Tallawarra Lands Concept Plan
Approval Modification

APPENDIX F

NOISE ASSESSMENT

Cardno
Shaping the Future

Report

Land use planning study – Tallawarra Lands

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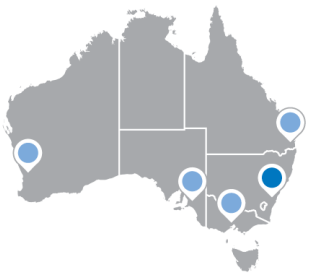

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Table of contents

List of Figures

List of Tables

1 Introduction

Assessment of noise issues has been undertaken to limit potential land use conflicts.

This land use planning study ('the study') has been prepared to assess potential noise issues from proposed changes to the Tallawarra Lands development. The potential for future land use conflicts in the areas labelled the Northshore precinct, and Central precinct has been considered. No comment on the Southern precinct has been provided as part of this report.

The Tallawarra Concept Plan (MP 09_0131 Mod 1) was granted by the Planning and Assessment Commission of NSW on 23 May 2013. A Section 75W modification is proposed to increase residential density from 1,010 up to 1,480 allotments. Commentary on potential noise issues has been undertaken as part of the Section 75W modification, which will be informed by an Environmental Assessment.

This assessment has been completed with reference being made, but not limited, to the current Environment Protection Licence for Tallawarra Power Station (Licence number: 555; Licensee Energy Australia Tallawarra Pty Limited) and the NSW EPAs Industrial Noise Policy (NSW INP) (EPA, 2000).

Assessing potential noise issues allows the effective management of existing infrastructure combined with maintaining acceptable socio-acoustic standards for proposed land redevelopment.

1.1 Scope

The scope of works for this study was to identify the environmental noise impact potential for the proposed residential development for the areas labelled Northshore precinct and Central precinct. This involved:

- review studies undertaken from previous approvals on the subject site
- compile available background noise monitoring data available for the study area;
- undertake environmental noise monitoring to assess the existing ambient noise environment in the areas surrounding the subject site;
- delineate influence from key noise sources in the vicinity of the proposed Tallawarra Lands redevelopment;
- present noise contours (based on previous predictions completed by others) from existing and approved operations from the Tallawarra Power Station (Stage A and Stage B);
- determine noise impacts and quantify potential future land-use conflict; and,
- discussion of issues raised by the results and outline management options to control noise impact and to reduce land use incompatibility.

Supporting documentation has been included in the Appendices of this report.

2 Subject site

The site is bordered by Lake Illawarra to the east (industrial noise) and the Princes Motorway (M1) to the west (transportation noise)

The Tallawarra Lands redevelopment site is located within the Lake Illawarra Catchment, South of Wollongong, between the suburbs of Koonawarra and Albion Park and is provided within the local context as Figure 2-1.

Current land uses for the area are consistent with a general suburban and urban setting.

The Tallawarra Power Station is the primary noise generating activity for the area (located on Lake Illawarra to the east). The Southern Freeway is located to the west and would also have some influence on diurnal noise trends.

2.1 Local setting

The regional area has a large residential population, most of which would be classified as urban or suburban. To the north of the site is the residential area of Koonawarra which continues to the west and is separated from the Tallawarra Power Station site by Mount Brown.

2.2 Noise setting

Industrial noise emissions from the operations of the Tallawarra Power Station have the greatest potential to influence surrounding ambient noise environs. In December 2008, TRUenergy commissioned Stage A combined cycle gas turbine (with a nominal operating capacity of 400 MW). Approval has also been granted for Tallawarra Stage B (with a nominal capacity of 300 – 450 MW – dependent on final design) in April 2016 the approval was modified to expire November 2020.

Tallawarra Stage A (currently operational) and Stage B (when commissioned) may be in operation up to 24 hours per day, seven days per week.

Secondary noise issues may be associated with noise from existing transportation sources, including road traffic (M1 Motorway); rail (Illawarra Rail line); and, aircraft (Illawarra Regional Airport). Potentially affected receivers located adjacent to, or have a direct line of site, to these sources, may be subject to potential impacts. Overview commentary has been provided on these secondary issues.

