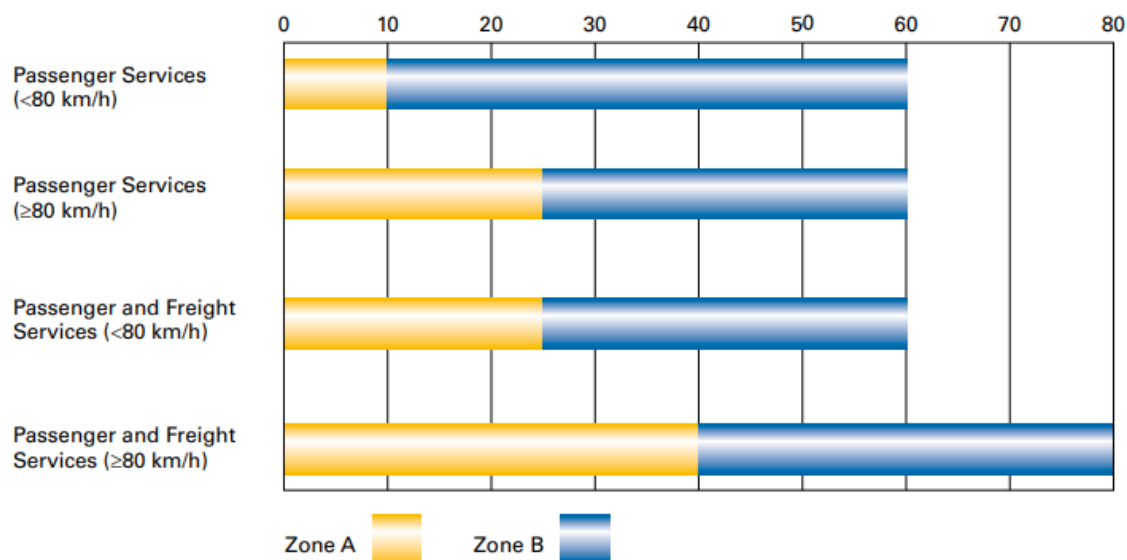


Figure 3.1: Acoustic Assessment Zones based on distance (m) of noise-sensitive development from operational track (not corridor)

Figure 3.3 DNRCBR Screening test for acoustic assessment zones based on distance (m) of noise-sensitive development from operational track (not corridor)

Source: NSW Government's Development Near Rail Corridors and Busy Roads – Interim Guideline 2008

3.5.2 RAIL VIBRATION

The DNRCBR provides a distance-based assessment for the requirement to assess rail vibration on sensitive developments and would apply to the approved North South Rail Line (NSRL) corridor. The DNRCBR states that developments within the distances indicated in Figure 3.4 would necessitate a vibration assessment.

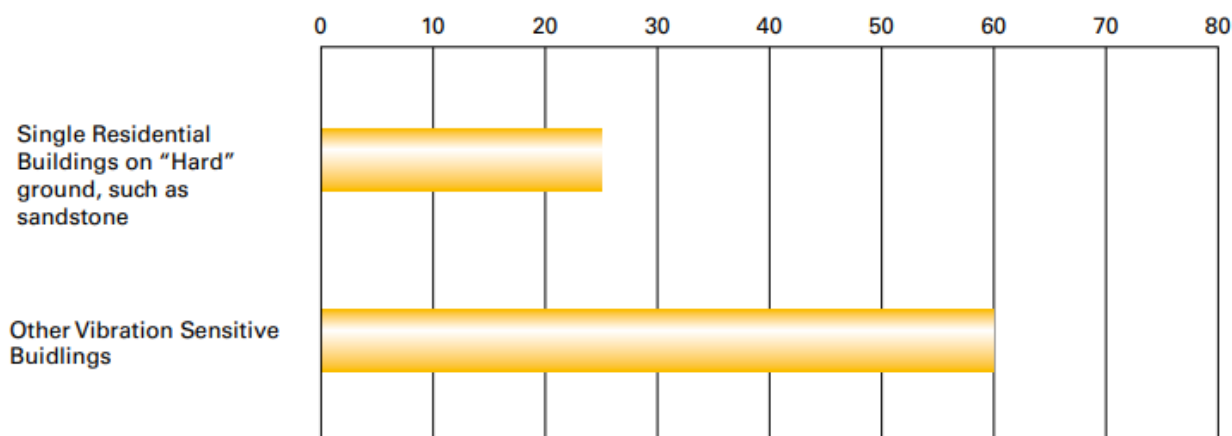


Figure 3.2: Distance from the nearest operational track (m)

Figure 3.4 DNRCBR Screening test for vibration assessment based on distance (m) of noise-sensitive development from operational track (not corridor)

Source: NSW Government's Development Near Rail Corridors and Busy Roads – Interim Guideline 2008

3.6 RAIL NOISE GUIDELINES

The *Rail Infrastructure Noise Guideline* (RING) (NSW Environmental Protection Authority 2013) provides guidance on the assessment and management of airborne noise impacts generated by railways, providing non-mandatory airborne noise trigger levels for sensitive receivers

The trigger levels represent external levels of noise that trigger the need for an assessment of potential noise mitigation measures to reduce noise levels from a rail infrastructure project. Where trigger levels are exceeded by a project, the consideration of mitigation should aim to reduce noise towards the relevant trigger levels where reasonable and feasible. It is not mandatory to achieve the trigger levels but the assessment should provide justification if they cannot be met.

Noise trigger levels are assessed for a height of 1.5 metres above ground, at a location one metre in front of the most affected building façade. Predicted noise levels are to include a façade correction factor of +2.5 dBA.

The project is considered a new rail line development for the purpose of the operational noise assessment. Table 3.3 presented the criteria applicable to the project.

Table 3.4 Airborne noise trigger levels for residential land-uses

TYPE OF DEVELOPMENT	NOISE TRIGGER LEVEL, DBA (EXTERNAL) DBA	
Residential land uses	Day 7am-10pm	Night 10pm-7am
	Predicted rail noise levels exceed:	
New rail line development	60 $L_{eq,15hr}$ or 80 L_{Fmax}	55 $L_{eq,9hr}$ or 80 L_{Fmax}
Other sensitive land uses	When in use	
	Predicted rail noise levels exceed:	
Schools, educational institutions and child care centres	40 $L_{eq,1hr}$ internal	
Open space – passive use (e.g. parkland, bush reserves)	60 $L_{eq,15hr}$ external	
Open space – active use (e.g. sports field, golf course)	65 $L_{eq,15hr}$ external	

Source: Rail Infrastructure Noise Guideline (EPA 2013).

3.7 LOCAL TRAFFIC NOISE

The Pondicherry redevelopment will result in additional traffic on public roads. This change could lead to an increase in noise levels at existing residences along existing roads.

The *NSW Road Noise Policy*, (DECCW, 2011) sets criteria for road noise based on the category of road, nature of the project being assessed and type of receiver potentially being affected. The applicable criteria for are presented in Table 3-5.

Table 3-5 Local traffic noise criteria (RNP, 2011)

ROAD CATEGORY	AFFECTED ROADS	TYPE OF PROJECT/LAND USE	ASSESSMENT CRITERIA dB(A)	
			Day (7 am to 10 pm)	Night (10 pm to 7 am)
Local road	All public roads	6. Existing residences affected by additional traffic on existing local roads generated by land use developments	$L_{Aeq\ 1\ hr}\ 55$ (external)	$L_{Aeq\ 1\ hr}\ 50$ (external)

4 ROAD TRAFFIC NOISE IMPACTS

This section outlines the methodology completed to assess the road noise intrusion impacts from major roads into the proposal area and investigates potential noise mitigations for future residential dwellings.

The assessment involved validation of existing monitoring conditions associated with sub-arterial road influences based on previous monitoring data, and projection of this assessment to the proposed opening and design years for the project. This data was then used to assess the potential constraints and mitigation measures required to achieve relevant noise goals in internal areas from arterial and sub-arterial roads.

As discussed in the Traffic Assessment for the Pondicherry redevelopment (GHD 2020) “*disruptions to travel patterns due to COVID-19 from March 2020 has resulted in a lower level of traffic that is not representative of typical weekday conditions in proximity to the subject site. Following discussion with DPIE and TfNSW, it was agreed and approved (at a meeting on 3rd April 2020) that the available historical traffic counts would be utilised to identify the current traffic activity and to calibrate and validate the base mesoscopic model for the Pondicherry Precinct.*”

4.1 ARTERIAL ROADS - THE NORTHERN ROAD

4.1.1 METHODOLOGY

The Northern Road is the most significant noise source with potential to impact noise sensitive receivers within the development. Preliminary modelling was completed by WSP in 2017 (‘the 2017 assessment’) which assessed the existing (pre-upgrade) Northern Road alignment and traffic volumes.

Traffic projections for the Northern Road have been based on assumptions from the *Pondicherry Tranche 41 Rezoning Noise and Vibration Assessment* ref: PS118563-ACO-REP-RW Rev1a (WSP March 2020) (‘the Tranche 41 noise assessment’) (WSP 2020) for the purpose of this assessment.

Based on the preliminary screening assessment (Section 3.5.1) it was identified that residences within 200 m of The Northern Road alignment would be subject to more detailed noise investigations. Predictive noise modelling was completed to quantify the potential impacts of the design year traffic volumes on the proposed development area, and the potential noise mitigation requirements to achieve relevant noise levels at internal spaces.

The Northern Road Upgrade Review of Environmental Factors (REF) provides an assessment of the impact of this upgrade. The following documents were referenced:

- *MR154 The Northern Road Upgrade Between The Old Northern Rd and Mersey Rd, Traffic and Transport Assessment Report, Sinclair Knight Merz, ref: NB11363-ETR-RP-0068, August 2012*
- *The Northern Road Upgrade, Narellan to Bringelly Noise and Vibration Assessment, Sinclair Knight Merz, ref: NB11363-NNA-RP-0159 - Noise Assessment_Final 18102012, October 2012*
- *Report for Pondicherry Future Condition Traffic Assessment - Pondicherry Precinct Traffic Study, 2127552 (GHD 2020).*

The 2017 assessment included model validation and traffic counting as reported in Section 2.2.3 and Section 2.2.4. As the model was previously validated as part of the 2017 investigations and no substantive changes are required to the current noise model, the model validation has been used in this assessment (refer Section 4.1.4). This model was then updated to reflect the subsequently upgraded alignment and future traffic predictions.

4.1.2 TRAFFIC MODELLING PARAMETERS

A traffic assessment for the Tranche 41 noise assessment was completed by Positive Traffic Pty Ltd in January 2020. The report makes reference to the traffic assessment completed for *The Northern Road between Old Northern Road Narellan*

and Mersey Road, Bringelly (MR154), and the Old Northern Road and Glenmore Park (Sinclair Knight Merz (SKM) in 2012. The report makes the following statements with regard to the Tranche 41 project:

- SKM developed forecast traffic flows in future years 2016, 2026 and 2036 by using the transportation-planning software package “SATURN”.
- SKM accounted for all future population growth along the corridor for the full length of the study area including the area known as Tranche 41.

Based on the above findings, the road traffic assessment has been developed based on the traffic volumes provided in the SKM (2012) report. The 2016 values adopted as the basis for the opening year of The Northern Road upgrade have been extrapolated to the proposed opening year (2026) and design year (2036) for the Pondicherry Precinct.

Traffic noise modelling was conducted for the following assessment years:

- Opening year 2026 – traffic volumes provided for Project opening year assuming upgrade complete
- Design year 2036 - traffic volumes provided for Project design year (opening year + 10 years) assuming upgrade complete

Based on discussions with the traffic consultant and available traffic data for The Northern Road, traffic volumes for the project assessment years have been developed using the following sources and assumptions:

- Traffic data for peak hours sourced from MR154 *The Northern Road Upgrade Between The Old Northern Rd & Mersey Rd* (SKM 2012) (ref: NB11363-ETR-RP-0068 v5) (‘the SKM 2012 traffic assessment’). The Northern Road traffic volumes were used for the project design year (2036) volumes.
- Peak hour volumes assumed to be 8-12 % of AADT volumes
- Hourly volumes for The Northern Road (north of Cobbitty Road) were sourced from Appendix J2 of the SKM 2012 traffic assessment – SIDRA intersection peak hour volumes. Worst case AM or PM peak volumes were used in this assessment
- Hourly traffic volumes and annual growth factors estimated from RMS traffic counter at Camden Valley Way (data available until 2013).
- Peak hour traffic volumes were assumed to equate to 10% of the average annual daily traffic volumes
- Heavy vehicle percentages adopted from the Traffic Assessment (SKM 2012) and The Northern Road Noise Assessment (SKM 2012) for “North of Bringelly Road / Greendale Road”. It is noted that classification counts were not conducted on The Northern Road north of Cobbitty Road and south of Bringelly Road as consistent traffic was assumed in this assessment.
- Traffic volumes are assessed over day (7am-10pm) and night (10pm to 7am) periods. Day/night splits in northbound/southbound direction were classified based on flows at the nearby RMS traffic volume counter at Camden Valley Way (85019)

A summary of the modelled traffic volumes is provided in Table 4.1.

Table 4.1 Modelled traffic volumes – The Northern Road – north of Cobbitty Road

Direction	Period ¹	2026 (vehicles per hour)			2036 (vehicles per hour)		
		Light	Heavy	Total	Light	Heavy	Total
North Bound	Day	10,268	1,269	11,538	11,704	1,447	13,150
	Night	6,092	831	6,923	6,943	947	7,890
South Bound	Day	7,657	4,693	12,350	8,944	5,482	14,425
	Night	3,853	3,557	7,410	4,501	4,154	8,655

(1) Day (7am to 10pm), night (10pm to 7am).

Posted speeds are currently 80 km/h on The Northern Road which will remain unchanged following the upgrade.

The pavement surface for all roads is Dense Graded Asphalt (DGA). The existing and future road alignments and topography were sourced from SixMaps (NSW Government) and included in the model. Topographical data outside the road alignment was sourced from 2m topographic data (source: LPI). Receiver heights, buildings, barriers and ground absorption in the project area were determined from site visits, aerial photography and maps.

4.1.3 MODELLING METHODOLOGY

The predicted noise impacts from The Northern Road once the proposal is operational were calculated using supplied information on the road alignment, the existing conditions and several conservative assumptions.

A noise model including nearby roads was created using the Calculation of Road Traffic Noise (CoRTN) (UK Department of Transport, 1988) as implemented in the SoundPLAN software (version 8.1). The model predicted the road traffic noise generated as a result of changes to traffic volumes and composition, vehicle speed, road gradient, pavement surface, ground absorption and shielding, and reflections from topography, buildings and barriers. The predictive model assumed four lanes of traffic in each direction on The Northern Road to account for the upgraded alignment.

The modelling predicted the noise emissions at three heights to represent the various class of heavy vehicles that use The Northern Road. Table 4.2 summarises the modelling conditions.

Table 4.2 Noise modelling parameters

Item	Assumptions
Calculation method	CoRTN (1988) with variations as described in this report. Low traffic correction not used.
Ground topography	From a combination of supplied 3D drawings and survey data and existing topographical maps provided by NSW Lands and Property Information.
Pavement surfaces	Existing and proposed pavement surfaces DGA. No correction applied.
Traffic volumes and mix	Supplied by project Traffic Consultant for The Northern Road; further assumptions extracted from the results of traffic counts
Existing structures and barriers	Buildings, fences and noise barriers defined from aerial photography and site surveys. Existing solid fences included in model where they are located between a road source and a receiver point. Buildings within Pondicherry have not been included
Source heights and correction	Model assumes three sources heights: - Light vehicles at 0.5m with 0 dB correction - Heavy vehicles at 1.5m with a -0.6 correction and at 3.6m with a -8.6 dB correction
Vehicle speeds	Existing and proposed designs set at posted speeds: - The Northern Road modelled at 80 km/h, - sub-arterial roads at 60 km/h, - collector roads at 50 km/h. 85 th percentile speeds used for model validation.
Road gradient	Gradient calculated from supplied topographical and road design data
Number of lanes	One lane each way on The Northern Road for validation. Two lanes each way are assumed for all Build and No Build scenarios.

Item	Assumptions
Ground absorption	Set at 75% soft ground for grass, wooded areas and park land Set at 50% soft ground for residential land use Set at 25% soft ground for commercial land uses
Receiver locations	Assessed at 1m from the façade at heights of 1.5m for ground floor and 4.5m for first floor receivers. Free-field receivers set at 1.5m.
Façade correction	+2.5 dB
ARRB correction	-1.7 dB for façade noise levels and -0.7 dB for free-field noise levels
L₁₀ to L_{eq} correction	-3dB

4.1.4 NOISE MODEL VALIDATION

The predictive noise model was validated using the background noise monitoring (2017) and concurrently collected traffic volumes in May and June 2017 by Trans Traffic Consultants (refer Section 2.2.3). Validation was conducted at location NM03 as The Northern Road was identified as the dominant source at this monitoring location (the other locations are further offset from The Northern Road and subject to rural and other noise sources). Table 4.3 presents a summary of the measured and predicted noise levels.

As discussed in the Traffic Assessment for the Pondicherry redevelopment, COVID conditions prevented further modelling and validation therefore these findings have been adopted based on the 2017 noise assessment validation.

Table 4.3 Results of model validation (free field noise levels)

ID	Day, dBA (L _{EQ,15HR})			Night, dBA (L _{EQ,9HR})		
	Measured	Predicted	Difference	Measured	Predicted	Difference
NM03	68.3	68.4	0.1	62.6	63.5	0.9

(2) Day (7am to 10pm), night (10pm to 7am).

The average difference in modelled results are in general agreement with the measured levels. During the day, the average difference is 0.1 dB greater than the measured levels with 0.9 dB difference during the night. The modelled noise levels are within 2 dB of the measured noise levels and no correction has been applied to the model results.

The model is considered suitable for the road noise assessment based on available data.

4.1.5 PREDICTED NOISE RESULTS – THE NORTHERN ROAD

Predicted road noise levels associated with the upgraded Northern Road alignment were modelled for the Pondicherry project area. Predicted operational noise levels are presented in Appendix C, and include predictions for the design year (2036).

Preliminary results present unmitigated noise levels for day and night periods. Results are presented to provide a conservative estimate of potential impacts, allow comparison against relevant criteria and noise goals and assess potential constraints.

Noise level impacts have been estimated based on distance to The Northern Road to present a comparison of noise levels to relevant criteria and required noise reductions. Noise levels have been presented for ground level (1.5m) heights to inform future design requirements. Levels are presented for 2036 traffic volumes, being the most stringent of the design requirements.

Noise levels are then compared to relevant ENP internal noise levels, assuming windows are partially open, based on a standard noise reduction from external to internal of 10 dB. Results are presented in Table 4.4.

The concept design does not incorporate lot layout information; therefore modelled results in Appendix C do not include the attenuation from intervening buildings. These structures would result in significant reductions in noise levels beyond the first row of houses (likely to be in the order of 8 dB per row of houses), which will reduce the affectation distances significantly, as discussed in Section 4.1.6. These corrections have been applied to each row of residential dwellings located behind the first row of houses in Table 4.4.

Table 4.4 Noise results (Unmitigated, Year 2036) – Residential Receivers affected by The Northern Road

Receivers	External L_{eq} Noise Level ¹ (Free Field), DBA		External L_{eq} Noise Criteria – Windows Partially Open ² , dBA	
	Day	Night	Day	Night
Up to 65 m	70-73	67-70	50	45
Up to 150 m ³	57-62	54-62	50	45
Up to 320 m ³	44	41	50	45
Up to 900 m ³	31	28	50	45

- (1) Day (7am to 10pm), night (10pm to 7am).
- (2) Based on ENP criteria for sleeping areas, including internal to external reduction of 10 dB.
- (3) Predictions at dwellings further back from the road include reduction for intervening buildings (8 dB correction applies).

This assessment has indicated that noise levels from The Northern Road will vary based on proximity of residences to the alignment. Noise levels are predicted to exceed noise goals over the dwellings in Stages 1 and 5 unless mitigation designs are implemented (levels do not incorporate specific architectural noise mitigation of façade components).

4.1.6 NOISE REDUCTION REQUIREMENTS

Several mitigation scenarios have been presented to outline potential design and layout options to mitigate the impacts of dwellings with the highest exposure to road traffic noise intrusion from The Northern Road. Mitigation results are presented for 2036 traffic volumes, being the more stringent design requirement to achieve compliance with internal noise levels.

The noise reductions required for dwellings within 150 m of The Northern Road are presented in Table 4.5 for windows partially open. The reductions have been determined to achieve compliance with Camden ENP and the DNRCBR.

Table 4.5 Noise reductions required (Unmitigated) - Residential Receivers on Arterial Roads

RECEIVERS	NOISE REDUCTION REQUIRED ^{1,2} (RW), DBA	
	Day	Night
Up to 65 m	23	25
Up to 150 m	12	17
Up to 320 m	n/a	n/a
Up to 900 m	n/a	n/a

- (1) External to internal, including 10 dB reduction for windows partially open
- (2) Reductions based on noise predictions presented in Table 4.4.

Dwellings in Stages 1 and 5 located within 65 m of the alignment would require up to 25 dB of acoustic reduction to achieve relevant internal noise levels. This reduction cannot be achieved by standard architectural measures, and would require line of site measures (refer to Section 4.1.7) or mechanical ventilation considerations (thereby allowing doors and windows facing The Northern Road to remain closed). These values do not account for the shielding impacts of intervening buildings.

Residences up to 150 m from the alignment would require reductions up to 12 dB. The results above indicate that noise mitigation is required to achieve relevant internal noise levels over the majority of the Pondicherry redevelopment area. These values are for single storey residences only.

Residences in the eastern portion of the Pondicherry redevelopment area (Stages 2, 3, 4 and 6) are located at sufficient distance to the alignment that standard construction is suitable to achieve internal noise levels.

4.1.7 MITIGATION RECOMMENDATIONS

The results of this assessment indicate that based on the proximity of dwellings of the alignment, design and mitigation measures are required for consideration to achieve internal noise goals throughout the project area. A range of mitigation options have been investigated, to allow flexibility in the design of the proposal with reference to the requirements of the ENP (refer to Section 3.3). These are presented in Section 4.1.7.1.

4.1.7.1 RECOMMENDED MEASURES

The following measures have been investigated for 2036 traffic volumes, with reference to ENP amenity considerations:

Line of site measures

- Construction of noise barriers (not preferred under Section 6 of the ENP) (locations presented in Appendix C)
- Use of the built form as a barrier
 - assuming construction of two storey residences along first row of houses to shield subsequent dwellings (this has not been investigated in detail in this assessment, and would result in notable reductions to noise levels. These reductions should be investigated as part of subsequent DA subdivision noise assessments.

Layout and design considerations

- Acoustic treatment of building facades
- Reconfiguration of southern portion of site to incorporate service road to increase buffer to site
- Internal layout configuration

4.1.7.2 LINE OF SITE MEASURES

Mitigation measures were assessed to identify the effectiveness of each measure, with results presented in Appendix C. A high-level assessment of a noise barrier along the length of the Pondicherry redevelopment area to understand the acoustic benefits possible; this is indicative only and subject to more detailed understanding of practicalities of the design. The findings of these investigations are as follows:

— Mitigation option 1: 2 m high barrier along The Northern Road

Implementation of a 2 m high barrier along the western boundary of the site would result in minor reductions to noise levels, with reductions up to 2 dBA over the majority of the project area; reductions up to 4 dB are identified within Stage 5 where the barrier can be positioned along the curve of the Northern Road alignment. These results may be attributable significant portions of high vehicles and proximity of alignment following The Northern Road upgrade. This option has not been investigated further.

— Mitigation option 2: 3 m high barrier along The Northern Road

Increasing the height of the barrier to 3 m would result in noticeable reductions in noise levels, up to 7 dB during the day period over the majority of the project area for receivers within 60 m of the alignment where the barrier is continuous (i.e. towards the centre of the Pondicherry redevelopment area). This reduction reduces to approximately 3 dB at the extents of the barriers.