General noise levels are influenced by local industry closely follows by the M1. The Bluescope steel mill and other industry at Port Kembla, located 12-13 km to the north-east, also has the potential to be audible during periods of low background noise and under enhancing meteorological conditions.

Tertiary noise issues include ingress and egress of local traffic flows and general urban noise sources consistent with the proposed land use for the area. These have not been considered further within the study.

Figure 2-1: *Subject site and surrounding land uses*

3 Proposal details

A Section 75W modification is proposed to increase in residential density from 1010 up to 1480 allotments.

The Tallawarra Concept Plan (MP 09_0131 Mod 1) was granted by the Planning and Assessment Commission of NSW on 23 May 2013. A Section 75W modification is proposed. The NSW Department of Planning and Environment (DP&E) Secretary Environmental Assessment Requirements (SEARs), dated 23 January 2017, identify key issues and matters which require consideration.

The proposed Section 75W modification comprises:

- development boundary changes to Northshore and Central precinct with extent and form to accommodate design and constraints present
- change in proposed allotments from density from 1010 to 1480 lots (Northshore precinct increase 310 to 542 and Central precinct increase from 350 to 588
- zoning changes (expand, and minor alterations to, the R2 Zone – for low-density residential use) within the Northshore precinct and Central precinct and amend the zoning of the B1 zone to B4 Mixed Use Zone.

The amendments have been proposed to streamline the conditions and to separate the Northshore and Central precinct from the Southern precinct – which will assist in the final sale and streamline overall timing.

The proposed layout has been provided as Figure 3-1.

Timing and final staging for development for the two precincts within Tallawarra Lands are not known at the time of writing this document.

Figure 3-1: *Proposed development layout*

4 Previous noise investigations

Impact and compliance studies have been referenced from 2007, 2009, 2010 and 2016.

Several studies have been carried out for the subject site. This land use planning study has referenced the following documents:

- Sinclair Knight Mertz (undated) *Environmental Assessment Tallawarra Stage B Power Station Appendix E Noise Assessment (unreferenced)* – measurements taken in 2007 and 2009
- SKM (2011) *Tallawarra Lands Part 3A Concept Plan* Application (EN02773, Final v5) – measurements taken in 2010
- Renzo Tonin & Associates (2015) *Albion Park Rail ByPass Noise and Vibration Assessment* (TH508-01F02 NV Assessment (r5) – measurements taken in 2015
- Energy Australia (2017) *EPA MONTHLY MONITORING 2017 January* (unreferenced) – measurements taken in 2016

The location of previous noise monitoring reference points is provided in Figure 4-1. Results considered relevant to this study have only been presented and commented on.

4.1 2007

The 2007 monitoring included unattended (four locations) and attended (three locations) noise measurements. With no Tallawarra power station operations, the following was reported

- **Central precinct.** Existing receiver. T2, Carlyle Street, Koonawarra
  Night: L_{Aeq} 44 dB(A); L_{A90} 38 dB(A). Industrial influence of <35 dB(A) (BHP)
- **Northshore precinct.** Greenfield. T3. Tallawarra site ridgeline
  Night: L_{Aeq} 37 dB(A); L_{A90} 31 dB(A)
- **Northshore precinct.** Existing receiver. T4. Wyndarra Way, Koonawarra.
  Night: L_{Aeq} 38 dB(A); L_{A90} 33 dB(A). Industrial influence of <37 dB(A) (BHP)

Monitoring locations T1 and T2 are exposed to transportation noise, with higher noise levels reported. Location T3 was reported to provide a good measure of general noise in the area.

4.2 2009

Following the commissioning of Tallawarra Stage A, attended monitoring was carried out in the area directly surrounding the plant and within the Tallawarra Lands. The attended monitoring was used to determine the influence of the operations. The attended monitoring indicated that the Tallawarra plant (Stage A) was audible at approximately 800 metres from the stack, with the estimated noise contribution reported at:

- L_{Aeq} 36 – 38 dB(A) (north); and, L_{Aeq} 38 – 40 dB(A) (west)

The operations (power output); meteorological conditions present and duration of monitoring during the 2009 attended measurements were not reported. No analysis of potential annoying characteristics was presented.

4.3 2010

The 2010 monitoring included unattended (six locations) noise measurements. Attended noise monitoring results were not sited. Tallawara Stage A operations were present. The measures levels can be summarised as follows:

- **Northshore precinct.** Location 1
  Night: L_{Aeq} 41 dB(A); L_{A90} 36 dB(A)
- **Northshore precinct.** Location 2
  Night: L_{Aeq} 41 dB(A); L_{A90} 34 dB(A)
- **Central precinct.** Location 3. Road influence
  Night: L_{Aeq} 52 dB(A); L_{A90} 36 dB(A)
- **Northshore precinct.** Location 5
  Night: L_{Aeq} 43 dB(A); L_{A90} 57dB(A)
- **Central precinct**. Location 6
  Night: L_{Aeq} 44 dB(A); L_{A90} 40 dB(A)

Within the Northshore precinct (Location 1, Location 2 and Location 5), the night time L_{Aeq} levels are consistent with the NSW INP acceptable levels for a suburban noise environment.

Within the Central precinct (Location 6), higher LAeq noise levels were measured, which indicate more of an urban noise profile.

Noise levels for all locations within the Northshore precinct and Central precinct (2010 conditions, no road influence) were consistent. Measured levels were within 4 dB(A) (L_{Aeq}) and 6 dB(A) (L_{A90}).

The influence of road traffic noise (Location 3 and Location 4) resulted in higher night time LAeq noise levels. Night time L_{A90} levels ranged between 34 – 40 dB(A) throughout the study area.

Discussion or comment on measured noise levels within the Southern precinct was beyond the scope of this land use planning study.

Where road traffic noise was not a key contributor (Location 1, Location 2, Location 5 and Location 6), L_{A90} noise levels were within 1-3 dB(A) during the day time, evening and night time period.

The operations (power output) during the monitoring interval were not reported.

Without concurrent attended measurements, it is difficult to characterise existing ambient noise levels, and key sources currently influencing measured noise levels.

4.4 2015

Data referenced for 2015 conditions included measurement of noise profiles at existing locations,primarily adjacent the arterial road.

The Renzo Tonin and Associates measurement L1 (4 Semillon Place, Mount Brown), is considered the only location that may be of relevance to this land use planning study.

- **Northshore precinct.**
  No measurements.

- **Central precinct.** Location 1. Road influence
  Night: L_{Aeq} 58 dB(A); L_{A90} 52 dB(A)

4.5 2016

Noise monitoring results for the Energy Australia compliance reporting period January 2016 to February 2017 were not sighted.

4.6 Energy Australia measurements

Noise monitoring results for a recent outage for the Tallawarra Stage A (April 2017) have not been sited.

4.7 Commentary

Between 2007 and 2010, ambient noise profiles were found to have increased in the Northshore precinct (1 – 3 dB(A)). This is consistent with the level of Tallawarra Stage A noise influence measured during the 2009 attended noise measurements.

Noise levels within the Central precinct were generally consistent between the 2007 and 2010 data sets. Some increase from road traffic noise levels was noted.

Figure 4-1: *Previous noise monitoring locations referenced*

5 Existing noise environment

The study area comprises both suburban and urban land uses, with some industrial noise influence.

The existing acoustic environment was characterised by a combination of long term and short term noise measurements

5.1 Methodology

The noise monitoring location was selected with consideration to *Australian Standard (AS) 1055: 1997 Acoustics - Description and measurement of environmental noise - General procedures*.

A description of acoustic terminology is provided in Appendix A.

The unattended noise monitoring was undertaken using Ngara noise loggers (serial number 8780FB 878005 and 878196) and a RION-31 (S/N 603874). All noise loggers were set to record A-weighted noise levels every 15 minutes and set to 'fast' response time. The Ngara instruments also recorded continuous audio data throughout the investigation period.