The effectiveness reduces with distance, however would be effective for the majority of receivers within the first 250 m of the alignment. Further noise reductions could be achieved using architectural treatments outlined in Section 4.1.7.3.

— Mitigation option 3: Two storey construction of first row of houses

Construction of the first row of houses adjacent to the alignment to two storeys would effectively act as a large noise barrier for dwellings further back.

The 2017 noise assessment incorporated high level lot layout information into the concept design, and the modelling included the attenuation from intervening buildings for the first two rows of houses within the proposal. This indicated that the shielding impacts of constructing the first two rows of buildings are likely to reduce noise levels in the order of 8 to 10 dBA. The attenuation impacts of intervening buildings beyond the first row of houses are likely to significantly reduce the noise impacts at dwellings at further offset to the alignment; however the first row of houses will be exposed to unmitigated noise levels as presented. Noise levels at second floor receivers located behind the first row of houses would be more exposed to road noise than ground floor receivers, with noise levels around 2 dB higher than the ground floor levels.

— Line of site - Mitigation summary

The results indicate that mitigation including 3 m high barrier will see reductions in the order of 7 dBA beyond the first row of houses. Noise levels would generally be reduced to within 26 dB of internal noise levels at the first row of houses, reducing to 15 dB behind the first row of houses.

The construction of two storey residences would be effective at reducing noise levels at houses further back, however the first row would experience noise levels up to 23 dB above relevant internal noise levels at ground level, up to 25 dB at the second floor. Architectural treatment would be required to achieve internal noise levels for this layout design (refer to Section 4.1.7.3).

It is considered that installation of the above mitigation measures would ensure compliance with ENP noise limits in private open spaces for the dwellings in the proposal, being limited to 57dBA $L_{Aeq(15hr)}$ from 7am to 10pm.

4.1.7.3 ACOUSTIC TREATMENT AND LAYOUT RECOMMENDATIONS

To achieve the internal noise levels specified in the ENP and DNRCBR, building construction should consider the categories of treatment presented in Appendix C and refer to the noise modelling presented in this report.

It is recommended that the future development include the following considerations:

- Dwelling layout and architectural treatment should be designed with consideration to *AS/NZS 3671:1989 – Acoustics – Road Traffic Noise Intrusion – Building Siting and Construction*.
- For a minimum of the first row of buildings, doors and windows on the most exposed facades of dwellings should be minimised (where possible).
- Dwellings fronting directly onto The Northern Road should be constructed of building components and glazing requirements selected with reference to AS/NZS 3671:1989. These requirements should be determined at the individual building design phase.
- Noise sensitive rooms and private open spaces should be situated away from The Northern Road, where possible.
- Design of internal layout to incorporate service road to the west of residences, where possible.

It is understood that the construction would generally be of standard brick veneer construction, however based on the results of this assessment, it is considered that further treatment would be required in the western properties to achieve relevant noise goals.

4.1.7.4 OVERALL ACOUSTIC MITIGATION RECOMMENDATIONS

To achieve the internal noise levels specified in the ENP and DNRCBR, it is recommended that the construction of noise barriers or two storey residences in the first row of houses be considered. In addition, to achieve relevant internal noise levels, building construction should consider the categories of treatment presented in Appendix D and refer to the noise modelling presented in this report.

It is considered that upon implementation of the measures outlined in this report, residences within 150 m of The Northern Road alignment would require Category 1 treatment, and residences within 65 m would require Category 2 treatment (refer to Appendix D). Residential dwellings located more than 230 m from The Northern Road alignment are located at sufficient distance that standard construction techniques are sufficient to achieve internal noise levels.

This implementation of the above recommendations would see the relevant internal noise goals achieved within the western portions of the redevelopment area.

4.2 SUB ARTERIAL ROADS

The Traffic Assessment (GHD, 2020) completed a detailed assessment of the key internal sub-arterial roads to be developed as part of the Pondicherry Precinct, based on regional traffic modelling and forecasts. A summary of the expected trip generation characteristics of the Pondicherry Precinct (per stage of development) is presented in Table 4.6.

Table 4.6 Trip generation summary – Full Development 2036 Residential and Town Centre

Land Use	AM	Peak	PM	Peak
	Inbound	Outbound	Inbound	Outbound
Stage 1	80	321	335	84
Stage 2	72	290	301	75
Stage 3	75	300	310	77
Stage 4	73	291	302	76
Stage 5	122	487	505	126
Stage 6	7	29	37	9
Additional Area	88	332	346	91
Town Centre	-	-	59	59
Total	505	2,021	2,158	584

(1) Day (7am to 10pm), night (10pm to 7am).

Source: GHD (2020)

The above data indicates that the Pondicherry Precinct (full development) and adjoining area will generate approximately 4,200 trips in the AM peak hour and 3,800 trips in the PM peak hour.

A section of land adjacent to the east of the Pondicherry Precinct in the Oran Park Precinct includes part of the proposed high school and some medium and low density dwellings. Given its proximity to Pondicherry, the land uses in this area have been included in the traffic assessment as “additional areas” in Table 4.6.

- The proposed road structure/hierarchy for the Pondicherry Precinct is as follows: Two east-west sub-arterial roads providing access from The Northern Road to the precinct via new signalised intersections at Maryland Link Road 1 and Maryland Link Road 2.
- A sub-arterial extension of Oran Park Drive providing north-south connectivity from Oran Park to the precinct. It is proposed to provide three signalised intersections along the sub-arterial road, within Pondicherry Precinct.
- A collector road network that distributes local traffic throughout the subject site and directs vehicles to sub-arterial roads at key intersections.
- A local road network providing access to the proposed residences.

The proposed road network, hierarchy and accesses are depicted in Figure 4.1.

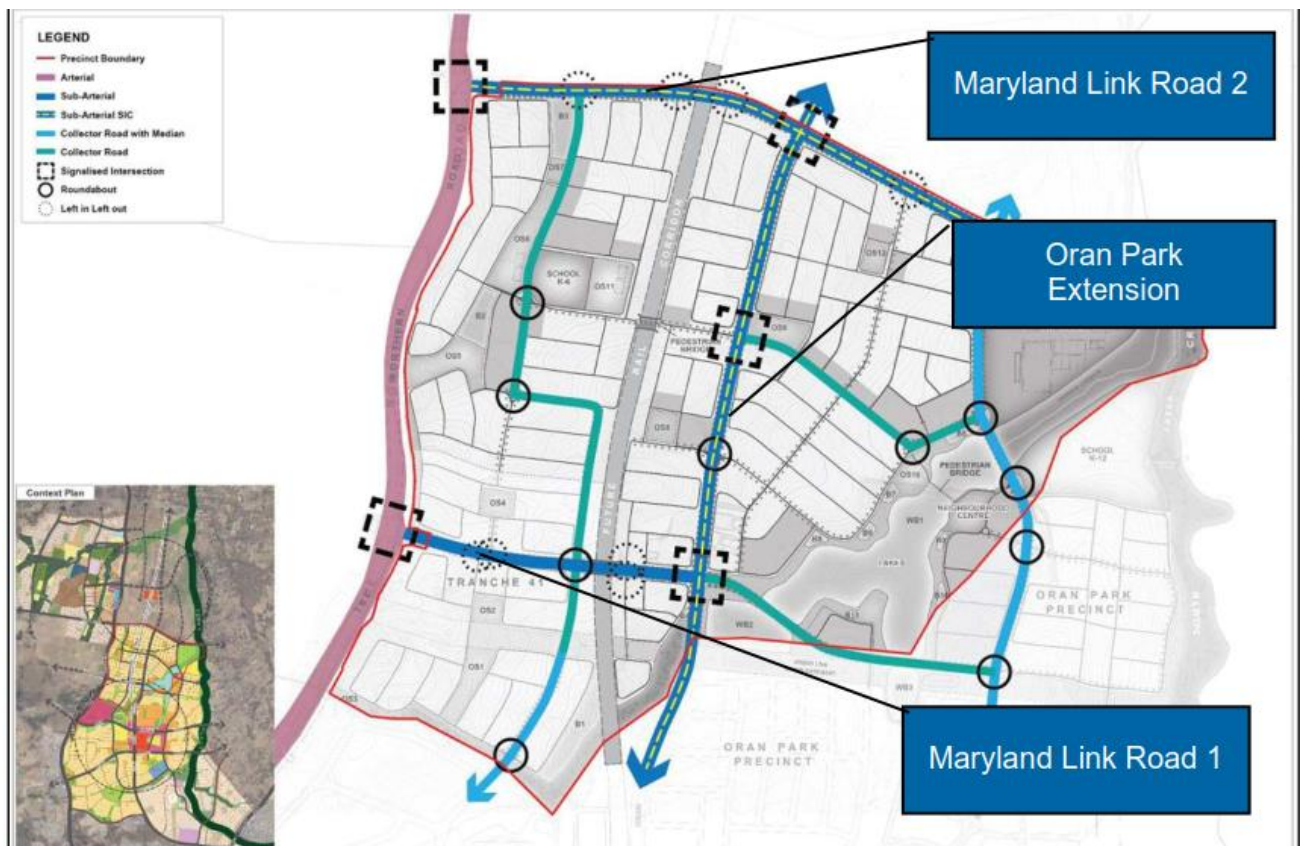


Figure 4.1 Pondicherry Precinct Road Network and Hierarchy

Source: GHD (2020)

4.2.1 TRAFFIC MODELLING PARAMETERS

The *Traffic Assessment for the Pondicherry Precinct* (GHD 2020) make the following assumptions:

Lowes Creek and South Creek Traffic

- For the purpose of traffic modelling for the impact of Pondicherry, only the traffic accessing The Northern road and Greendale Road is included, since they enter the study area.
- The internal local road network within Lowes Creek is not explicitly modelled for this project and instead represented by the centroid connection (it is noted that these volumes contribute to the Maryland Roads 1 and 2 traffic volumes.)

South Creek West Land

- The trips generated from the South Creek West Land area locating at the west of The Northern Road was estimated based on the outputs of STFM in 2036.
- Oran Park Drive extension is also proposed within South Creek West Land as a two-lane road, extending to connect with Bringelly Road
- It is anticipated that provided the land use forecast (2036) is much higher than those provided in STFM, a four-lane Oran Park Drive may be required (not modelled in this assessment).

Oran Park Precinct

- Oran Park Precinct is located south and adjacent to Pondicherry Precinct; traffic from the northern part of Oran Park may access the local road network within Pondicherry, therefore northern part of Oran Park was included in the Traffic Assessment.

Table 4.7 Dwelling and trip generation summary

Land Use (2036)	Dwelling	AM Peak			PM Peak		
		Inbound	Outbound	Total	Inbound	Outbound	Total
Pondicherry	2,700	1,810	3,090	4,900	2,270	930	3,200
Lowes Creek Maryland Precinct and South Creek West Land (W of TNR ¹)	7,000	930	4,030	4,960	4,310	1,200	5,510
South Creek West Land (E of TNR ¹)	1,800	830	900	1,730	750	1,070	1,820
Oran Park	5,000	4,740	5,380	10,120	3,960	3,610	7,570
Total	16,500	8,310	13,400	21,710	11,290	6,810	18,100

(1) The Northern Road

Source: GHD (2020)

The following trip distribution patterns have been adopted from the Traffic Assessment (GHD 2020):

- Approximately 23 percent (AM) and 19 percent (PM) between the Pondicherry and the Northern Road (north).
- Approximately 21 percent (AM) and 25 percent (PM) between the Pondicherry and the Northern Road (south).
- Approximately 47 percent (AM) and 51 percent (PM) between the Pondicherry and the internal precincts including Oran Park, Lowes Creek and South Creek West.
- Approximately 4 percent (AM) and 3 percent (PM) are Pondicherry internal traffic
- Approximately 5 percent (AM) and 1 percent (PM) between the Pondicherry and the Camden Valley Way (south east) via Oran Park Drive.

Based on the above information the road traffic assessment has been developed based on the 2036 traffic volumes provided in the GHD (2020) report.

Based on discussions with Greenfields, the following assumptions have been made:

- Traffic data for peak hours the Traffic Assessment (GHD 2020) for the project design year (2036) volumes.
- Peak hour traffic volumes were assumed to equate to 10% of the average annual daily traffic volumes
- Traffic volumes are assessed over day (7am-10pm) and night (10pm to 7am) periods.
- Day night splits between Marylands Link Roads 1 and 2 were sourced from the intersection counts in Appendix A of the Traffic Assessment (GHD 2020)
- Discrepancies in traffic volumes associated with traffic from Marylands Link Road 2 existing Precinct via Oran Park Road.

A summary of the modelled traffic volumes is provided in Table 4.1.

Table 4.8 Modelled traffic volumes – Sub arterial Roads

Direction	Period ¹	2036 (vehicles per hour)		
		Light	Heavy	Total
MARYLANDS CREEK ROAD 2				
East Bound	Day	2,773	228	3,001
	Night	12,599	1,783	14,383
West Bound	Day	9,595	494	10,089
	Night	1,974	151	2,125
MARYLANDS CREEK ROAD 1				
East Bound	Day	2,564	247	2,812
	Night	1,668	112	1,780
West Bound	Day	13,392	1,706	15,098
	Night	2,199	176	2,375
ORAN PARK				
Southbound	Day	26,218	3,407	29,625
	Night	12,920	1,931	14,850
Northbound	Day	32,583	1,042	33,625
	Night	12,644	893	13,538

(1) Day (7am to 10pm), night (10pm to 7am)

Based on feedback from the traffic consultant, speeds of 60 km/h have been adopted for all sub-arterial roads.

All other modelling and assessment assumptions are consistent with Section 4.1.2.

4.2.2 PREDICTED NOISE RESULTS – SUB ARTERIAL ROADS

Predicted road noise levels associated with the new project sub arterial roads were modelled for receivers within the Pondicherry redevelopment area. Predicted operational noise levels are presented in Appendix C, and include predictions for the design year (2036).

Preliminary results present unmitigated noise levels for day and night periods for 2036 traffic volumes. Results are presented to provide a conservative estimate of potential impacts, allow comparison against relevant criteria and noise goals and assess potential constraints.

Noise level impacts have been estimated based on distance to sub arterial roads to present a comparison of noise levels to relevant criteria and required noise reductions. Noise levels have been presented for ground level (1.5m) heights to inform future design requirements.

Noise levels are then compared to relevant ENP internal noise levels, assuming windows are partially open, based on a standard noise reduction from external to internal of 10 dB. Results are presented in Table 4.9. As discussed in Section 4.1.5, the results are presented including attenuation from intervening buildings, in the form of an 8 dB reduction to predicted noise levels, applied to each row of residential dwellings located behind the first row of houses.

Table 4.9 Noise results (Unmitigated, Year 2036) – Residential Receivers affected by Sub arterial Roads

Receivers	External L_{eq} Noise Level ¹ (Free Field), DBA		External L_{eq} Noise Criteria – Windows Partially Open ² , DBA	
	Day	Night	Day	Night
MARYLAND LINKS ROAD 1 AND 2				
Up to 20 m	Up to 70	Up to 73	50	45
Up to 55 m ³	57	60	50	45
Up to 220 m ³	44	47	50	45
ORAN PARK ROAD				
Up to 25 m	Up to 75	Up to 72	50	45
Up to 55 m ³	62	59	50	45
Up to 110 m ³	49	46	50	45

(1) Day (7am to 10pm), night (10pm to 7am).

(2) Based on ENP criteria for sleeping areas, including internal to external reduction of 10 dB.

(3) Predictions at dwellings further back from the road include reduction for intervening buildings (8 dB correction applies).

Noise levels from the sub arterial roads within the Pondicherry Precinct are predicted to result in elevated noise levels at receivers close to the alignments. Noise levels are predicted to exceed noise goals at dwellings within 55 m unless mitigation designs are implemented (levels do not incorporate specific architectural noise mitigation of façade components).

It is noted that noise levels are based on peak hour predictions from the GHD (2020) report. As a result, noise levels are highly conservative, and would be subject to further investigation as part of subsequent investigations.

4.2.3 NOISE REDUCTION REQUIREMENTS

The noise reductions that will be required for dwellings located within 55 m of sub-arterial roads are presented in Table 4.10 for windows partially open. The reductions have been determined to achieve compliance with Camden ENP and the DNRCBR.

Table 4.10 Noise reductions required (Unmitigated) - Residential Receivers on Sub Arterial Roads

Receivers	External L_{eq} Noise Level ¹ (Free Field), DBA	
	DAY	NIGHT
MARYLAND LINKS ROAD 1 AND 2		
Up to 20 m	33	35
Up to 55 m	17	25
Up to 220 m	4	12
ORAN PARK ROAD		

Receivers	External L _{eq} Noise Level ¹ (Free Field), DBA	
	DAY	NIGHT
Up to 25 m	33	35
Up to 55 m	22	24
Up to 110 m	9	11

(1) External to internal, including 10 dB reduction for windows partially open

(2) Reductions based on noise predictions presented in Table 4.9.

The findings of the assessment are summarised as follows (single storey residences only):

Maryland Links Road 1 and 2

- Dwellings within 20 m of the alignment would require up to 35 dB of acoustic reduction to achieve relevant internal noise levels. This reduction cannot be achieved by standard architectural measures, and would require line of site measures (refer to Section 4.1.7) or mechanical ventilation considerations. These values do not account for the shielding impacts of intervening buildings.
- Dwellings within 55 m of the alignments would require up to 25 dB of acoustic reduction to achieve relevant internal noise levels; dwellings within 220 m would require up to 12 dB of acoustic reduction.
- The results above indicate that noise mitigation is required to achieve relevant internal noise levels over parts of Stage 1, 4 and 5, and smaller portions of Stages 2 and 3 as a result of the projected traffic volumes on Maryland Links Road 1 and 2.
- Traffic predictions should be revisited as part of subsequent investigations to ensure heavy vehicle levels and projected flows are reasonable for the Pondicherry Precinct.

Oran Park Road

- Dwellings within 25 m of the alignment would require up to 35 dB of acoustic reduction to achieve relevant internal noise levels. This reduction cannot be achieved by standard architectural measures, and would require line of site measures (refer to Section 4.1.7) or mechanical ventilation considerations.
- Dwellings within 55 m of the alignments would require up to 24 dB of acoustic reduction to achieve relevant internal noise levels; dwellings within 110 m would require up to 11 dB of acoustic reduction.
- The results above indicate that noise mitigation is required to achieve relevant internal noise levels over the majority of Stages 2 and 4 as a result of noise levels from Oran Park Drive.
- Residences in the eastern portion of the Pondicherry redevelopment area (Stages 3 and 6) are generally located at sufficient distance to the alignment that standard construction is suitable to achieve internal noise levels.
- Traffic predictions should be revisited as part of subsequent investigations to ensure heavy vehicle levels and projected flows are reasonable for the Pondicherry Precinct.

4.3 TRAFFIC GENERATION ON LOCAL ROADS

The RNP also requires an assessment of noise impacts where a land use development generates additional traffic on existing roads. The internal roads will generate additional traffic on residences as a result of newly established local roads. The noise generating components of this proposal will be assessed as part of the DA noise assessment for subsequent stages, however for completeness a high level noise assessment has been conducted to assess potential road noise impacts from internal roads.

Traffic volumes have been adopted from the GHD (2020) report based on traffic generation within each Stage, as presented in Table 4.6. It is assumed that 50 % of all vehicles generated would access local roads in any one hour.

Based on the forecast modelled traffic volumes, indicative noise levels on local roads have been calculated using the Calculation of Road Traffic Noise (CORTN) calculation. High level results are presented in Table 4.11.

Table 4.11 Estimated local traffic noise impacts – (2036)

Stage	2036 AM Peak		2036 PM Peak	
	CRITERIA $L_{Aeq1\text{ hr}}$	PREDICTED NOISE LEVEL, DBA	CRITERIA $L_{Aeq1\text{ HR}}$	PREDICTED NOISE LEVEL, DBA
Stage 1	55	<50	50	60
Stage 2	55	<50	50	51
Stage 3	55	<50	50	51
Stage 4	55	<50	50	53
Stage 5	55	<50	50	42
Stage 6	55	<50	50	51

The results of this assessment indicate there is the potential for noise from peak hour traffic volumes to exceed local road noise criteria, however road noise levels throughout the remainder of the day and night will be substantially lower. These levels should be further investigated as part of subsequent investigations when more detailed traffic information is available.

5 INDUSTRIAL NOISE

The Camden Council ENP includes several provisions that relate to noise intrusion from existing and proposed industrial activities. These have been discussed in the following sections.

The proposed Pondicherry redevelopment area is located in an area generally currently used as rural property and farming land uses, with a wood chipping operation previously identified as operational (during 2017 field investigations) identified as no longer being in operation. This site has been replaced by a recycling facility, which was subject to investigation in 2020 to quantify acoustic influence on the project area. Further, on consideration of the Oran Park Precinct Plan, there are proposed industrial land uses identified as part of future components of the Oran Park Precinct which may impact on the redevelopment area.

5.1 EXISTING INDUSTRIAL ACTIVITIES

As part of the 2017 noise monitoring investigations, an existing wood chipping operation was identified to be in operation at 761 The Northern Road, Bringelly (refer to Section 2.2). Subsequent measurements undertaken in 2020 identified that these activities were no longer taking place; however, a recycling facility had been established at the same location (refer to Section 2.3).

Observations made during monitoring indicated that the operations were inaudible at the site boundary of the Pondicherry site, and inaudible from the boundary of the recycling facility boundary itself, with the contribution of the site was estimated at <30 dBA (Section 2.3). Due to the distance from the industrial site and the Pondicherry site and low-level noise contribution, existing industrial activities are not expected to generate any identifiable impacts into the Pondicherry site, particularly given the intervening Northern Road.

5.2 FUTURE INDUSTRIAL ACTIVITIES

The Oran Park Precinct is located to the southern boundary of the Pondicherry redevelopment area, including the Oran Park Employment Lands. Council requirements have identified the potential for noise associated with this land use to impact on the residential development area. It is understood that there is a development application in place to extend industrial uses over land previously proposed for residential development, therefore potential intrusive impacts as a result of this modification are to be assessed.

The location of the Pondicherry redevelopment area in relation to the Oran Park Precinct and relevant industrial components of the Employment Lands are presented in Appendix B. With reference to this plan, it is noted that there is a sizeable buffer between Pondicherry and the adjacent boundary of the Oran Park Precinct in the form of a riparian zone, providing approximately 65 m buffer from the nearest development. Based on discussions with Greenfields, it is understood that a rezoning application has been submitted for the industrial lands expansion which incorporate service roads at the north-eastern extent of the proposed industrial lands (refer to Appendix B). It is noted these service roads provide an additional offset of approximately 15 m between industrial lands and residential developments, excepting the southernmost portion of Stage 1.

The industrial land uses, if approved, have the potential to operate up to the amenity levels presented in Table 3.2 at the boundary of the industrial development area (i.e. 70 dBA). This is the maximum permissible level at the boundary that can be approved by Council and is considered highly conservative. The potential noise intrusion impact of these amenity levels has been conservatively assessed to the proposed Pondicherry redevelopment area. Based on the anticipated offset provided by the riparian zone and service road corridors associated with the industrial zone, noise level reductions of between 35 dBA and 40 dBA could be expected as a result of distance attenuation. These reductions would be sufficient to ensure amenity noise levels are achieved at the nearest residential dwellings in the Pondicherry development area when the industrial land use areas are operational.

Further, where the industrial zone comprises a cluster of industrial land uses, it is likely that amenity noise levels would be further reduced to maintain appropriate cumulative noise impacts on adjacent residential areas, therefore the above qualitative review of impacts is highly conservative.

6 RECREATION AREA NOISE

6.1 PASSIVE RECREATION AREAS

Guidelines for noise within passive recreation areas are outlined in the ENP (refer to Section 3.3.6), as follows:

“Public open space areas are to be designed to sensitively locate passive recreation areas away from noise sources without compromising the overall functionality of the area. Physical noise barriers (other than earth mounds) for public open space areas will not be supported.”

As presented in Figure 1.2, the main public recreation areas within the Pondicherry area are situated at a significant offset from the main noise sources in the locality, being road and rail infrastructure corridors. The majority of these public recreation areas are generally situated at least 150 m from the infrastructure alignments and will receive significant shielding from intervening structures, therefore it is considered that the objectives of the ENP to “sensitively locate passive recreation areas away from noise sources without compromising the overall functionality of the area” have been achieved.

Further, the ENP states that “an area of communal open space is to be attenuated to 57 dBA $L_{Aeq(15hr)}$ from 7am to 10pm”. Based on the noise contours (refer to Appendix C) and proposed mitigation options (refer to Section 4.1.7) it is considered that the design of the proposal will ensure noise levels in proposed recreation areas will comply with this noise goal, with the exception of the parklands fronting The Northern Road. These areas are likely to receive noise levels exceeding the noise goal; installation of the noise mitigation measures outlined in this report are likely to manage the residual noise impacts as far as reasonably practical.

7 RAIL NOISE AND VIBRATION

This section outlines the assessment undertaken to account for potential rail noise and vibration impacts from the gazetted South West Rail Link on receiver areas within the project area.

The North-South Rail Line (NSRL) and South West Rail Link Extension (SWRL) corridors were identified as being critical to the development of Western Sydney. The aim of the *Draft North-South Rail Line and South West Rail Link Extension Corridors Strategic Environmental Assessment* (Transport for NSW, 2018a) is to protect these two rail corridors in Western Sydney for future rail infrastructure for passenger train services.

The potential impacts from rail noise and vibration have been quantitatively assessed to understand limitations on the project design and any required design limitations or management considerations. As the corridors are gazetted, the development application needs to address any identified constraints. This section outlines the qualitative assessment of rail vibration for the project area.

7.1 RAIL NOISE MODELLING

Potential noise impacts associated with the project have been modelled for all residences in the vicinity of railway line using the Kilde Report 67/130 algorithm within SoundPlan 8.2 noise modelling software. This method is the preferred method by regulatory authorities for use in rail noise assessments.

Rail movement data for the South West Rail Link (SWRL) has been taken from information contained within the *North West Rail Link Noise and Vibration Technical Paper for Operations and Additional Construction Works* (SLR, 17 October 2012), herein referred to as 'the NWRL Operational NV'. This report provided rail movement data as presented in Table 7-1. Note that 'up' and 'down' in the below tables relate to the direction of travel for the train movements (up = towards Sydney, down = away from Sydney).

Rail movement data for the opening year was adopted for the purpose of this assessment as presented in Table 7-1.

Table 7-1 Rail movement data

RAIL MOVEMENTS	DAY 7:00AM TO 10:00PM		NIGHT (10:00PM TO 7:00AM)	
	Up	Down	Up	Down
Opening year	122	124	29	27

Source: NWRL Operational NV, GHD 2012.

The corresponding noise levels stated for the rolling stock trains in the NWRL Operational NV are presented in Table 7-2. These noise levels have been used as inputs to the SoundPlan model to assess the impacts to the project area.

Table 7-2 Train Set noise levels

	REFERENCE NOISE LEVEL (80 KM/H @ 15M), DBA	
	L _{Max}	L _E
Single-deck without rail dampers	91	94

Source: NWRL Operational NV, GHD 2012.

Assumptions regarding the length and number of carriages were sourced from the *Development of Rail Alignment for Pondicherry Site, Report of Study* (Parsons Brinckerhoff, April 2017) (ref: 2269595A-RAI-REP-001 Rev B), as referenced as part of the *Review of metro horizontal and vertical rail alignment for the Pondicherry Precinct* (WSP 31 August 2020) (ref: PS118563_revC). These documents assumed the rail alignment would be constructed to accommodate 12 cars sets of Waratah rolling stock with a total length of 244 m. The proposed design speed of 125 km/h was reduced to 120km/h consistent with the NWRL Operational NV assumptions.

As the exact location of the alignment was not known at the time of writing of this report, the alignment has been placed at the centre of the alignment corridor; this allows a conservative assessment for noise propagation with minimal intervening screening.

Noise modelling parameters and assumptions are provided in Table 7-3.

Table 7-3 Rail noise modelling parameters

PARAMETER	NOTES
Train type	Rolling stock trains
Train numbers	As per Table 7-1
Train lengths	240m, based on a 12-carriage (20m length) train ¹
Train speeds	120km/h
Train location	Located in a cutting (depth) approx. 5-7m, and located at the centre within a 50m width corridor.
Source heights/corrections	0.5m as per Kilde 67/130
Façade correction	+2.5dBA applied
Ground surface	Soft

Source: Development of Rail Alignment for Pondicherry Site, Report of Study (Parsons Brinckerhoff, April 2017).

7.2 RAIL NOISE PREDICTION RESULTS

Based on the noise model, noise contour maps for daytime and night time rail noise scenarios have been calculated. The predominant land use in the vicinity of the rail corridor is low density residential, presenting the most stringent assessment criteria in proximity to potential rail noise impacts. Impacts have been presented as the distance to compliance with the respective rail noise guidelines (refer to Table 3.3). The $L_{Aeq(15\text{hour})}$ 60 dB and $L_{Aeq(9\text{hour})}$ 55 dB associated with the SWRL noise contours presented in Appendix C.

These results present unmitigated noise levels for day and night periods. Based on discussions with Greenfields it is noted that there is a sizeable retaining wall adjacent the proposed railway corridor which would significantly reduce the line of sight from the Pondicherry development area to the railway line.

Results are presented to provide a conservative estimate of potential impacts, allow comparison against relevant criteria and assess potential constraints for development within the Pondicherry redevelopment area. The concept design included staging and high level lot layout information which have been overlain to indicate the potential affectation areas within each stage of the development.

Table 7-4 presents the minimum setback distance to achieve compliance with the rail noise guidelines.

Table 7-4 Minimum setback distances for predicted compliance with rail criteria (no barrier)

PERIOD	NOISE TRIGGER LEVEL, DBA (EXTERNAL) DBA	MINIMUM SETBACK DISTANCES FROM CENTRELINE
Day 7am-10pm	60 $L_{eq,15hr}$	> 40m (northern extent) – 75m (southern extent)
Night 10pm-7am	55 $L_{eq,9hr}$	> 40m (northern extent) – 80m (southern extent)

The operational rail noise levels are predicted to comply with the relevant RING noise trigger levels over the majority of the Pondicherry redevelopment area.

As discussed in Section 7.1, the track centreline was located at the centre of the 50 m wide rail corridor, and the majority of the alignment is located within a cutting. As a result the noise impacts are generally not predicted for noise sensitive receivers.

The findings of the assessment are summarised as follows:

Northern stages of Pondicherry

- Compliance would be achieved with rail noise trigger levels in the area approximately 15 m from the corridor edge during day and night periods.
- Internal roads should be positioned to increase the offset to residential development areas
- Noise levels in Stages 4 and 5 are predicted remain below relevant noise trigger levels for day and night periods (no additional mitigation required)
- Stage 3 is outside the potential affectation area of the rail corridor (refer to Figure 3.3).

Southern stages of Pondicherry:

- Compliance would be achieved with rail noise trigger levels in the approximately 50 m from the corridor edge during daytime and 55 m during night time
- Internal roads and active recreation areas should be positioned to increase the offset to residential development areas
- Noise levels in Stages 1 and 2 are predicted to remain below relevant noise trigger levels for the majority of residences during day and night periods. Mitigation may be required for residences south of Maryland Link Road within these distances.
- Stage 6 is outside the potential affectation area of the rail corridor (refer to Figure 3.3).

7.3 MITIGATION

Based on our understanding of the current project requirements and constraints, this subsection provides a discussion on possible mitigation options available to reduce the potential rail noise impact on future residential developments within the various stage of the Pondicherry development area.

7.3.1 PLANNING OF THE RESIDENTIAL SUBDIVISION

Based on the results derived from the noise modelling as presented in Section 7.1, typical setback distances for residential blocks have been determined to meet the relevant noise trigger levels. During the earliest stages of planning of the new residential subdivisions directly adjacent to the subject rail corridor, it is recommended that considerations be given to providing the setback distances where possible. Typical approaches may include (but not limited to) positioning of landscape buffer zones, internal access roads or the like between the rail corridor and the nearest residential blocks and planning of less noise-sensitive land uses on areas closest to the rail line.

7.3.2 MITIGATION ALONG THE NOISE TRANSFER PATH

This option typically involves the use of noise barrier(s) to break direct line of sight between the rail line and receivers. It should be noted that noise barriers are typically most effective if they are close to the source or the receiver. The most common types of barriers are typically in the form of solid property boundary fences and/or rail corridor barriers (earth mound or noise wall). **In general, by blocking the direct line of sight between the source and receiver, a noise reduction of at least 5 dB can be expected.**

When more information regarding lot development is available, assessment of the potential benefit of noise barriers should be investigated in greater detail.

7.3.3 MITIGATION AT THE RECEIVER

This typically involves strategic configuration of site configuration and providing a building envelope with sufficient sound insulation properties. Careful and considered design and planning of the residential development can provide suitable acoustic amenity to future residents.

Notwithstanding the above, the early planning stages should also take into account the setback distances determined to meet the planning guideline at 1 m in front of the building façade.

In the event that noise mitigation strategies (such as increasing setback distances or strategic planning of site configurations) not considered to be feasible or desirable, consideration may be given to accepting an external noise level that is higher than the relevant planning guidelines and providing appropriate internal acoustic amenity through building envelope design.

Any acoustic risk should be dealt with during early planning stages. This may include space planning to locate acoustic sensitive space (e.g. bedrooms) away from the rail line and making cost allowances for glazing systems that have higher sound insulation performances.

As discussed in Section 3.5.1.2, residences to be constructed within 60 m of a high speed rail track (in Zone B of the DNRCBR) would require treatment with Treatment Category 2 (refer to Appendix D). It is recommended that these measures be adopted as a minimum for single dwelling residences in Zone B. These standard mitigation measures are based on having windows and external doors closed, thus ventilation requirements would need to be assessed to meet the provisions of the Building Code of Australia.

7.4 RAIL VIBRATION

Based on the proposed site layout and the identified NSRL corridor location (refer to Figure 1.2 Indicative Lot Plan Pondicherry redevelopment

Figure 1.3 presents the indicative staging plan for the rezoning area.

), a high level assessment of potential vibration impacts has been conducted to residential dwellings. The nearest dwellings in Stages 1 and 2 are located approximately 80 m from the track (excluding service roads); residences in Stages 4 and 5 are located approximately 45 m from the track. Residential dwellings in Stages 3 and 6 are located outside the potential vibration assessment zone (refer to Figure 3.4).

With reference to Figure 3.4 the proposed dwellings within the Pondicherry redevelopment area are located outside the relevant vibration assessment zone (25 m) for the future SWRL corridor, therefore a vibration assessment would not be required.

8 AIRCRAFT NOISE

The potential for nearby airport facilities (both current and proposed) to impact on the proposed development has been assessed. There are two airports in the vicinity of the project area; the future Western Sydney Airport, proposed approximately 10km to the north; and the existing Camden Airport, located approximately 5km south-west.

Aircraft noise impacts are assessed using the Australian Noise Exposure Forecast (ANEF), as required by Commonwealth regulations for airports. The ANEF is a measure of noise impacts and is used in conjunction with Australian Standard (AS) 2021:2015 *Acoustics - Aircraft noise intrusion - Building siting and construction* to control and manage noise sensitive developments near airports.

According to AS 2021, where a development is outside of the ANEF 20 contour, there are no restrictions on noise sensitive developments and specific acoustic treatment is not required for aircraft noise.

The currently available public documentation for Western Sydney Airport is contained in the *Western Sydney Airport Environment Impact Statement (EIS)*, September 2016. The EIS contained the ANEF contours for the airports ultimate capacity using two runways in 2063.

The 2015 Camden Airport Masterplan contains the ANEF contours for airport operations at ultimate capacity in 2034/35, as presented in Figure 8.1. The Preliminary Draft Camden Airport Master Plan 2020 is currently on exhibition and has not been approved, however preliminary draft ANEF contours for ultimate capacity in 2040 are presented in Figure 8.2.

The project site is located well outside of the ANEF 20 contours for both Camden Airport and the proposed Western Sydney Airport. As a result, there are no restrictions on noise sensitive developments and no specific acoustic treatment for aircraft noise is warranted for the Pondicherry redevelopment area.

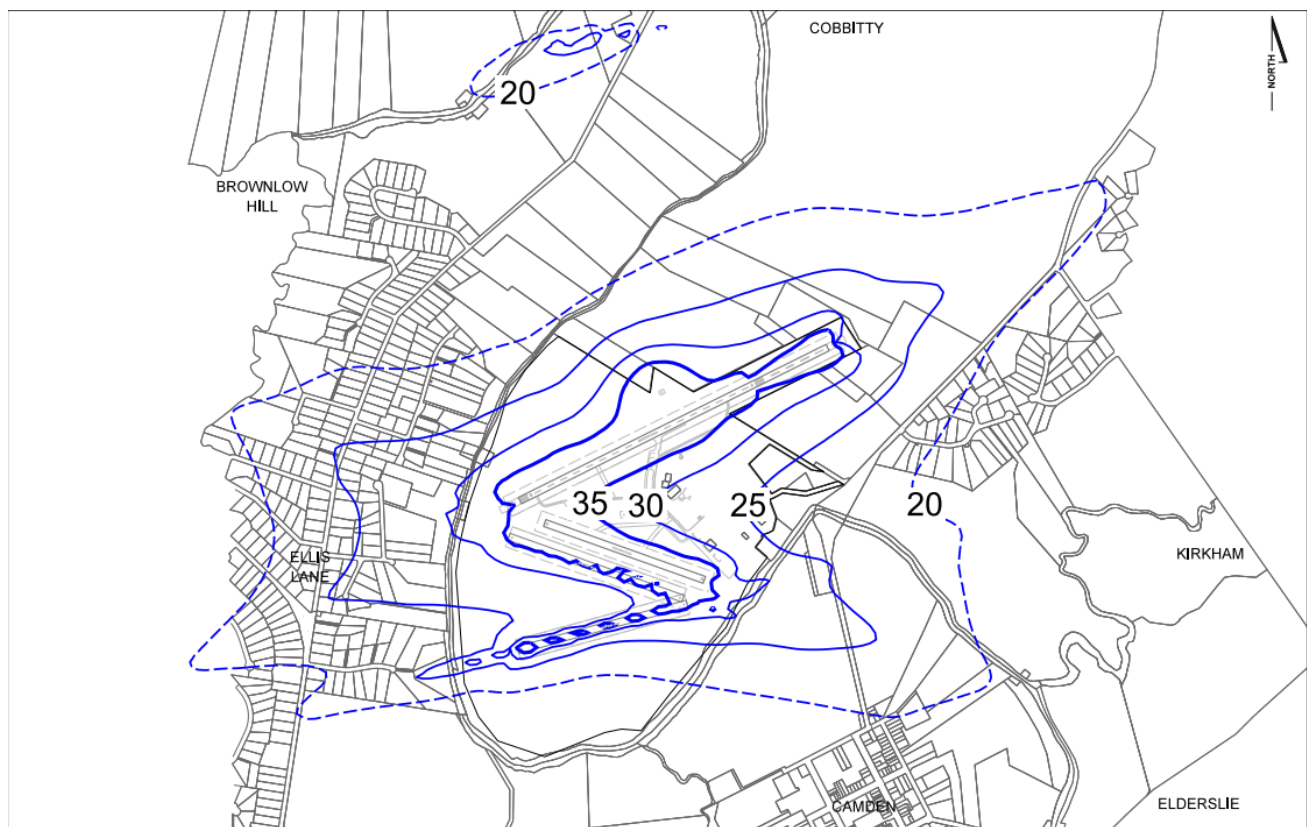


Figure 8.1 Camden Airport 2034/35 ANEF Contours

Source: Camden Airport Master Plan 2015

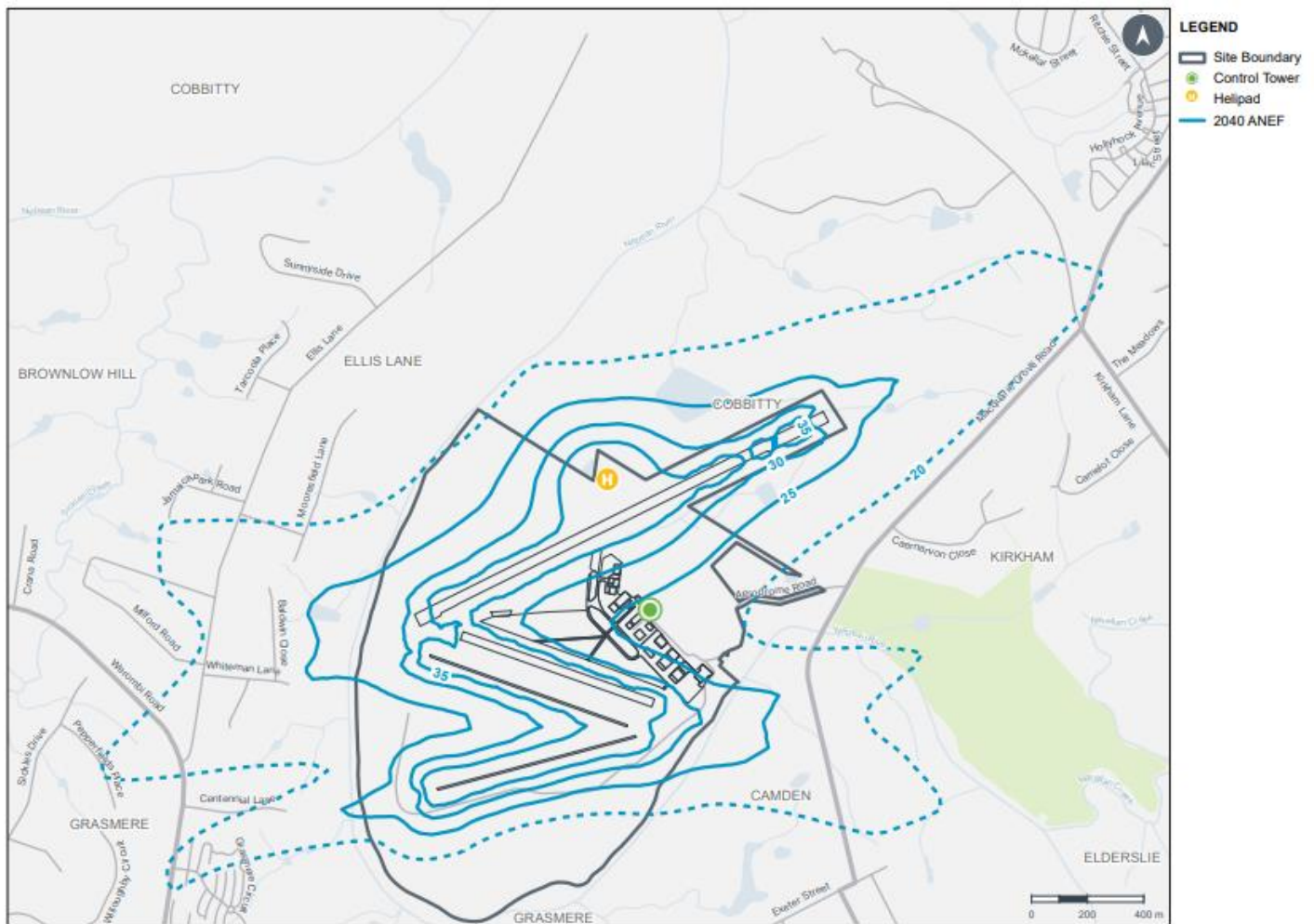


Figure 8.2 Camden Airport 2040 ANEF Contours

Source: Draft Camden Airport Master Plan 2040

9 CONCLUSIONS

This noise assessment has been prepared to support the development application for the proposed Pondicherry redevelopment in the northern section of Oran Park, NSW.

The assessment investigates the potential noise constraints and noise mitigation requirements for the future residential and non-residential areas in the area, with particular reference to noise impacts from the upgraded Northern Road and South West Rail Link, as well as intrusion impacts from existing and future industrial and aircraft sources.

The assessment has been completed with consideration to the following policy and guidance:

- NSW Department of Planning (DoP) – *Development near rail corridors and busy roads – interim guideline* (DRCBR) (2008) (DNRCBR)
- Department of Planning and Environment (DPE), *Oran Park Development Control Plan 2007* (2016)
- Camden Council Environmental Noise Policy (ENP) (2018)
- Department of Planning and Environment (DPE), *Camden City Council Growth Centre Precincts Development Control Plan* (2017).

The annual average daily volumes predicted for The Northern Road are predicted to be in the order of 20,000 vehicles, therefore the project has been assessed with regard to DNRCBR as good practice, and in line with Camden Council requirements. Based on the findings of this methodology, dwellings located within 200 m from The Northern Road alignment would require noise control treatment under the provisions of the guideline.

Predicted traffic volumes for the Northern Road have been assessed and extrapolated based on measured background traffic information to facilitate the assessment of potential noise intrusion impacts during the opening year (year 2026) plus 10 years in accordance with Council requirements. Noise impacts from proposed sub-arterial roads has also been conducted, based on available traffic volume information for the Pondicherry Precinct.

Noise contours were developed over the project area to graphically represent the noise impacts for the modelled assessment year (2036). Based on the findings of this assessment, a range of acoustic mitigation measures have been recommended in consideration of Council guidelines. These measures include incorporation of noise mounds/barriers, increasing setbacks to residential dwellings, and architectural treatments for consideration during subsequent planning stages.

This report outlines recommendations to achieve the relevant internal noise goals within various Stages of the Pondicherry redevelopment area. Residential dwellings located more than 260 m from The Northern Road alignment are located at sufficient distances that standard construction techniques are sufficient to achieve internal noise levels. It is recommended that traffic predictions for sub-arterial and local roads be revisited as part of subsequent investigations to ensure heavy vehicle levels and projected flows are reasonable for the Pondicherry Precinct.

An assessment of existing and future industrial noise sources has been completed and identified that industrial noise influences are not anticipated within the redevelopment area.

An assessment of potential future rail noise influence has been completed and identified that rail noise is not likely to generate significant adverse impacts on the Pondicherry redevelopment area. Impacts are likely to be constrained to within 55 m of the corridor edge and limited to Stages 1 and 2 of the Pondicherry Precinct; it is considered that impacts can be managed by the incorporation of appropriate acoustic category treatments as identified in this report.

Potential future rail vibration influence was assessed and not found to be significant within the Pondicherry redevelopment area.

Existing and future aircraft noise influences are not anticipated within the Pondicherry redevelopment area.

It is considered that upon implementation of the recommendations outlined in this report, relevant internal noise levels can be achieved, in compliance with the requirements of Camden Council.

9.1 RECOMMENDATIONS FOR FUTURE ASSESSMENT

Based on the findings of this assessment, the following recommendations are made for future assessment:

- Traffic predictions for sub-arterial and local roads be revisited as part of subsequent investigations to ensure heavy vehicle levels and projected flows are reasonable for the Pondicherry Precinct.
- Subsequent DA noise assessments should consider concept design and lot layout information to understand the noise reductions achieved beyond the first row of houses from intervening buildings.