Short term (attended) noise measurements were also carried out at the background monitoring locations presented in Table 5-1. Measurements were undertaken over a 15-minute period using an NTI Audio XL2 sound level meter.

Calibration checks were undertaken before and after each measurement with no significant drift (±0.5 dB) observed.

Weather conditions were recorded at the Bureau of Meteorology Albion Park weather station (068241). Data collected during periods of unsuitable weather conditions was excluded with consideration of the NSW INP.

During the monitoring period the plant cycled between peak generating load (approx 400 MW) and standby mode.

5.2 Locations

Unattended background noise monitoring was undertaken at four locations within the Tallawarra Lands Precinct. Unattended and attended noise monitoring was undertaken at the four locations. The noise monitoring locations are presented in Figure 5-1.

Figure 5-1: *Measurement locations for current ambient profiles (2017 conditions)*

Table 5-1 Noise Monitoring Location

ID	Description	Distance to Tallawarra plant	Coordinates (MGA Zone 56H)	
			Easting	Northing
E1	Power plant not visible from location.	1025 metres	299184	6178696
E2	Power plant fully visible from location.	730 metres	298943	6178437
W1	Power plant partially visible from location.	1380 metres	297462	6177626
W2	Power plant partially visible from location.	1060 metres	297744	6177515

5.2.1 Justification

Two locations were selected for the Northshore precinct (E1 and E2) and two for the Central precinct (W1 and W2). Locations W2 and E2 are closer to the Tallwarra Power Station. The locations were established to obtain current ambient profiles in the areas representative of the proposed Tallawara Lands development.

5.3 Monitoring results

5.3.1 Unattended

Table 5-2 provides a summary of the noise monitoring data. Daily graphs for the noise monitoring results are included in Appendix B.

Table 5-2 Unattended noise monitoring results

Location	Measured Noise Level, dB(A)								
	L_{A10}			L_{Aeq}			L_{A90}		
	D	E	N	D	E	N	D	E	N
E1 (05/05/2017 – 17/05/2017)	52	43	40	49	40	**37**	30	32	**27**
E2 (05/05/2017 – 06/05/2017)	54	42	42	58	39	**39**	32	35	**31**
W1 (05/05/2017 – 10/05/2017)	55	52	53	52	48	**47**	39	42	**30**
W2 (05/05/2017 – 06/05/2017)	56	51	46	56	48	**44**	37	38	**34**

Notes to Table 5-2:

All values rounded to nearest whole decibel.

Day (7.00am to 6.00pm Monday to Saturday, 8.00am to 6.00pm Sundays and Public Holidays), evening (6.00pm to 10.00pm).

Measured night time levels have been referenced. This is the period where the greatest potential for impact (land use planning issues) is expected to be present.

- **Northshore precinct.** Location E1/E2
  Night: L_{Aeq} 37-39 dB(A); L_{A90} 27-31 dB(A)
- **Central precinct.** Location W1/W2
  Night: L_{Aeq} 44-47 dB(A); L_{A90} 30-34 dB(A)

Based on the unattended noise monitoring, ambient level for locations close to the Tallawarra Power Station (E2 and W2) were 2-3 dB higher (L_{Aeq}) and 4 dB higher (L_{A90}) during the night time, when compared to corresponding noise levels within each catchment (E1 and W1). This is expected to be due to the influence of existing industrial noise.

5.3.2 Attended

Table 5-3 provides a summary of the attended noise measurements. Satisfactory meteorological conditions were present.