10 REFERENCES

- Australian Government department of Infrastructure and Regional Development, Western Sydney Airport Environment Impact Statement (EIS) (September 2016)
- Australian Standard AS 1055:2000 - Acoustics - Description and measurement of environmental noise
- Australian Standard AS 2021:2015 - Acoustics - Aircraft noise intrusion - Building siting and construction
- Australian Standard AS/NZS 2107:2016 - Acoustics - Recommended design sound levels and reverberation times for building interiors
- Australian Standard AS 3671:1989 - Acoustics - Road traffic noise intrusion - Building siting and construction
- Camden Council, Camden Airport Master Plan and Airport Environment Strategy (2015)
- Camden Council, Preliminary Draft Camden Airport Master Plan 2020 (2015)
- Camden Council, Policy 3.20 Environmental Noise Policy (ENP) (2018)
- Department of Planning and Environment (DPE), Camden City Council Growth Centre Precincts Development Control Plan (2017)
- Department of Planning and Environment (DPE), Oran Park Development Control Plan 2007 (2016)
- Department of Transport, Welsh Office, Calculation of Road Traffic Noise (CoRTN) (1988)
- Development of Rail Alignment for Pondicherry Site, Report of Study (ref: 2269595A-RAI-REP-001 Rev B) (Parsons Brinckerhoff, April 2017)
- North West Rail Link Noise and Vibration Technical Paper for Operations and Additional Construction Works (SLR, 17 October 2012)
- MR154 The Northern Road Upgrade Between The Old Northern Rd and Mersey Rd, Traffic and Transport Assessment Report, Sinclair Knight Merz, ref: NB11363-ETR-RP-0068 (August 2012)
- The Northern Road Upgrade, Narellan to Bringelly Noise and Vibration Assessment, Sinclair Knight Merz, ref: NB11363-NNA-RP-0159 - Noise Assessment_Final 18102012 (October 2012)
- North South Rail Line and South West Rail Link Extension Corridors Draft Strategic Environmental Assessment (Transport for NSW, January 2018)
- North West Rail Link Noise and Vibration Technical Paper for Operations and Additional Construction Works (SLR, 17 October 2012)
- NSW Department of Environment and Climate Change (DECC) – Road Noise Policy (RNP) (2011)
- NSW Department of Planning (DoP) – Development near rail corridors and busy roads – interim guideline (DRCBR) (2008)
- NSW Environment Protection Authority (EPA) – Noise Policy for Industry (NPfI) (2017)
- NSW Government State Environmental Planning Policy (Infrastructure) 2007
- NSW Environmental Protection Authority (EPA) Rail Infrastructure Noise Guideline (2013).
- Pondicherry Tranche 41 Rezoning Noise and Vibration Assessment ref: PS118563-ACO-REP-RW Rev1a (WSP March 2020)
- Proposed Residential Sub Division Tranche 41 Pondicherry Precinct - Rezoning Traffic and Access Assessment Report (Positive Traffic January 2020).

- *Review of metro horizontal and vertical rail alignment for the Pondicherry Precinct (ref: PS118563_revC) (WSP 31 August 2020)*
- *Transport for NSW - Draft North-South Rail Line and South West Rail Link Extension Corridors Strategic Environmental Assessment (2018a).*

APPENDIX A

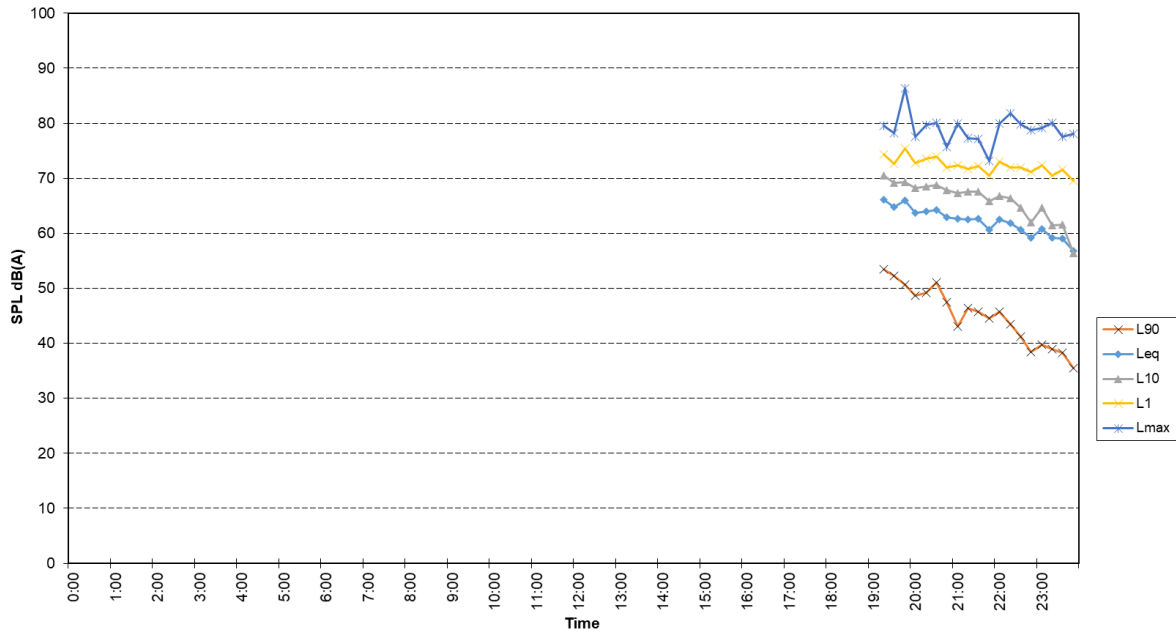
NOISE MONITORING GRAPHS



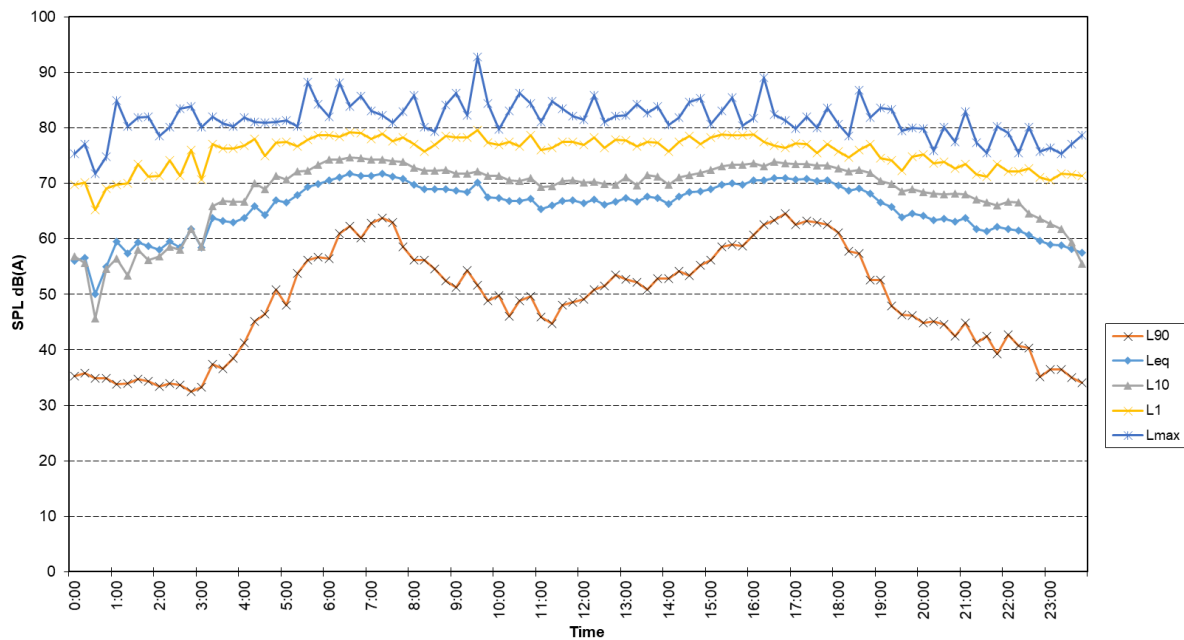
A1 NOISE MONITORING GRAPHS

Noise Monitoring Location 1

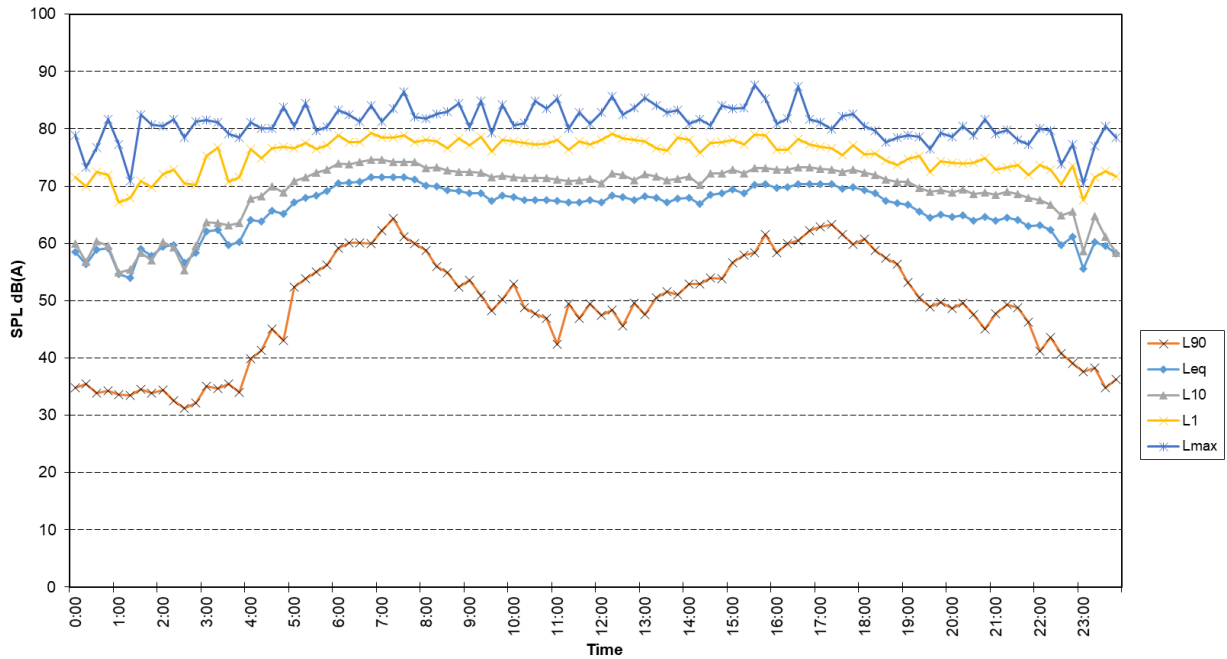
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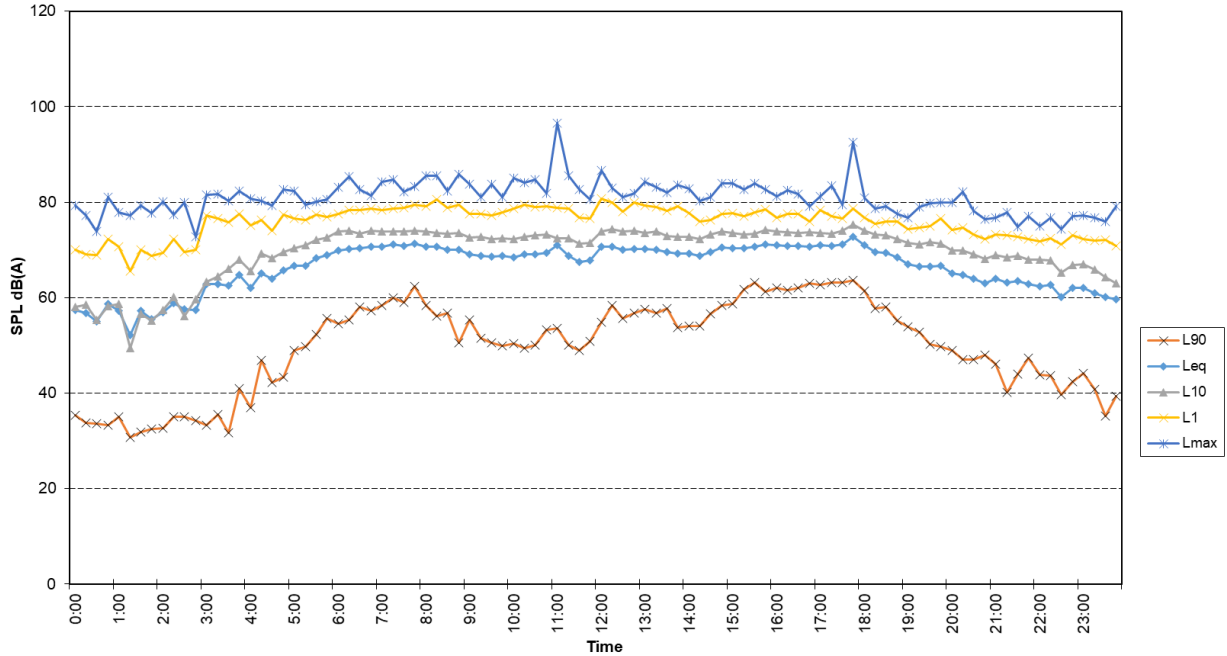
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Location - N1
Measured Noise Levels - Thursday 18/05/2017



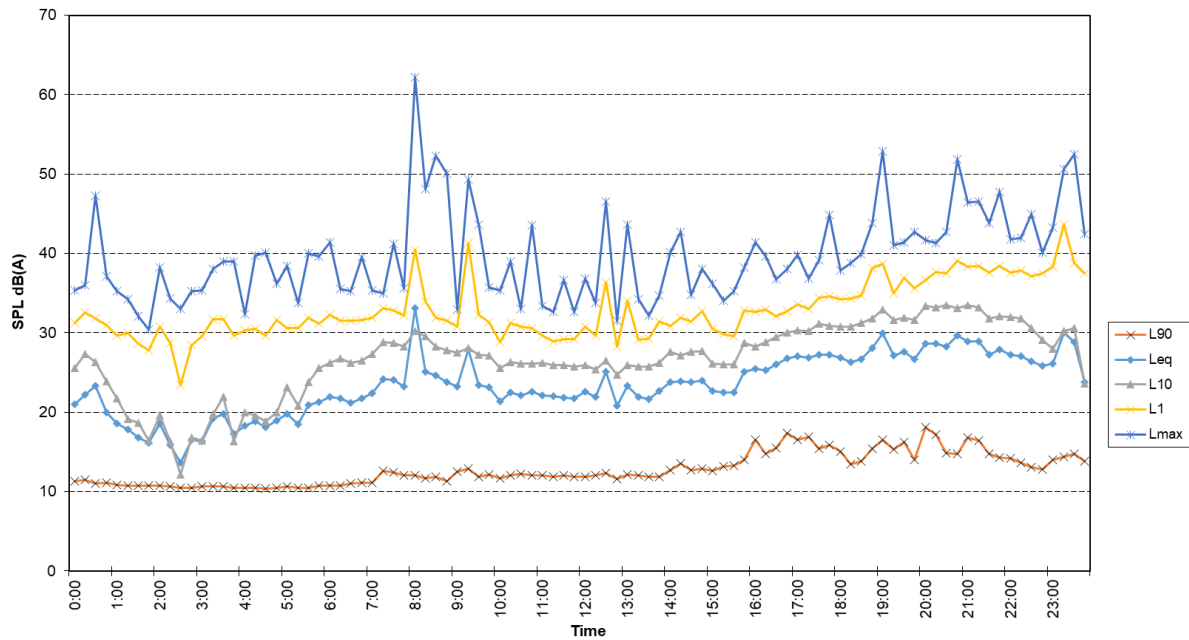
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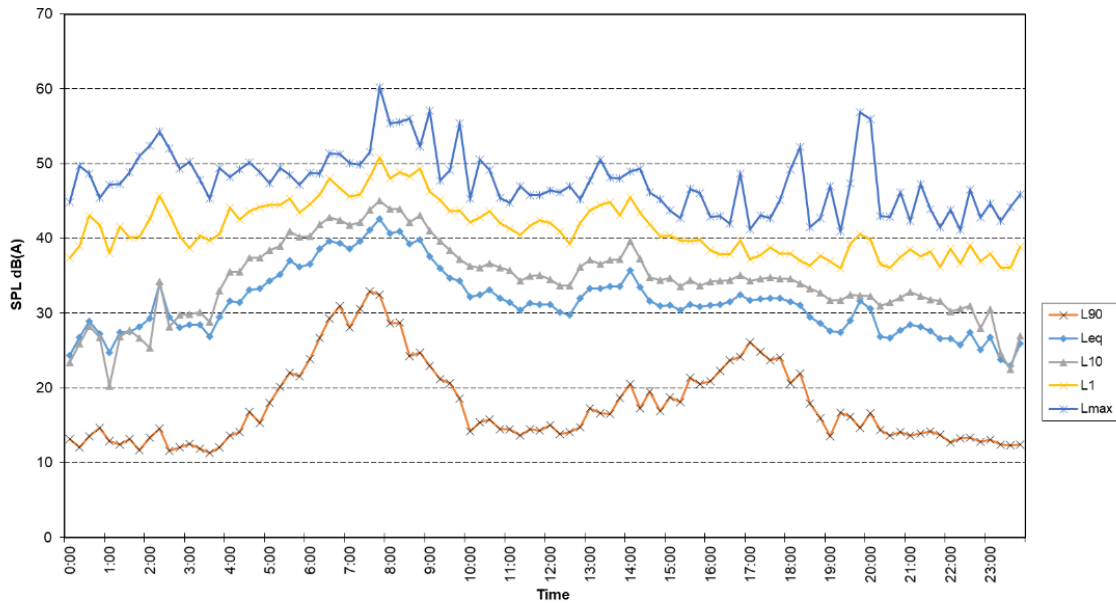
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Location - N1
Measured Noise Levels - Sunday 21/05/2017

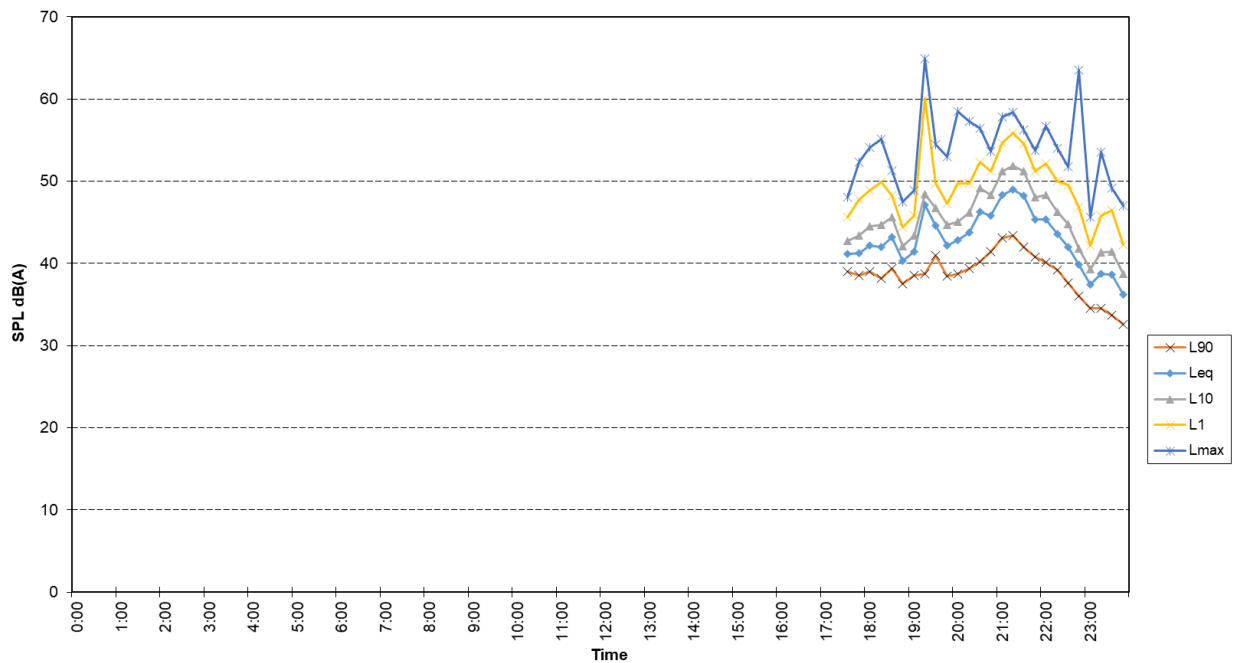


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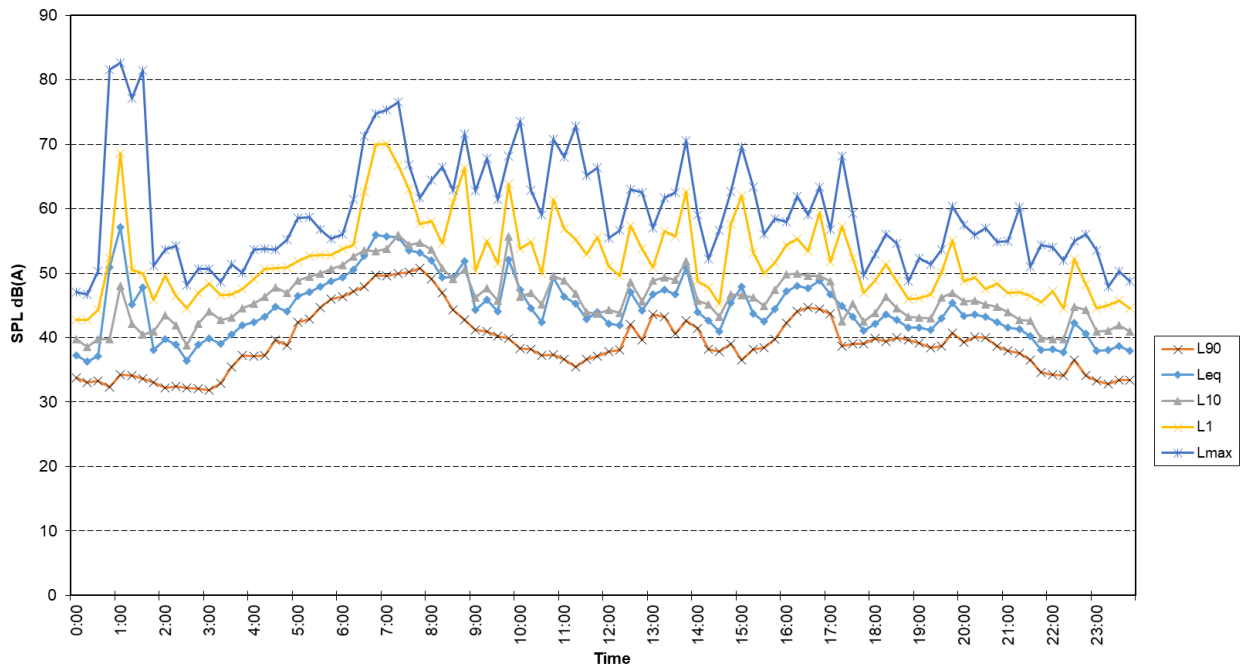


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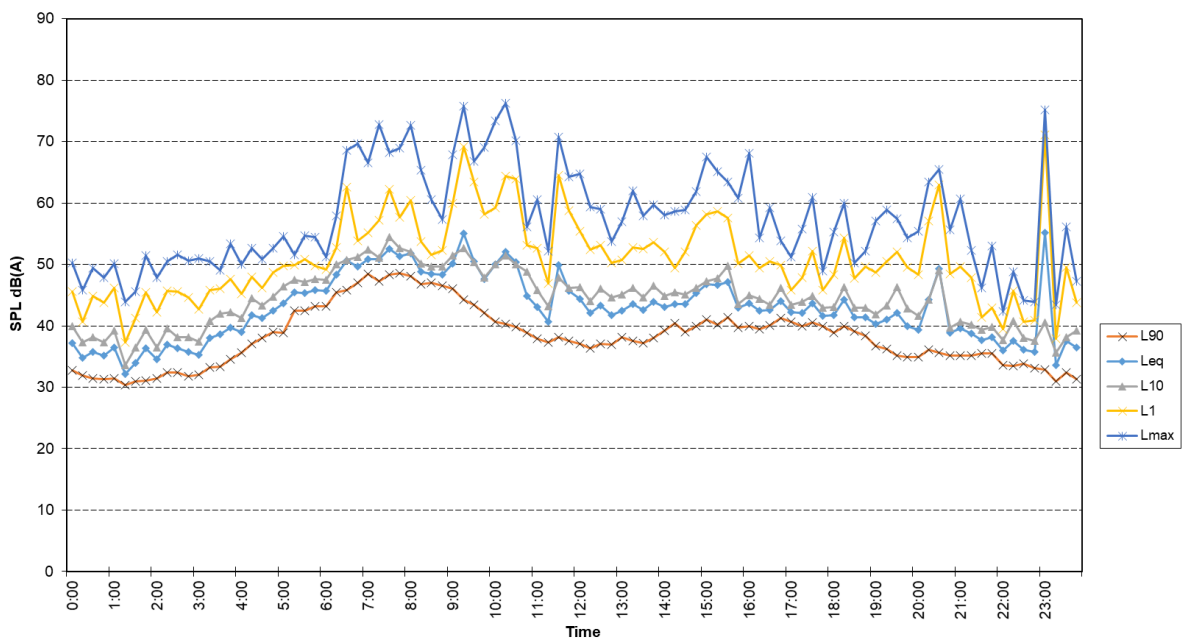
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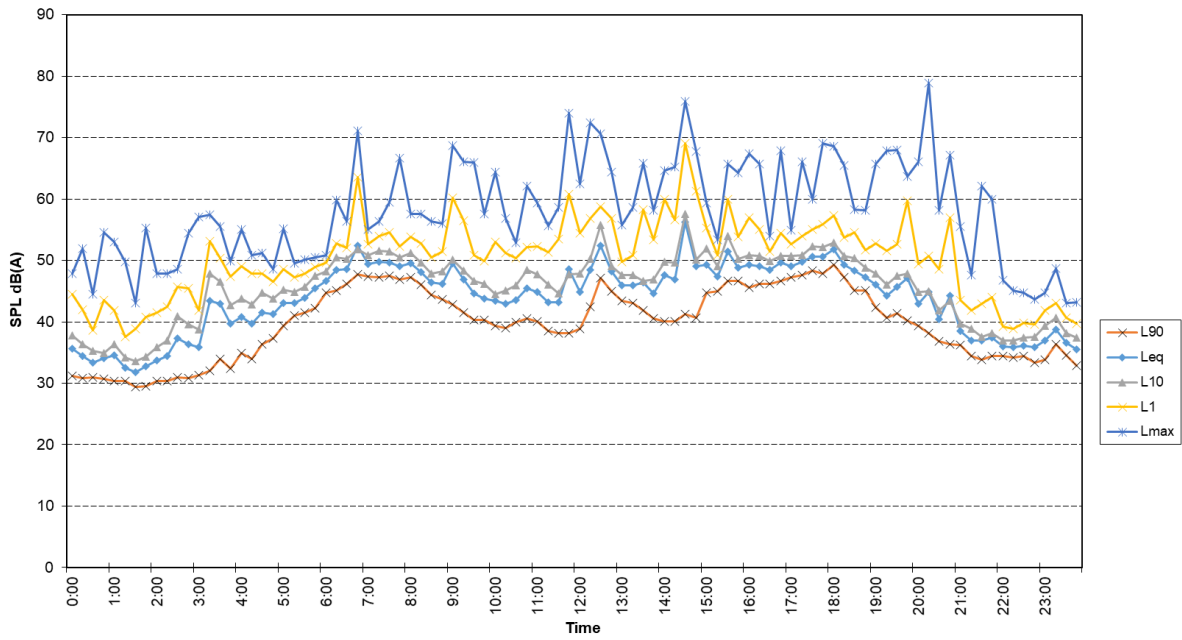
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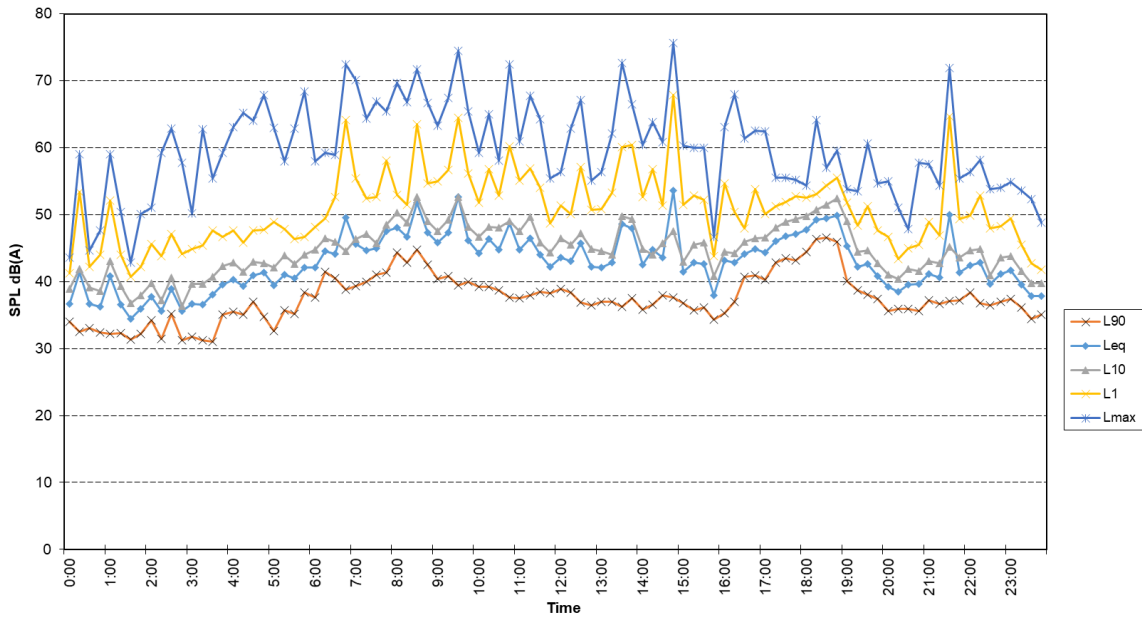
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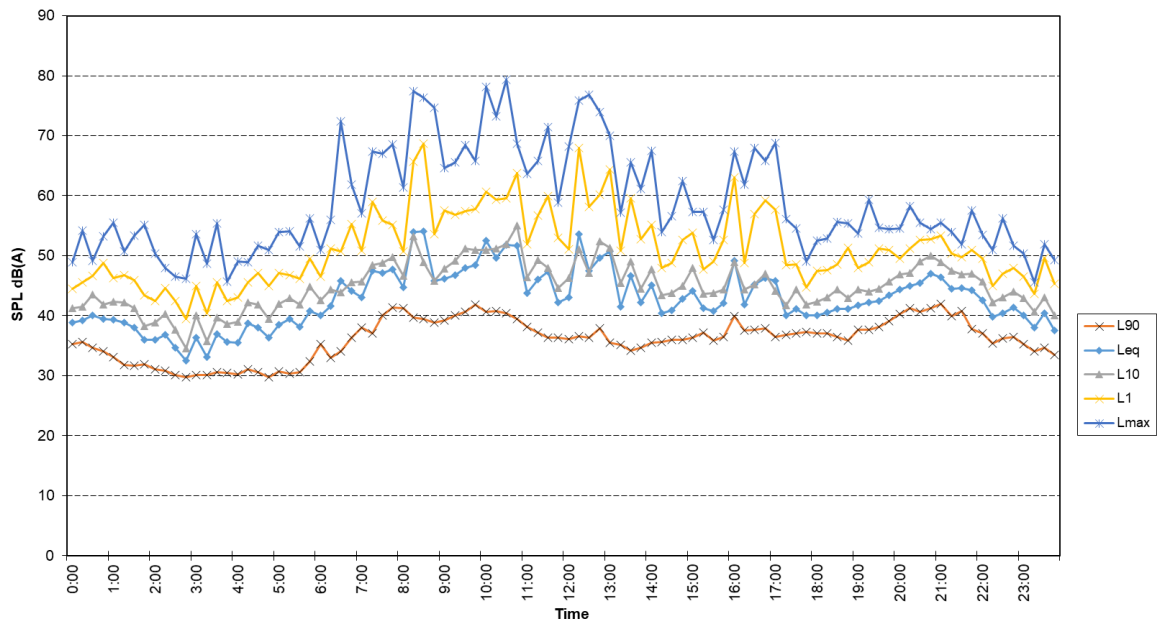
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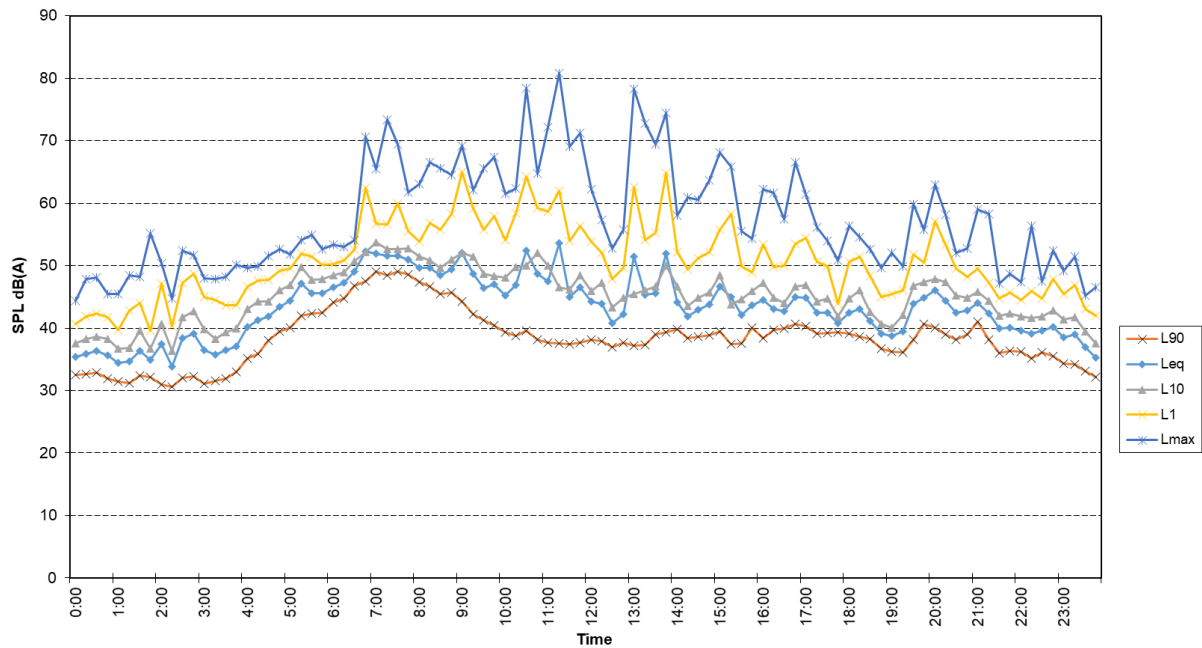
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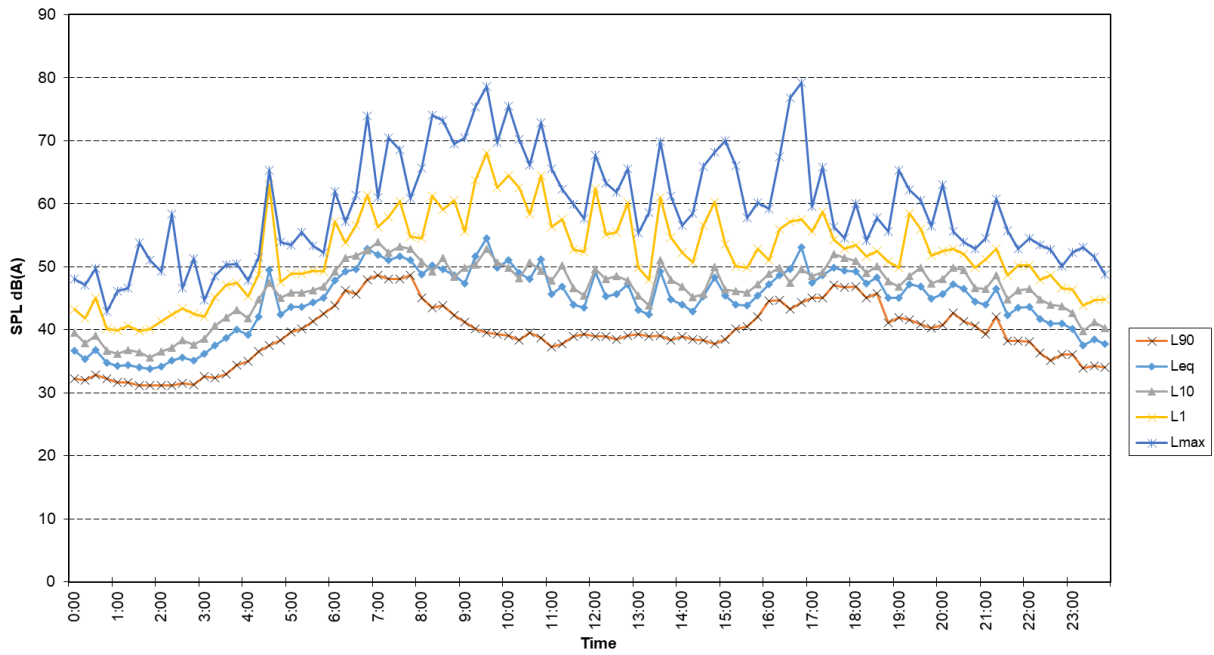
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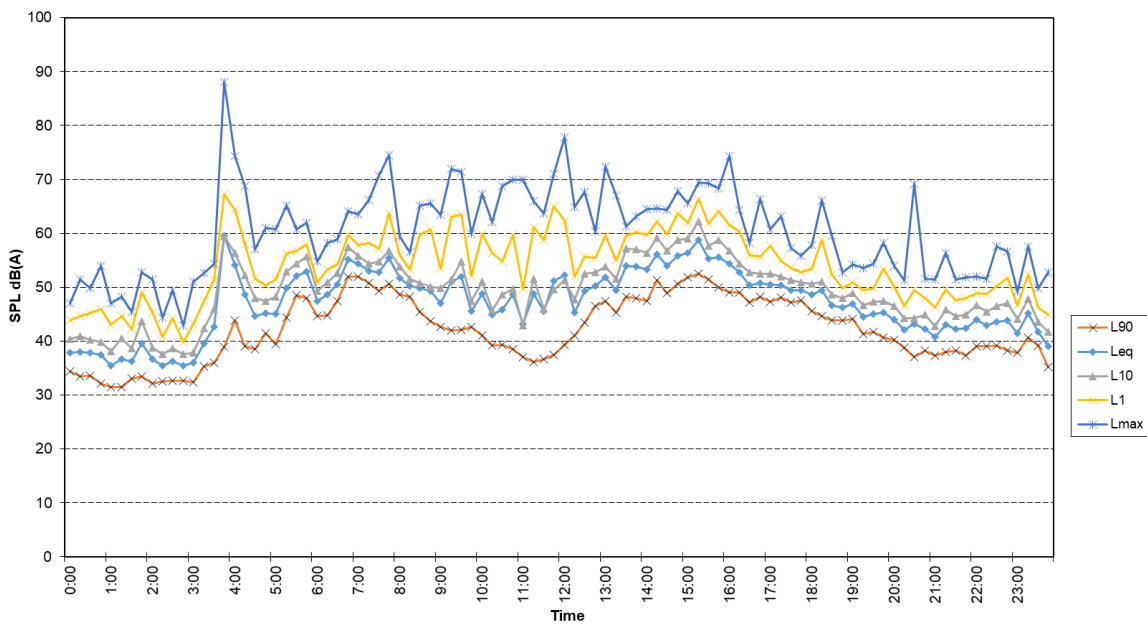
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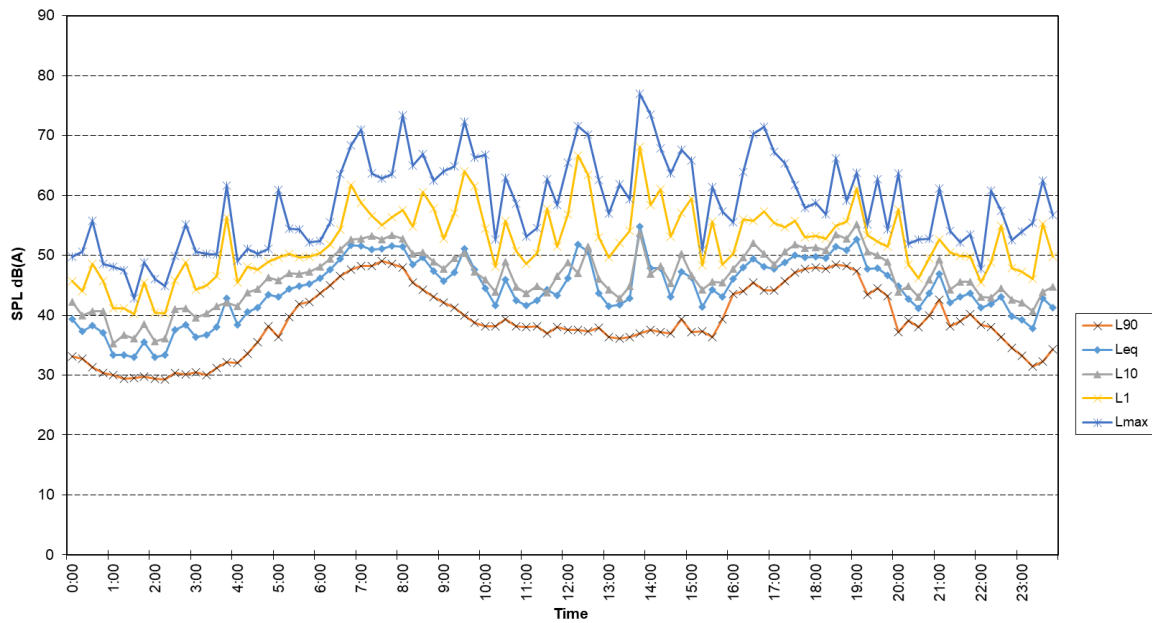
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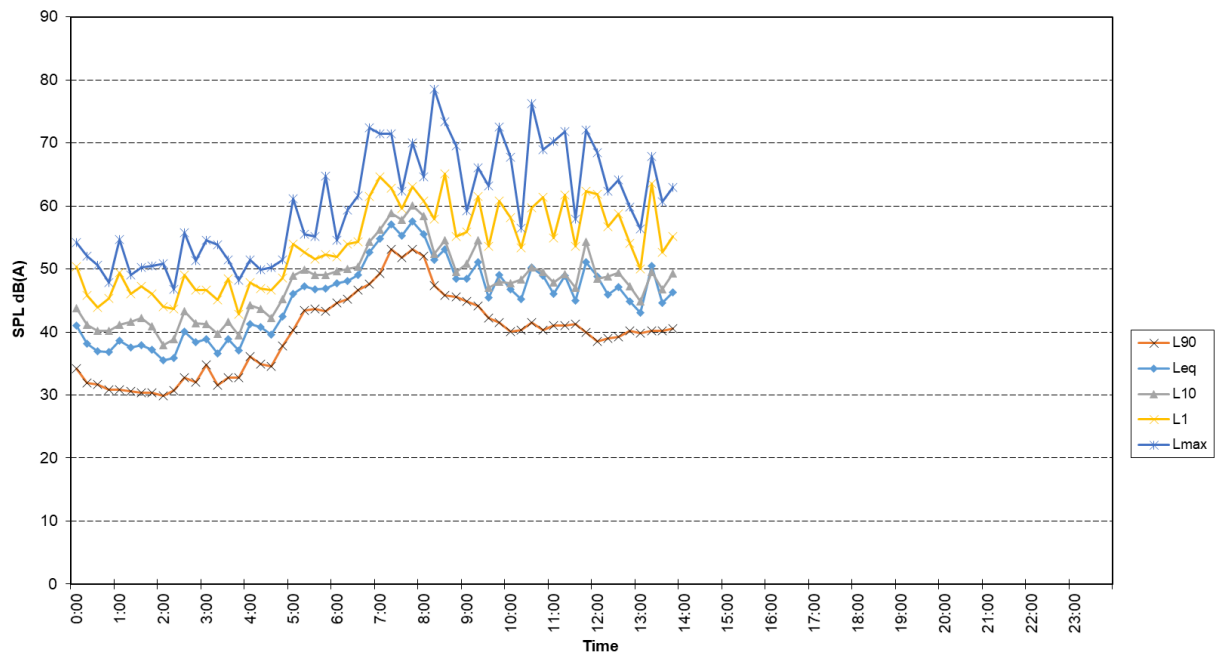
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Location - NM02
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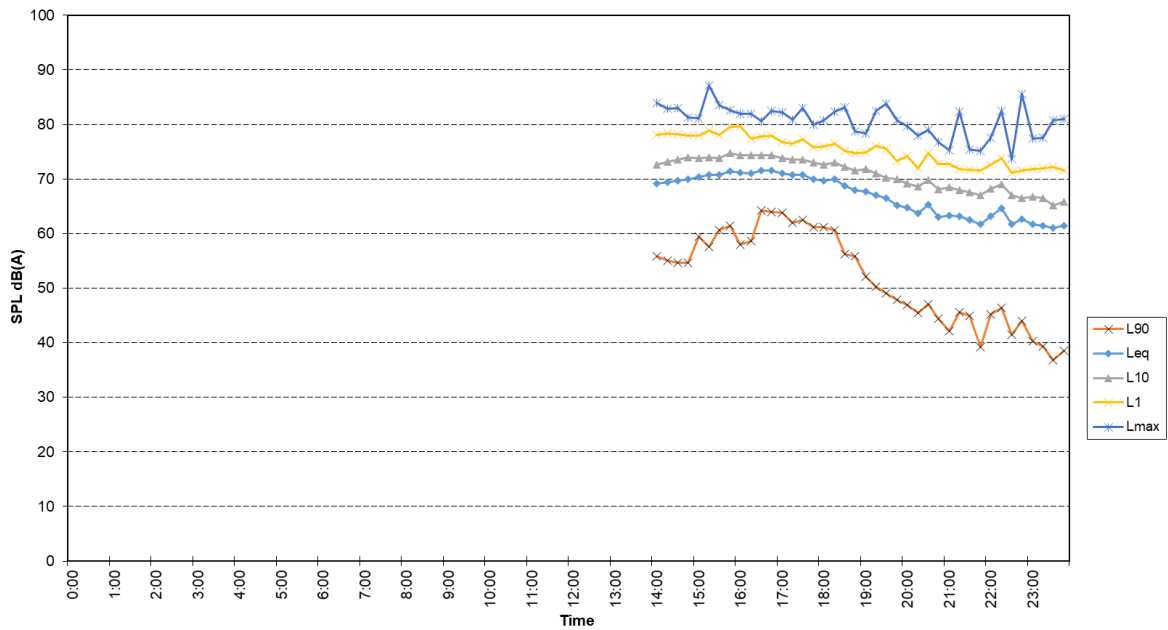


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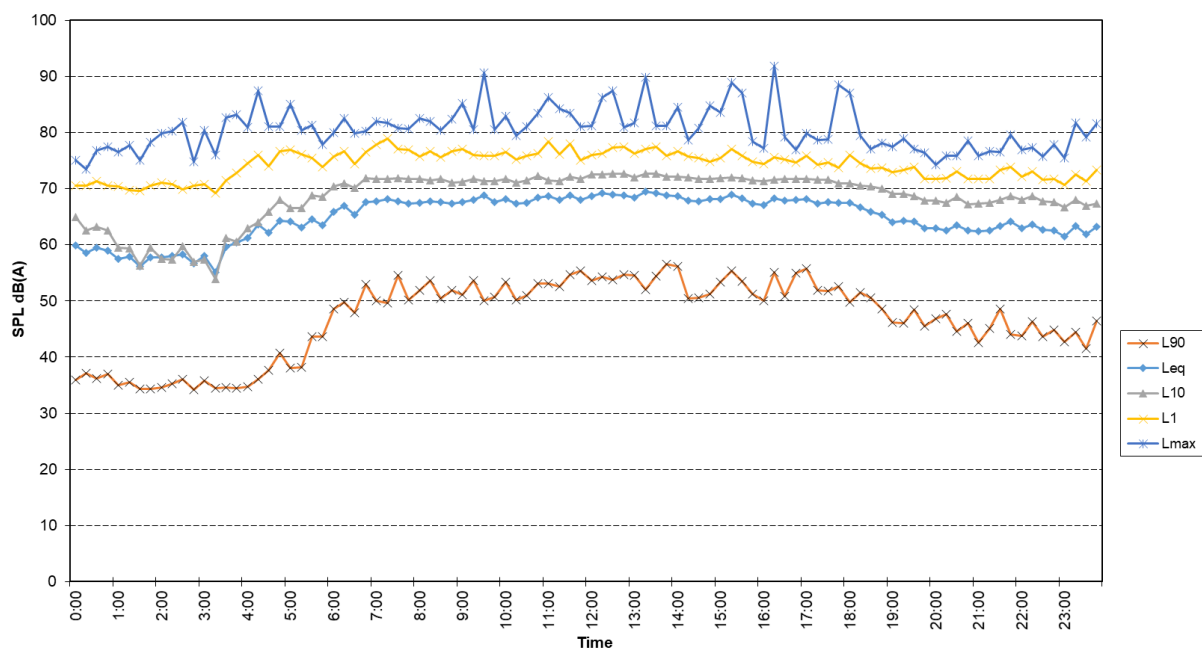


Noise monitoring location 3

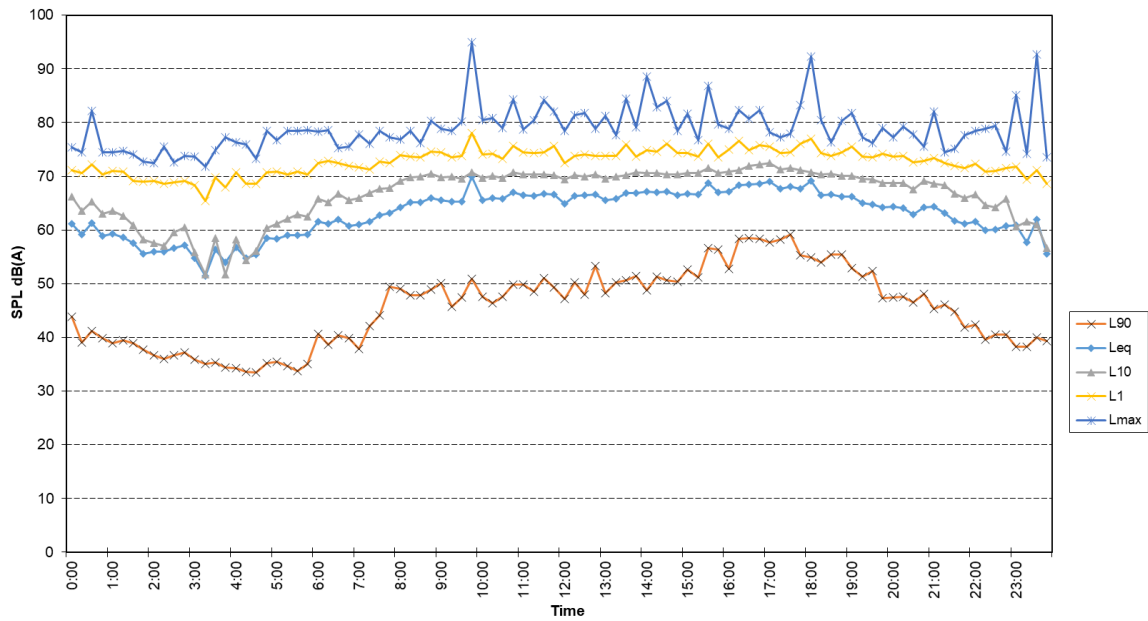
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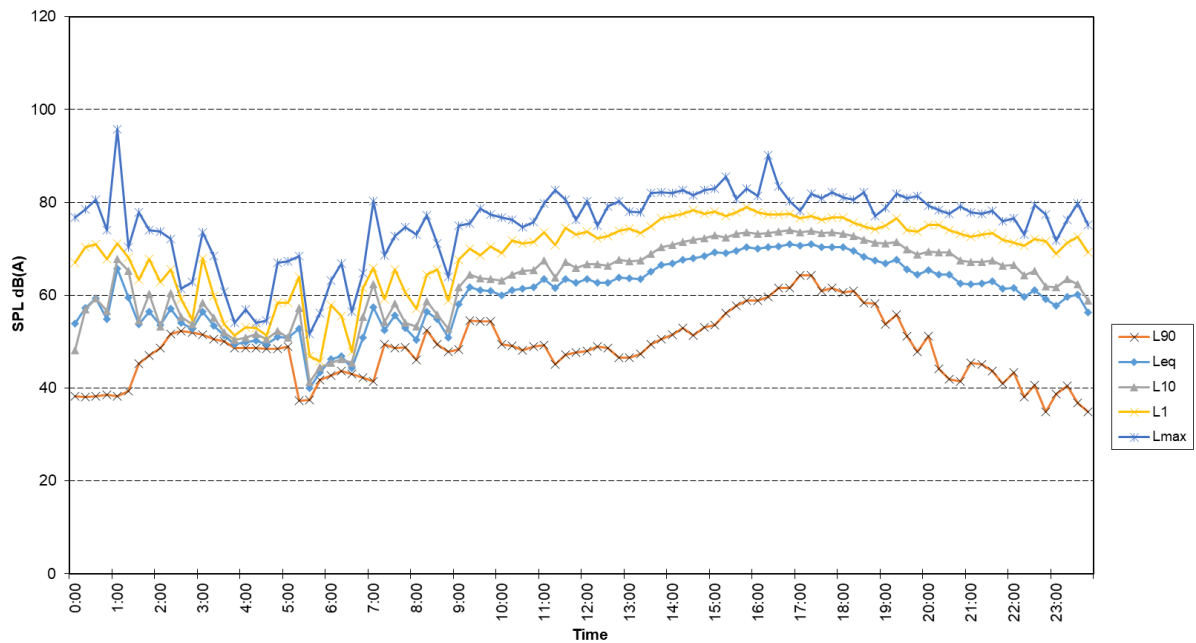
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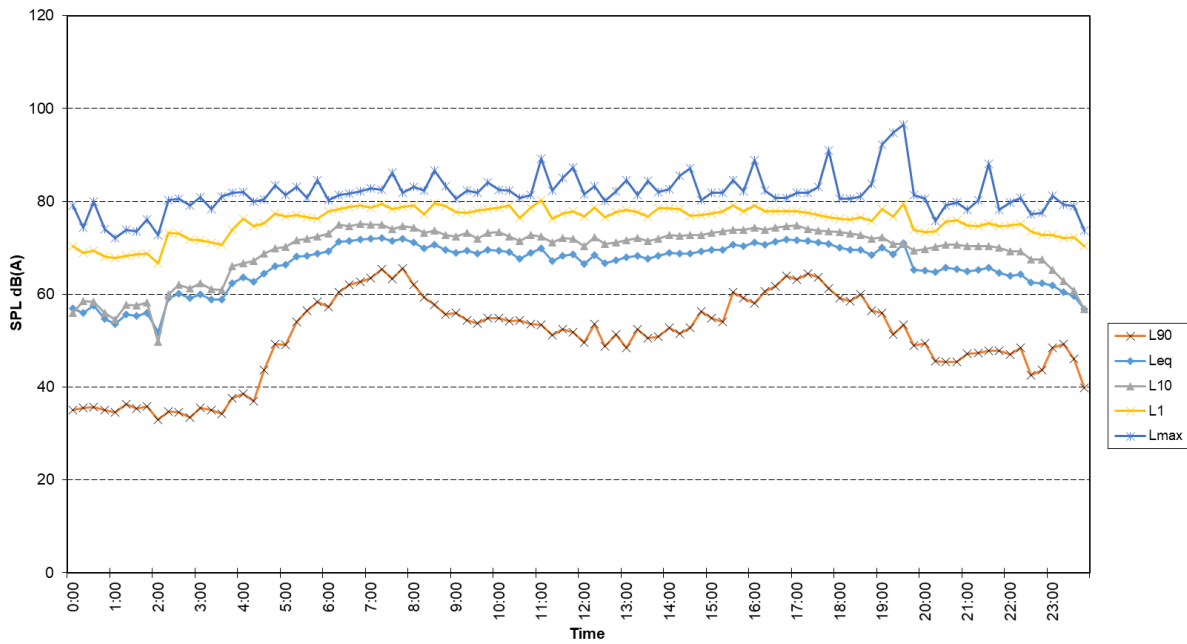
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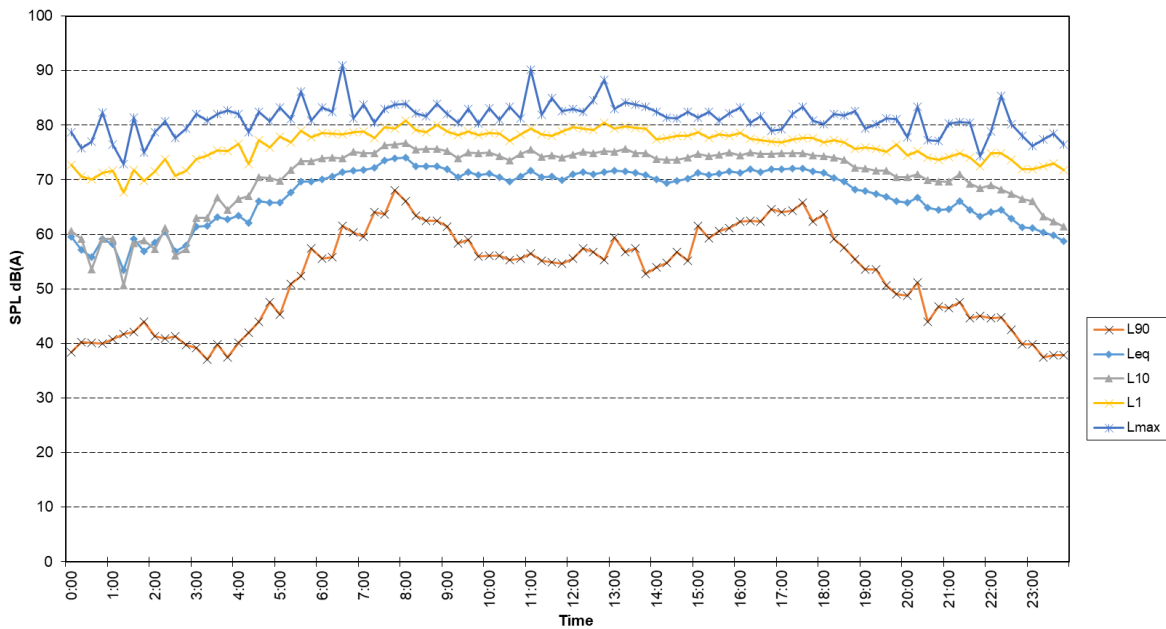
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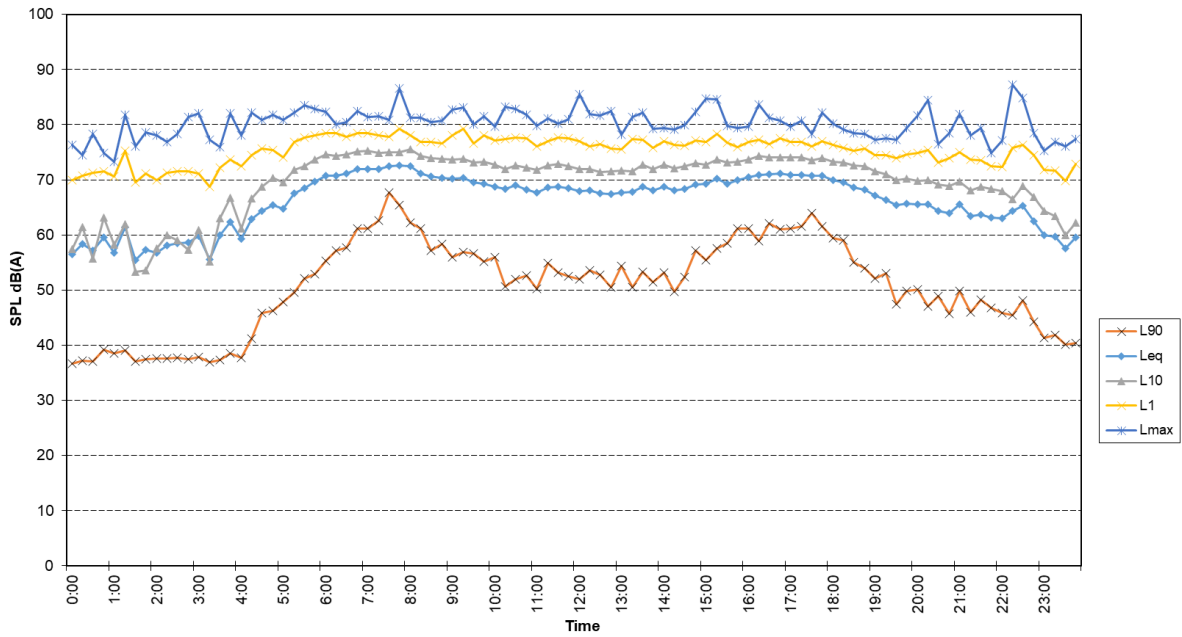
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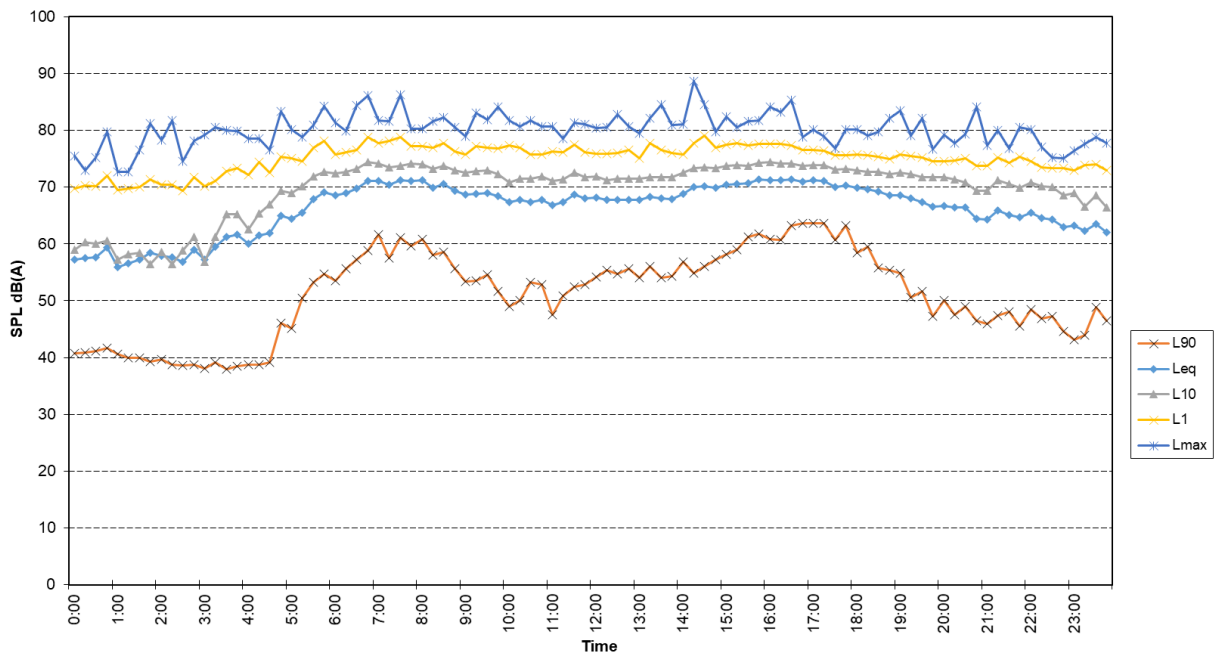
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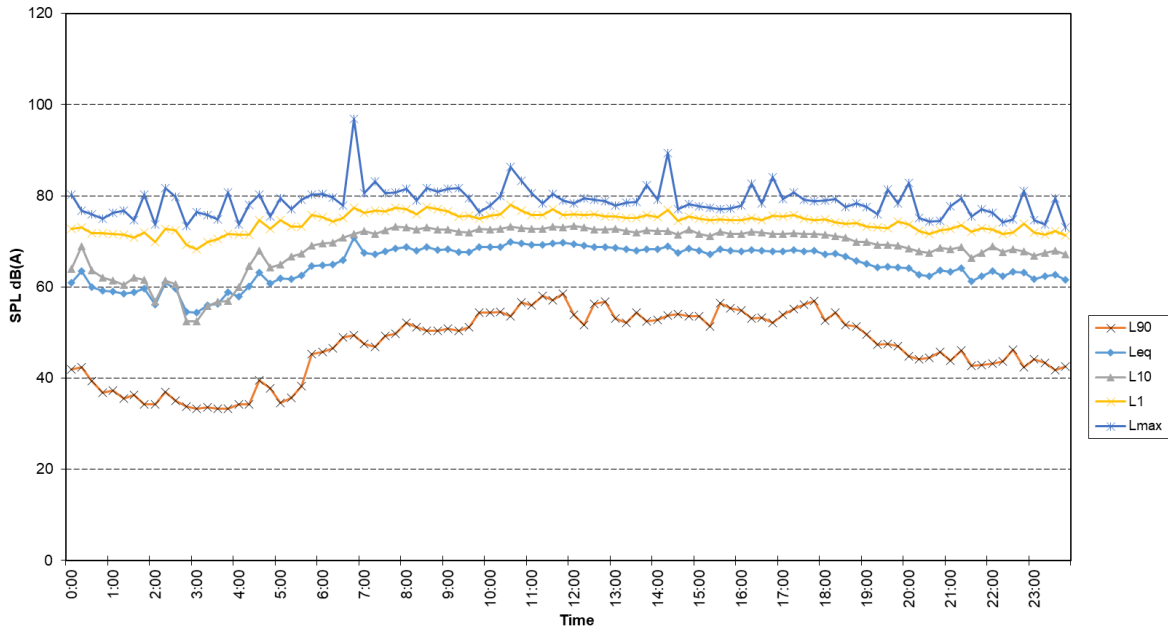
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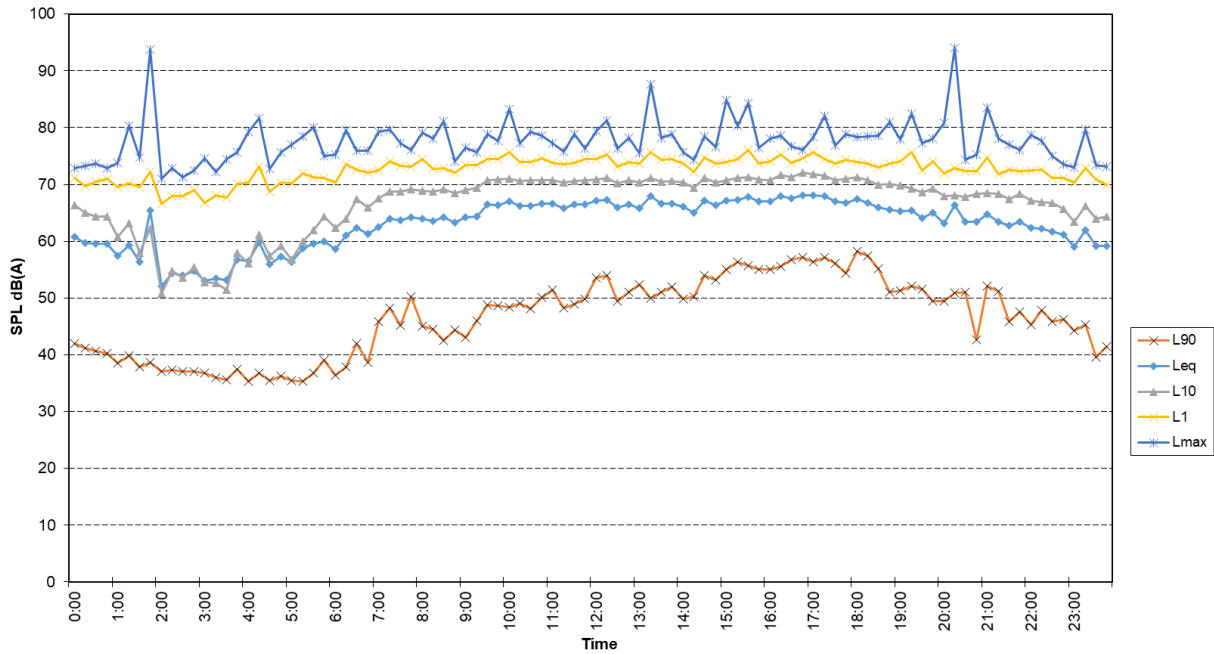
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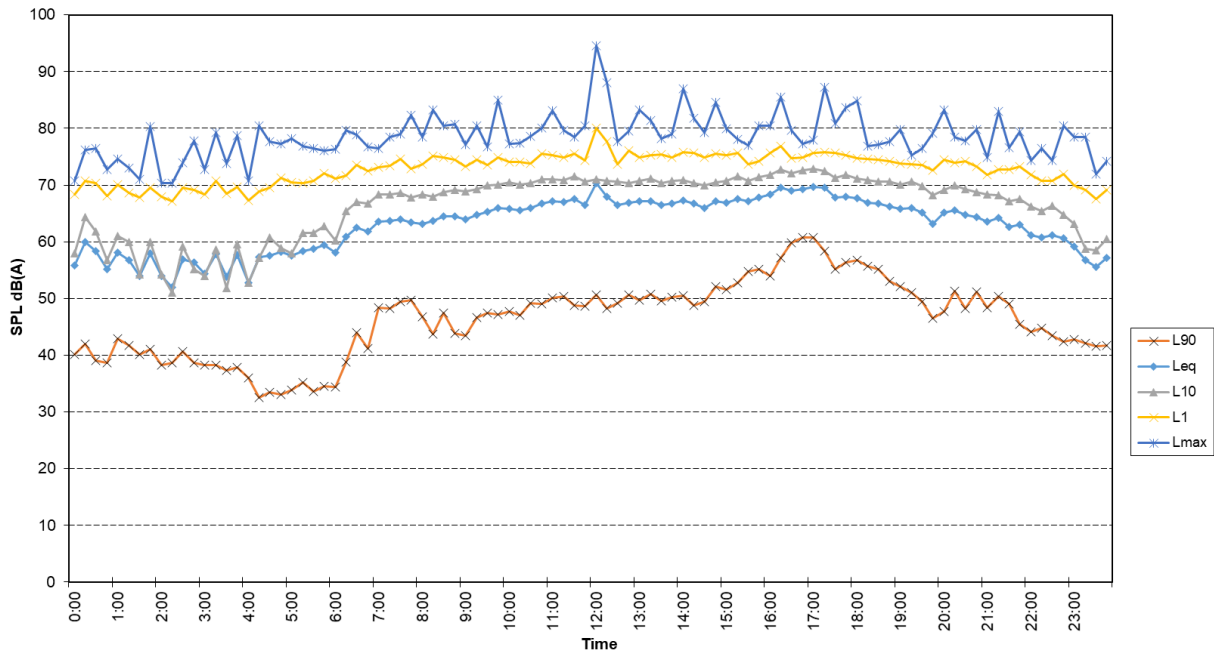
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Measured Noise Levels - Sunday 11/06/2017



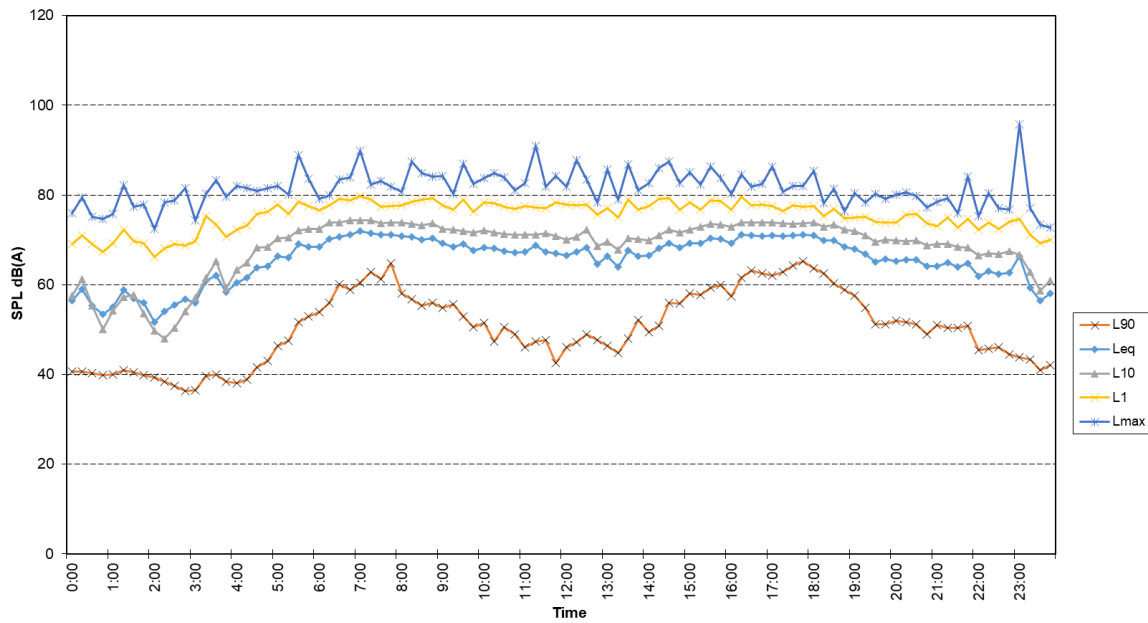
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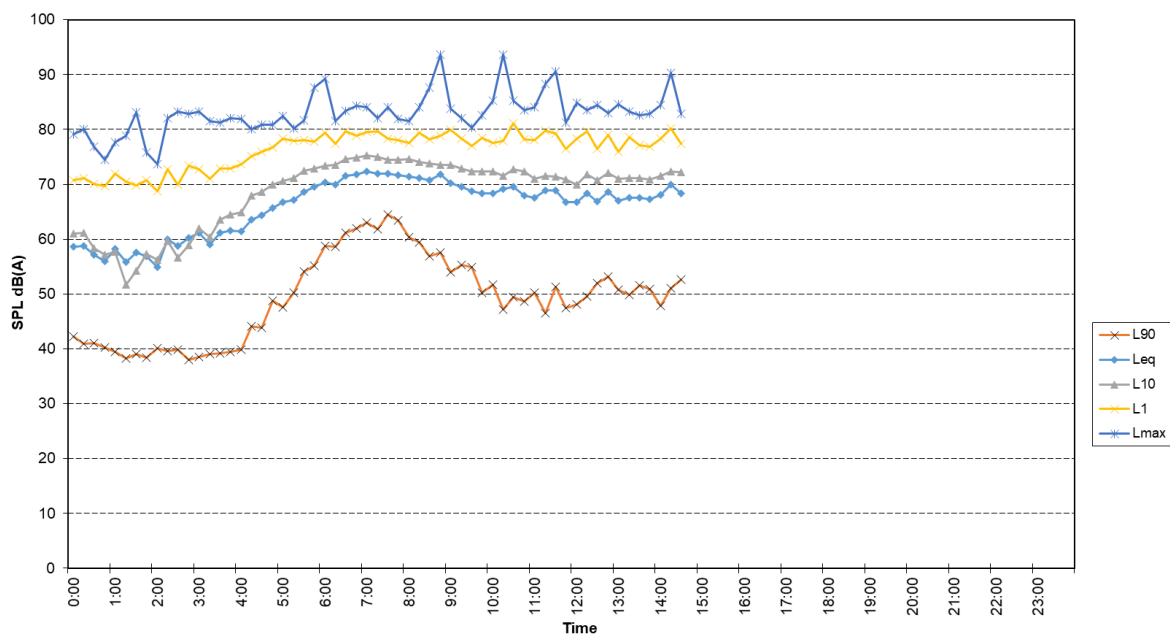
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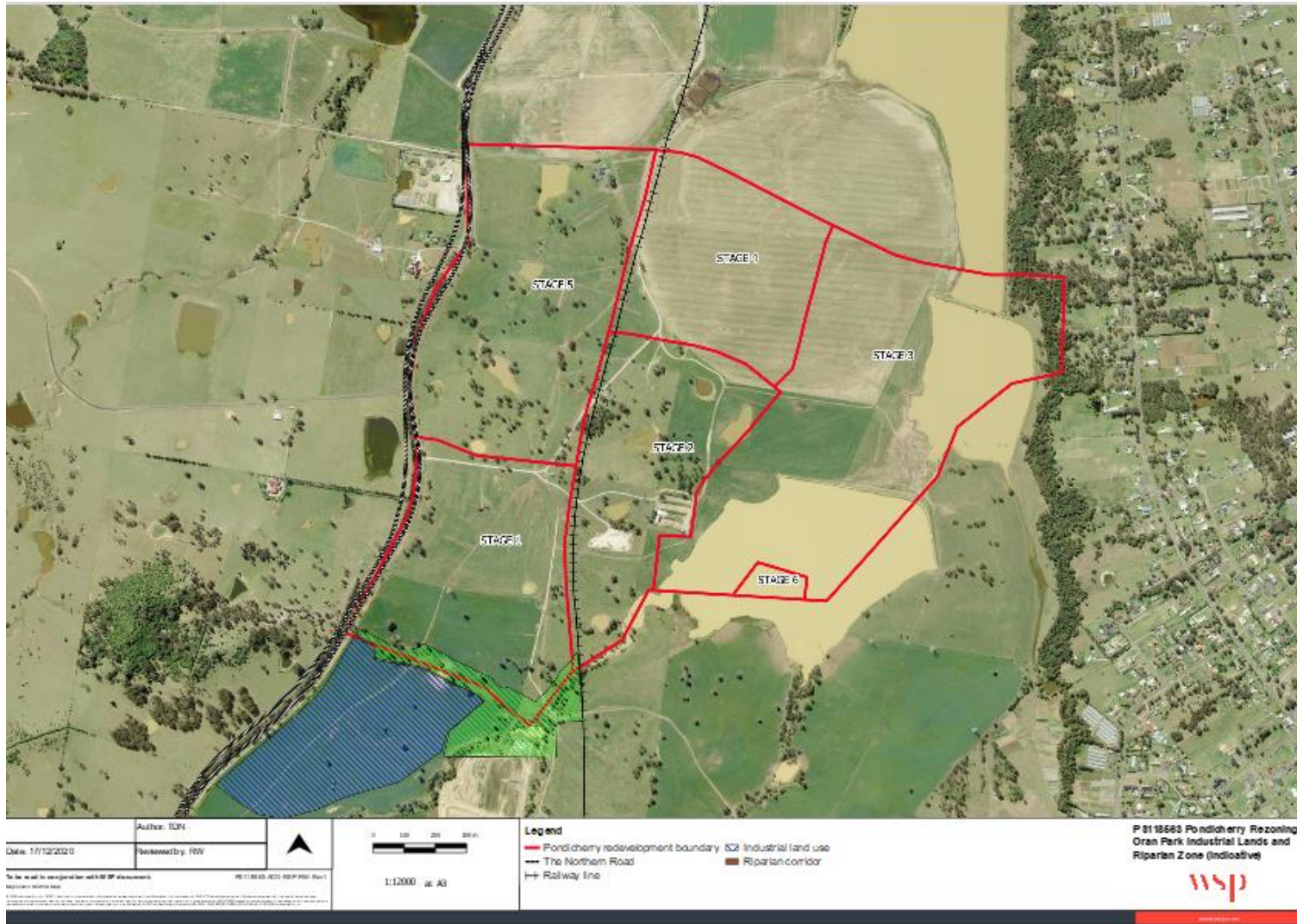


APPENDIX B

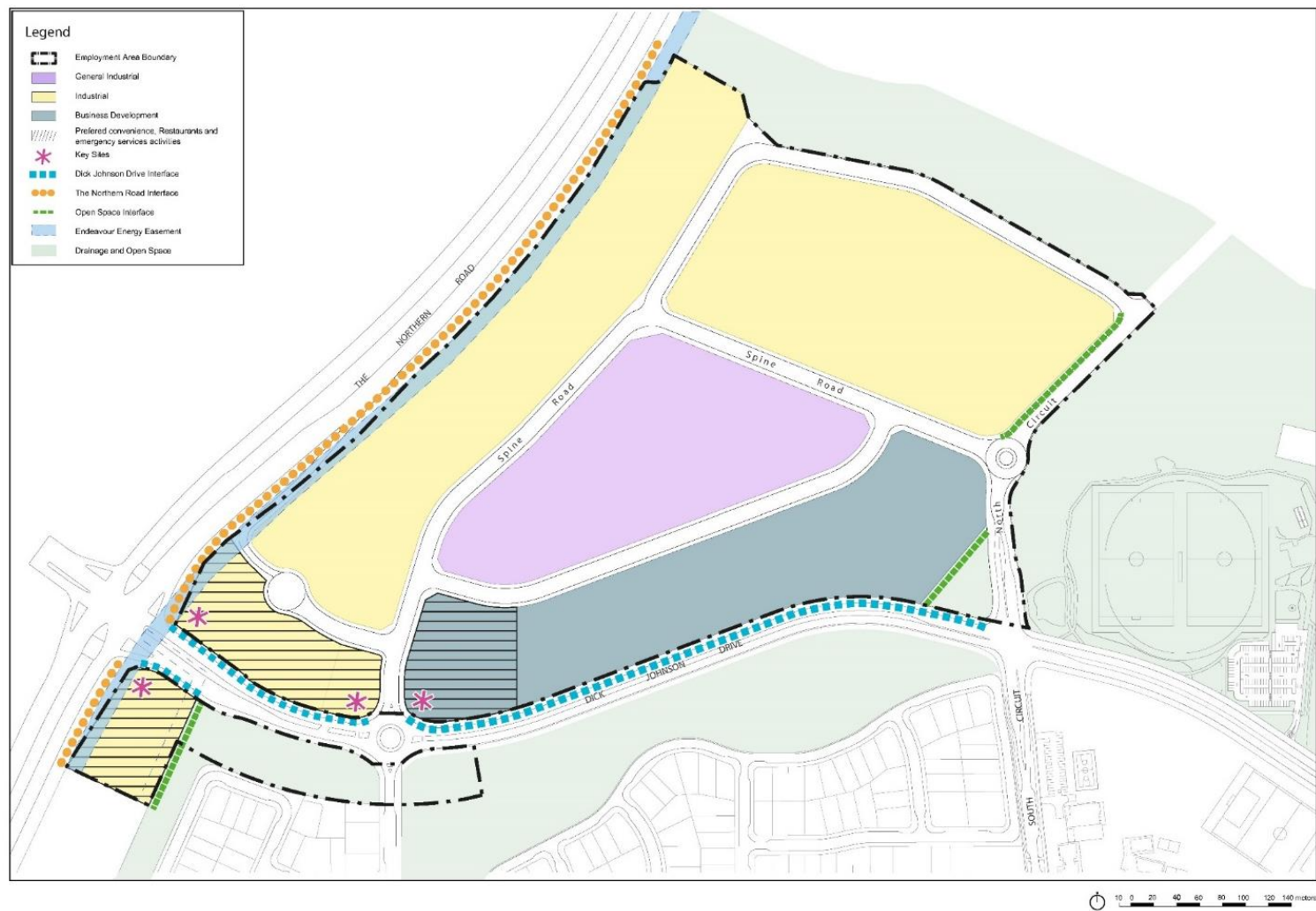
CAMDEN COUNCIL LAND USE ZONING



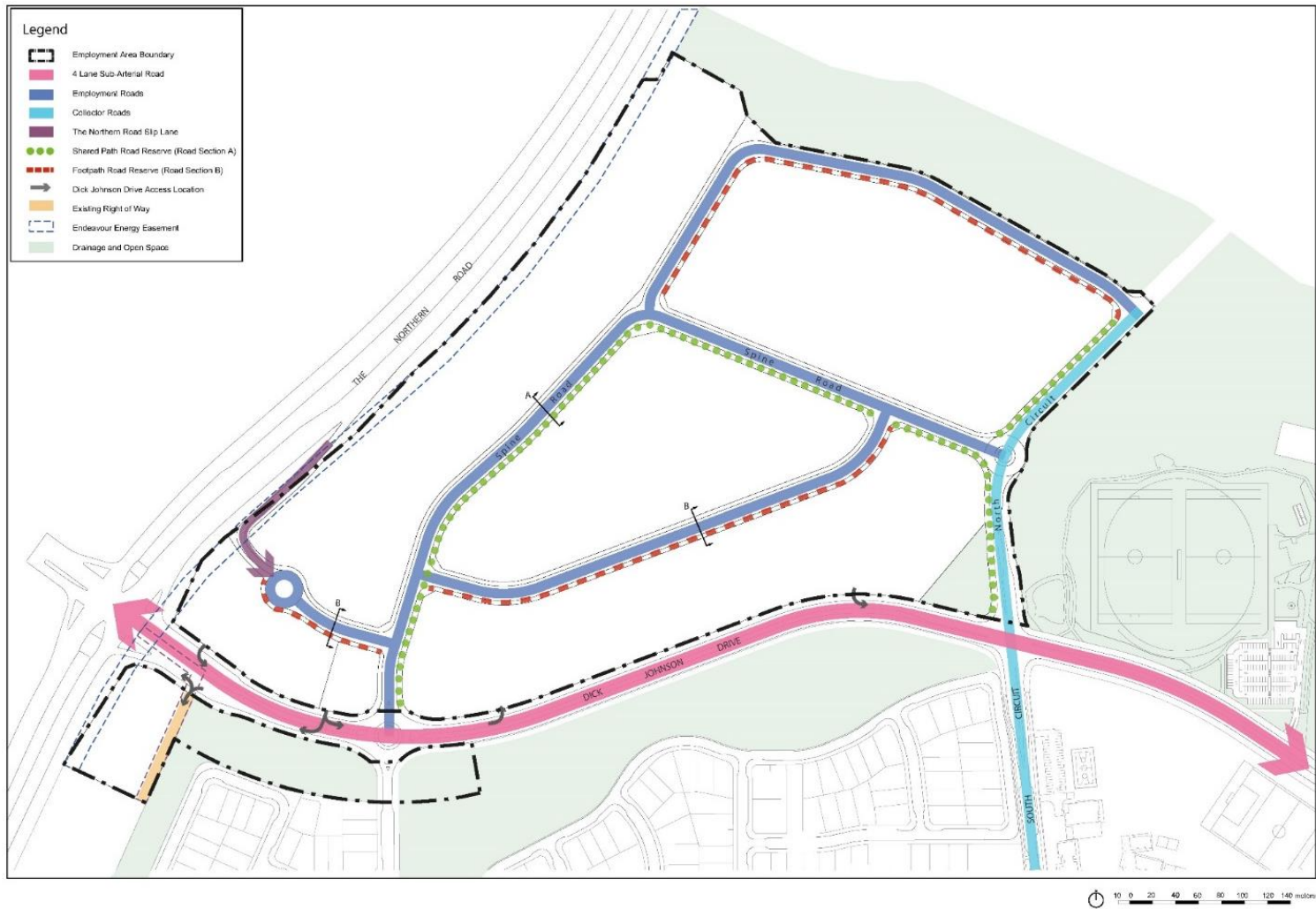
B1 LAND USE ZONING ORAN PARK EMPLOYMENT LANDS



10.1 ORAN PARK EMPLOYMENT LANDS – DRAFT INDUSTRIAL LANDS EXPANSION DCP



Source: Greenfields (2020)



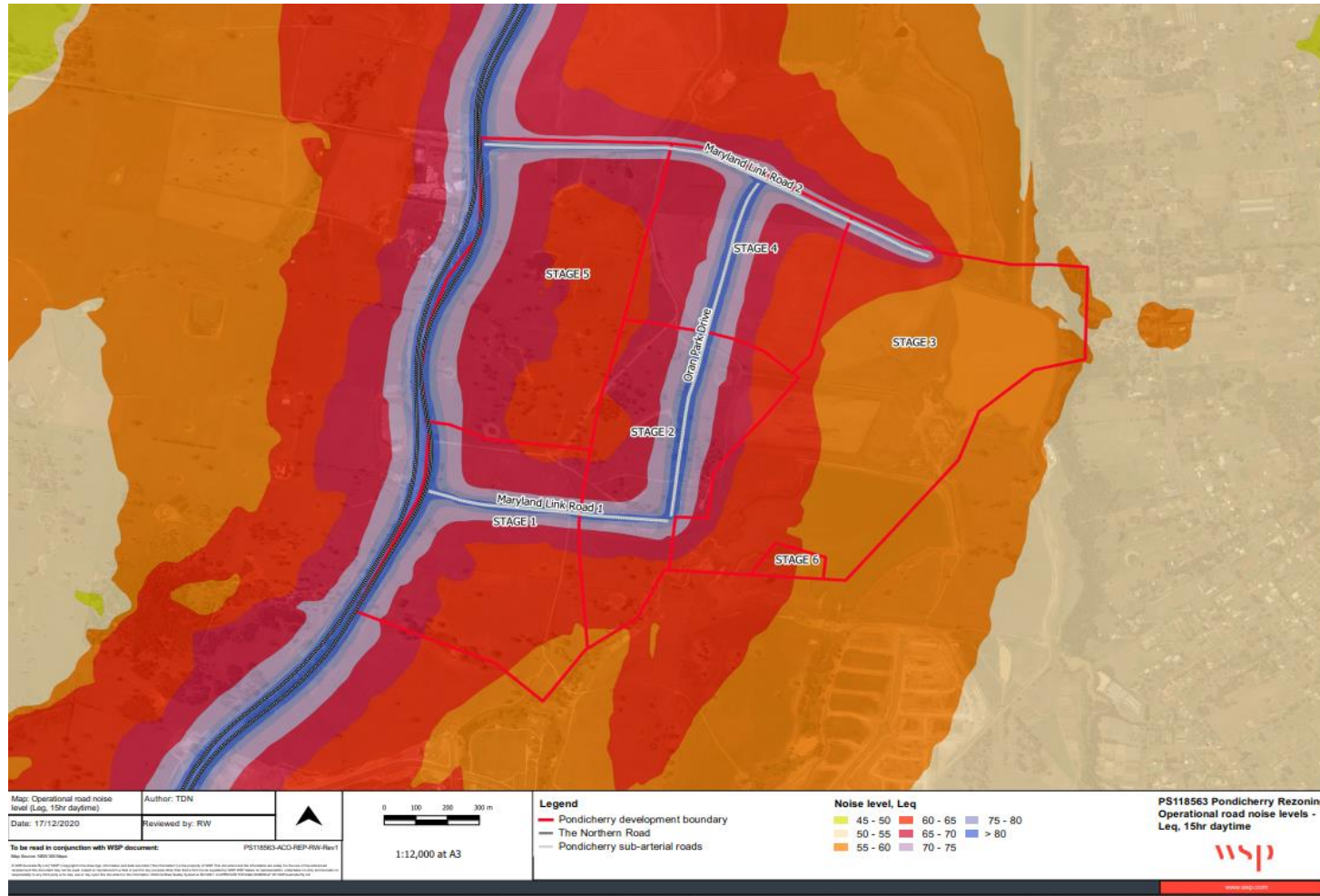
Source: Greenfields (2020)

APPENDIX C

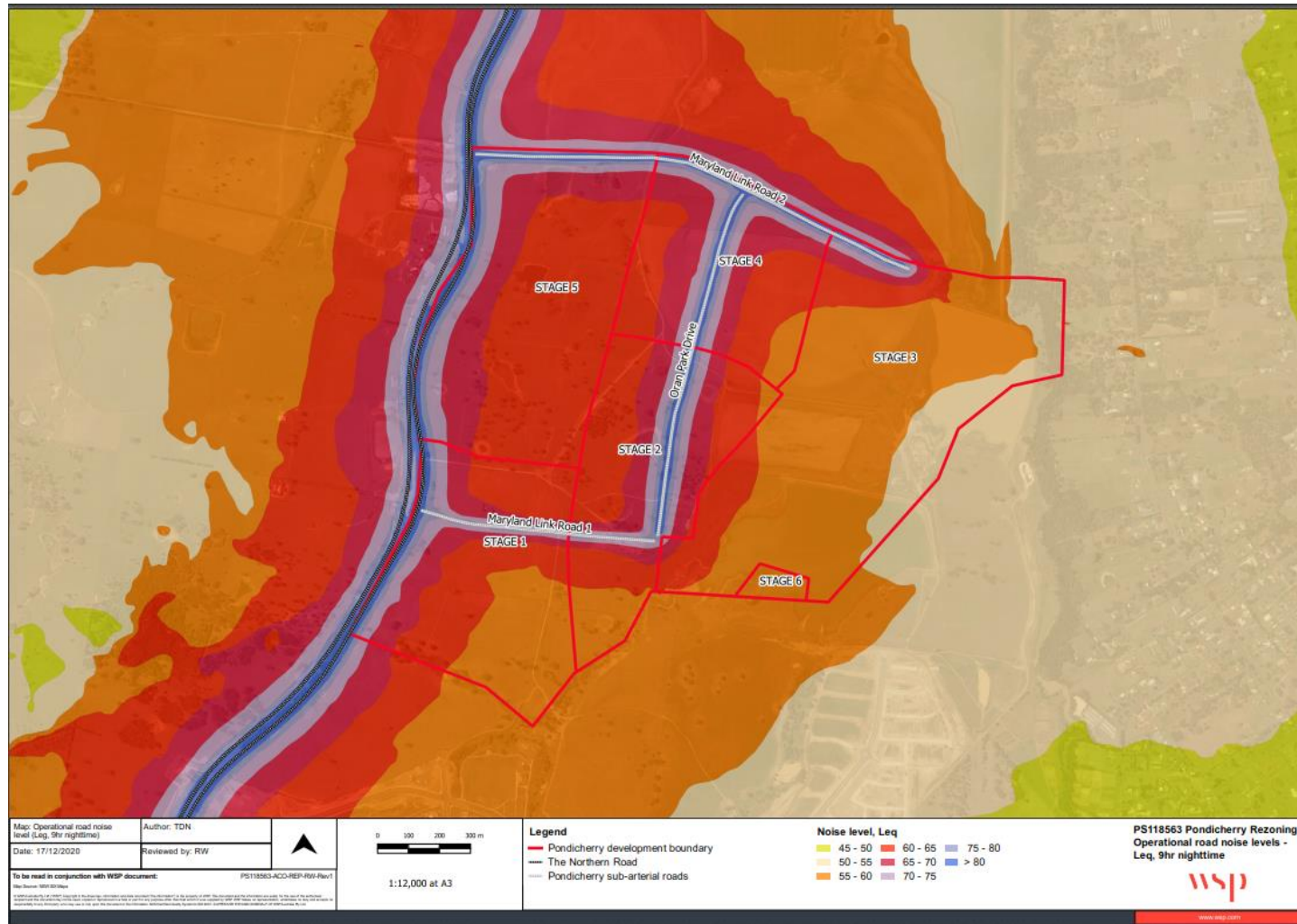
ROAD NOISE CONTOURS



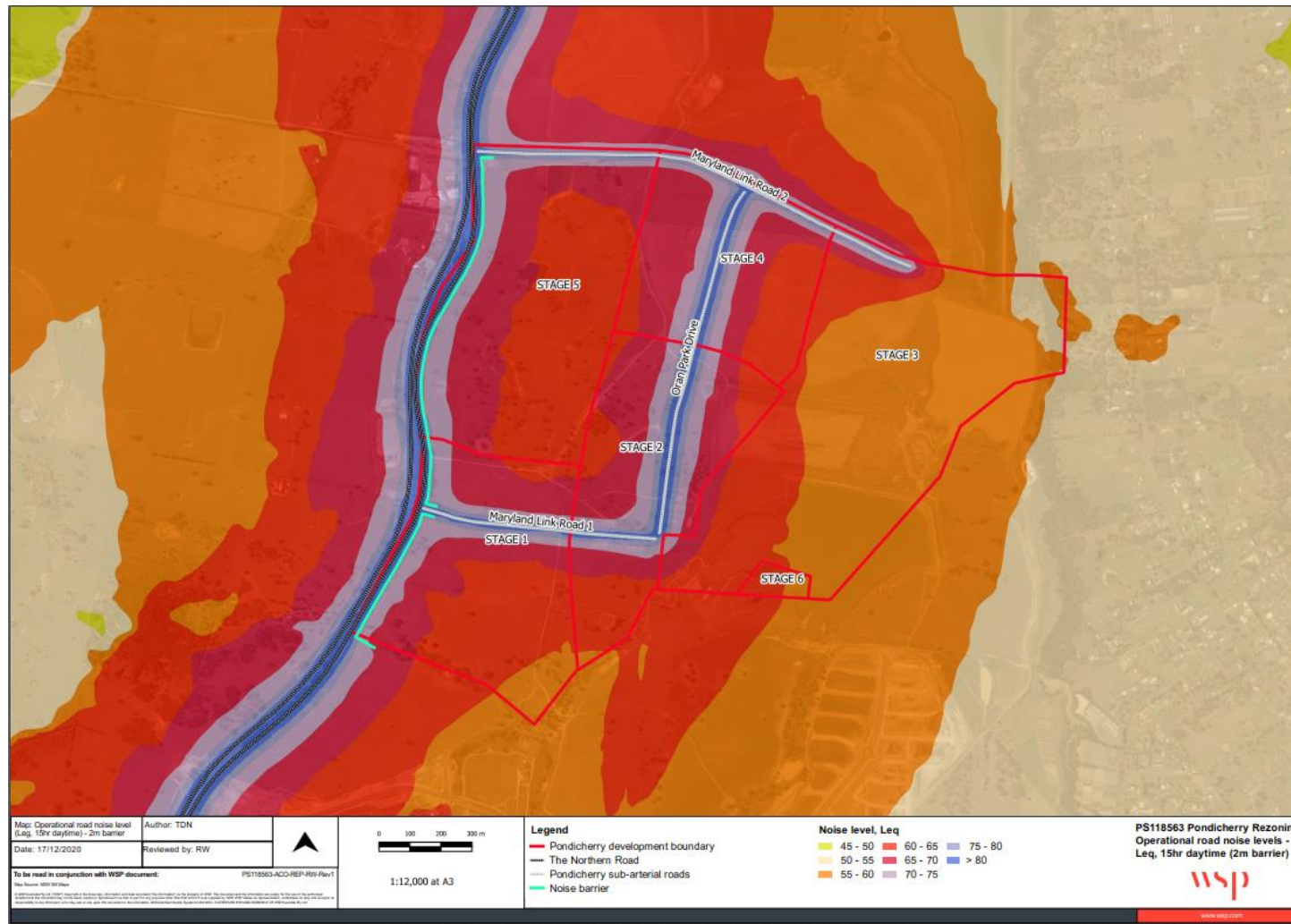
C1 2036 DAY- UNMITIGATED



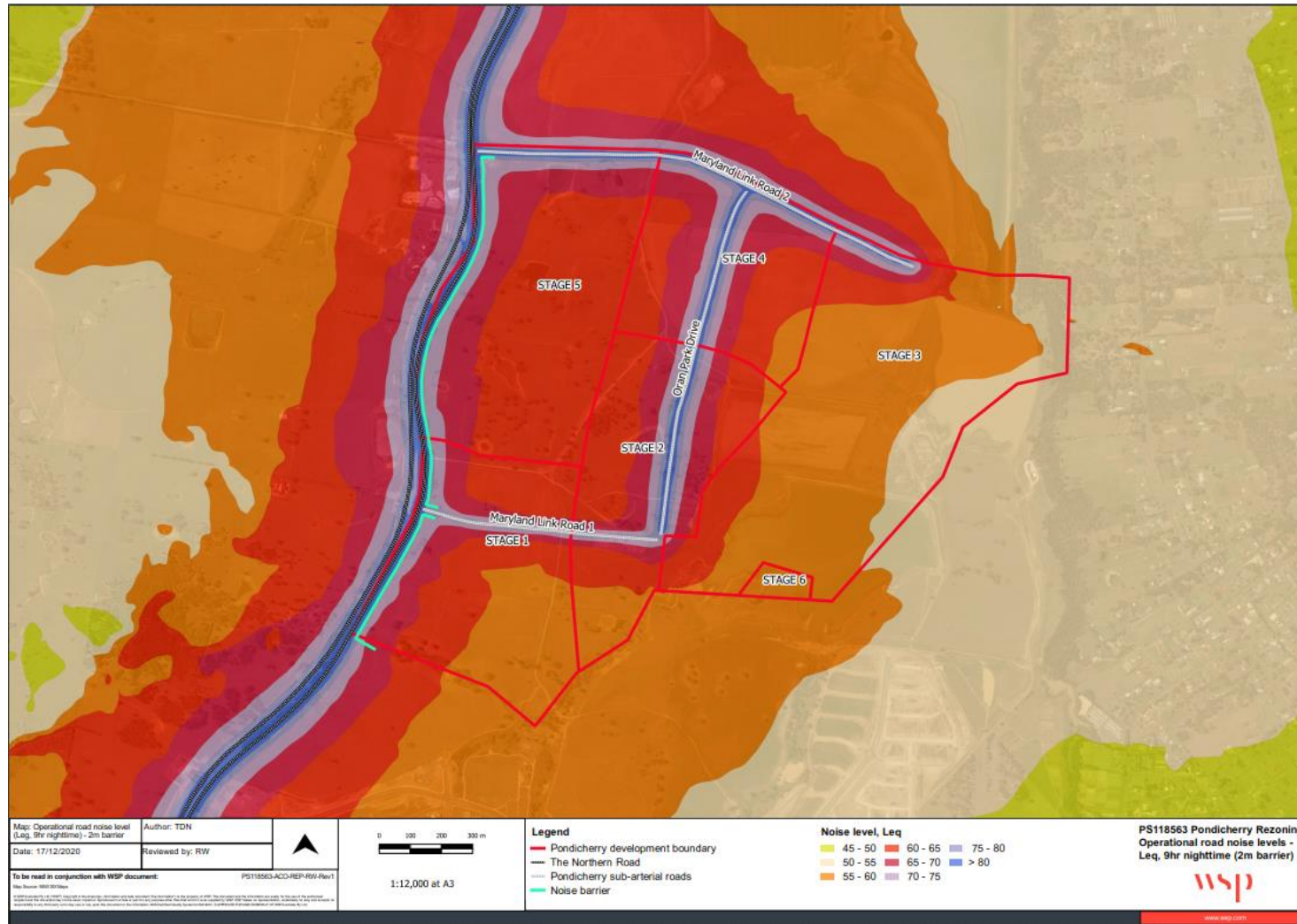
C2 2036 NIGHT- UNMITIGATED



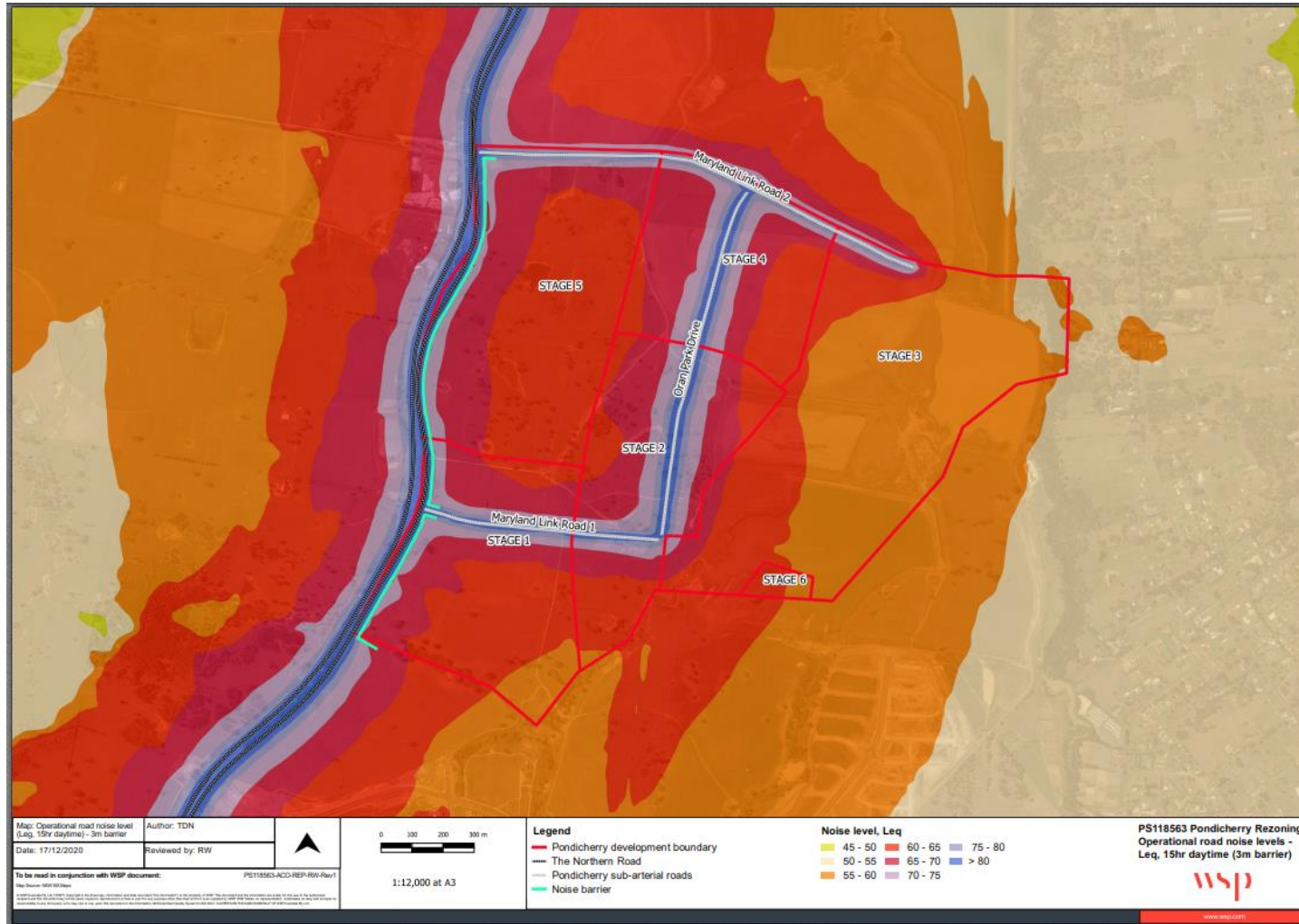
C3 2036 DAY- 2M NOISE BARRIER



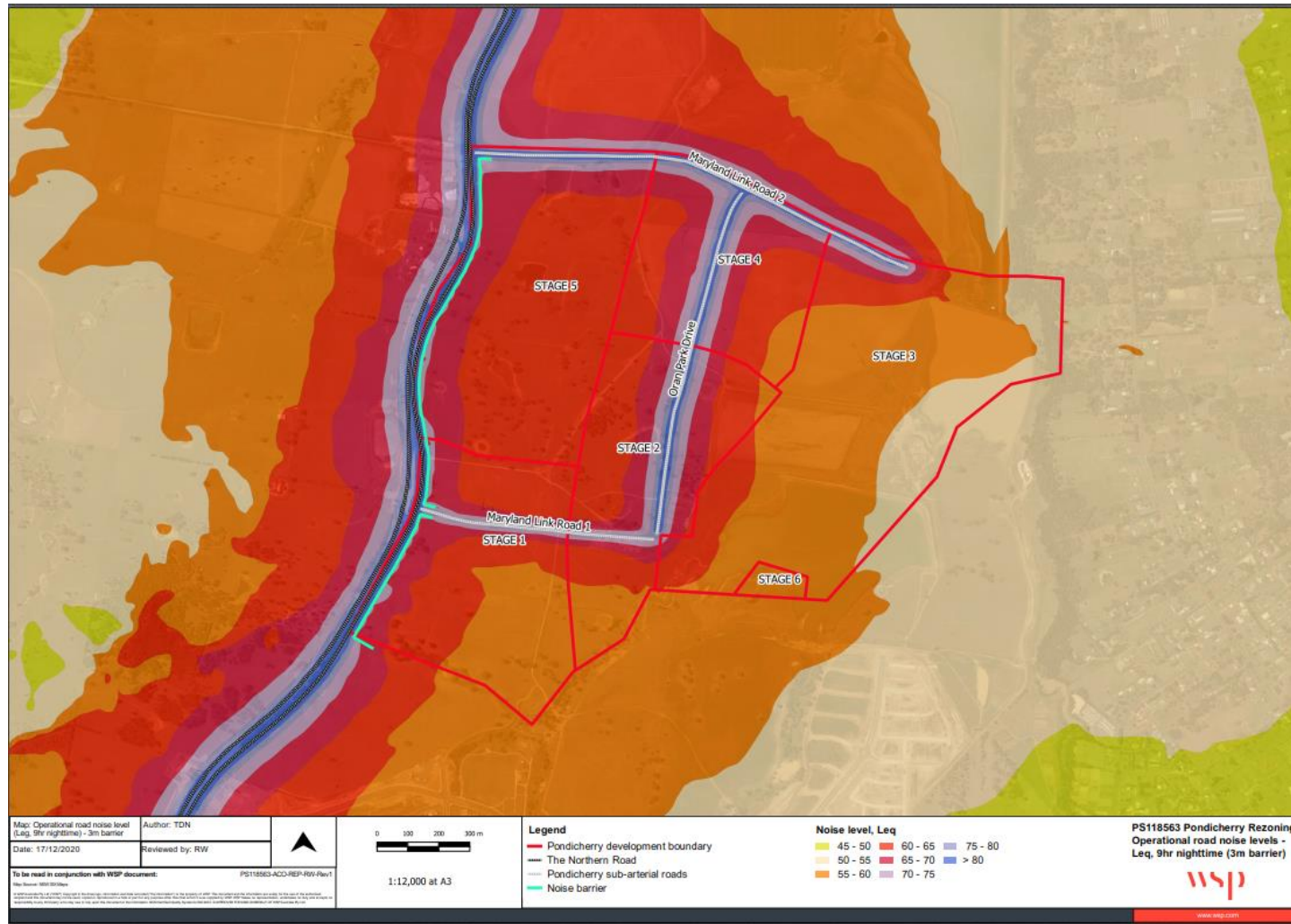
C4 2036 NIGHT- 2M NOISE BARRIER



C5 2036 DAY- 3M NOISE BARRIER



C6 2036 NIGHT- 3M NOISE BARRIER



APPENDIX D

NOISE MITIGATION CATEGORIES







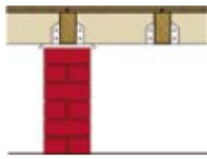









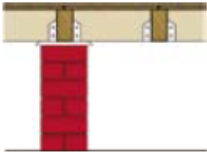

D1 ACOUSTIC TREATMENTS


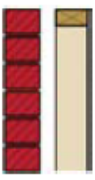


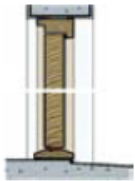

ACOUSTIC PERFORMANCE OF BUILDING ELEMENTS

The acoustic performances assumed of each building element in deriving the Standard Constructions for each category of noise control treatment presented in the preceding Table, are presented below in terms of Weighted Sound Reduction Index (R_w) values, which can be used to find alternatives to the standard constructions presented in this Appendix:

Category of Noise Control Treatment	R _w of Building Elements (minimum assumed)				
	Windows/Sliding Doors	Frontage Facade	Roof	Entry Door	Floor
Category 1	24	38	40	28	29
Category 2	27	45	43	30	29
Category 3	32	52	48	33	50
Category 4	35	55	52	33	50
Category 5	43	55	55	40	50

Category No.	Building Element	Standard Constructions	sample
1	Windows/Sliding Doors	Openable with minimum 4mm monolithic glass and standard weather seals	
	Frontage Facade	Timber Frame or Cladding: 6mm fibre cement sheeting or weatherboards or plank cladding externally, 90mm deep timber stud or 92mm metal stud, 13mm standard plasterboard internally	
		Brick Veneer: 110mm brick, 90mm timber stud or 92mm metal stud, minimum 50mm clearance between masonry and stud frame, 10mm standard plasterboard internally	
		Double Brick Cavity: 2 leaves of 110mm brickwork separated by 50mm gap	
	Roof	Pitched concrete or terracotta tile or metal sheet roof with sarking, 10mm plasterboard ceiling fixed to ceiling joists, R1.5 insulation batts in roof cavity.	
	Entry Door	35mm solid core timber door fitted with full perimeter acoustic seals	
	Floor	1 layer of 19mm structural floor boards, timber joist on piers	
		Concrete slab floor on ground	

Category No.	Building Element	Standard Constructions	sample
2	Windows/Sliding Doors	Openable with minimum 6mm monolithic glass and full perimeter acoustic seals	
	Frontage Facade	Timber Frame or Cladding Construction: 6mm fibre cement sheeting or weatherboards or plank cladding externally, 90mm deep timber stud or 92mm metal stud, 13mm standard plasterboard internally with R2 insulation in wall cavity.	
		Brick Veneer Construction: 110mm brick, 90mm timber stud frame or 92mm metal stud, minimum 50mm clearance between masonry and stud frame, 10mm standard plasterboard internally.	
		Double Brick Cavity Construction: 2 leaves of 110mm brickwork separated by 50mm gap	
	Roof	Pitched concrete or terracotta tile or metal sheet roof with sarking, 10mm plasterboard ceiling fixed to ceiling joists, R2 insulation batts in roof cavity.	
	Entry Door	40mm solid core timber door fitted with full perimeter acoustic seals	
	Floor	1 layer of 19mm structural floor boards, timber joist on piers	
		Concrete slab floor on ground	

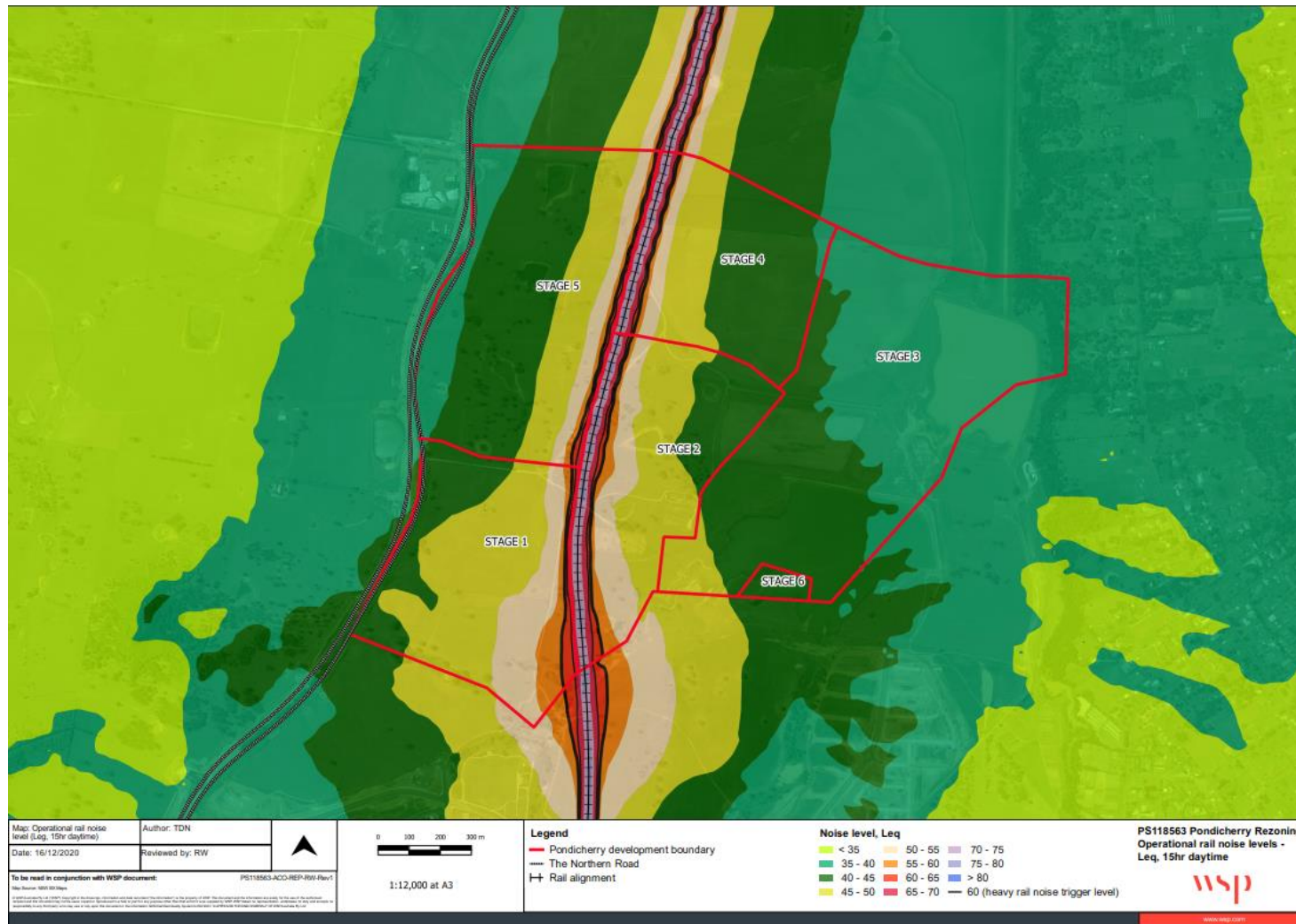
Category No.	Building Element	Standard Constructions	sample
3	Windows/Sliding Doors	Openable with minimum 6.38mm laminated glass and full perimeter acoustic seals	
	Frontage Facade	Brick Veneer Construction: 110mm brick, 90mm timber stud or 92mm metal stud, minimum 50mm clearance between masonry and stud frame, 10mm standard plasterboard internally.	
		Double Brick Cavity Construction: 2 leaves of 110mm brickwork separated by 50mm gap	
	Roof	Pitched concrete or terracotta tile or sheet metal roof with sarking, 1 layer of 13mm sound-rated plasterboard fixed to ceiling joists, R2 insulation batts in roof cavity.	
	Entry Door	45mm solid core timber door fitted with full perimeter acoustic seals	
	Floor	Concrete slab floor on ground	

APPENDIX E

RAIL NOISE CONTOURS



E1 RAIL NOISE CONTOUR – DAY 2036



E2 RAIL NOISE CONTOUR – NIGHT 2036