Table 5-3: Attended noise measurement results

Date/ Time	Location	Measured Noise Level dB(A) (15min)				Tallawarra Operations	Comments
		L_{Amax}	$L_{A10,}$	L_{Aeq}	L_{A90}		
17052017 09:48	E1	76	43	44	35	Powerplant was in Startup/Shutdown at 1MW for this entire period	Ambient noise environment consists of local flora and fauna; 38-40 dB. Horse training nearby; 45-60 dB.
05052017 11:36	E2	71	44	49	**37**	Plant was running at almost full generational capacity (~399MW) at this time	Ambient noise environment comprised industrial noise from **power plant**, local flora and fauna; **38**-41 dB. Airplane in distance; 50dB. Jet ski on lake; 58 dB
17052017 10:28	E2	67	47	45	33	Plant was in complete Shutdown at 0MW around this time.	Ambient noise environment consists of local flora and fauna; 38-42 dB. Plane overhead; 61 dB.
17052017 11:54	W1	76	49	48	34	Plant was in startup/shutdown mode 0MW at this time.	Ambient noise environment consists of distant traffic, local flora and fauna; 35-37 dB.
05052017 12:51	W2	80	50	55	**37**	Plant was at full operational capacity (~416MW) at this time.	Ambient noise environment consists of distant traffic, local flora and fauna; 38-42 dB. Airplanes in distance; 79 dB.
17052017 11:30	W2	82	48	51	35	Plant was at full operational capacity (~416MW) at this time.	Ambient noise environment consists of distant traffic, local flora and fauna; 40 – 42 dB. Plane 2; 60 dB. Passing car on-site 60 dB.

Notes to Table 5-3:

All values rounded to nearest whole decibel

During the day time attended monitoring, the Tallawarra Power station was observed at a noise level of approximately 37 dB(A) within the Northshore precinct. Within the Central precinct, Tallawarra Power station operations were not audible.

An existing industrial noise influence of 37 dB(A) (L_{Aeq}) has been conservatively adopted.

Observations and analysis of the collected data did not identify any significant annoying characteristics.

5.3.3 Review of night time data

Audio files obtained from the unattended noise loggers has been analysed. During the night time period for 6 of May 2017 at 0145, the power plant was noted as being faintly audible. Review of station operational data during this period indicated the plant was in standby mode at this time

The following is observed:

- **Northshore precinct.** Location E1
  Night: L_{Aeq} 32 dB(A)
  Night: L_{A90} 29 dB(A)
- **Northshore precinct.** Location E2
  Night: L_{Aeq} 40 dB(A)
  Night: L_{A90} 31 dB(A)
- **Central precinct.** Location W1
  Night: L_{Aeq} 50 dB(A)
  Night: L_{A90} 34 dB(A)
- **Central precinct.** Location W2
  Night: L_{Aeq} 46 dB(A)
  Night: L_{A90} 33 dB(A)

Analysis of the collected audio and frequency data did not identify any significant annoying characteristics.

5.4 Commentary

Within the Northshore precinct, 2017 conditions indicate that Location E1 is generally consistent with a low noise environment typical of a 'rural' setting. Noise monitoring at Location E2 was similar, with some influence from the operations of the Tallawarra Power Station.

The 2017 noise monitoring within the Central precinct (Location W1 and Location W2) was consistent with a typical 'suburban' noise environment. Night time noise levels were low, with road traffic noise noted to be a key contributor (particularly during the day time periods).

Regarding monitored noise levels during 2010, the night time L_{Aeq} Location 1 (41 dB(A)) and Location 2 (41 dB(A)) were similar with those measured during 2017 for Location E1 (37dB(A)) and Location E2 (39 dB(A)). A 2-3 dB(A) change in noise levels, over a seven-year period, is considered marginal.

Within the Central precinct, the 2010 night time L_{Aeq} for Location 3 (52 dB(A)) and Location 6 (44 dB) were reasonably consistent those measured in 2017 at Location W1 (47dB) and Location W2 (44 dB(A))

5.5 Start Up and Shut Down

Unattended noise monitoring data collected during start up and shut down periods from the E2 and W2 logger locations (nearest to Tallawarra A) was also reviewed to identify if significant changes in noise impact are anticipated. Examples of this data are presented in Figure 5-2 and Figure 5-3. Review of the collected data did not indicate significant changes in 15 minute average noise levels. Attended noise monitoring targeting start up and shut down periods would provide further detail on start up and shut down events.

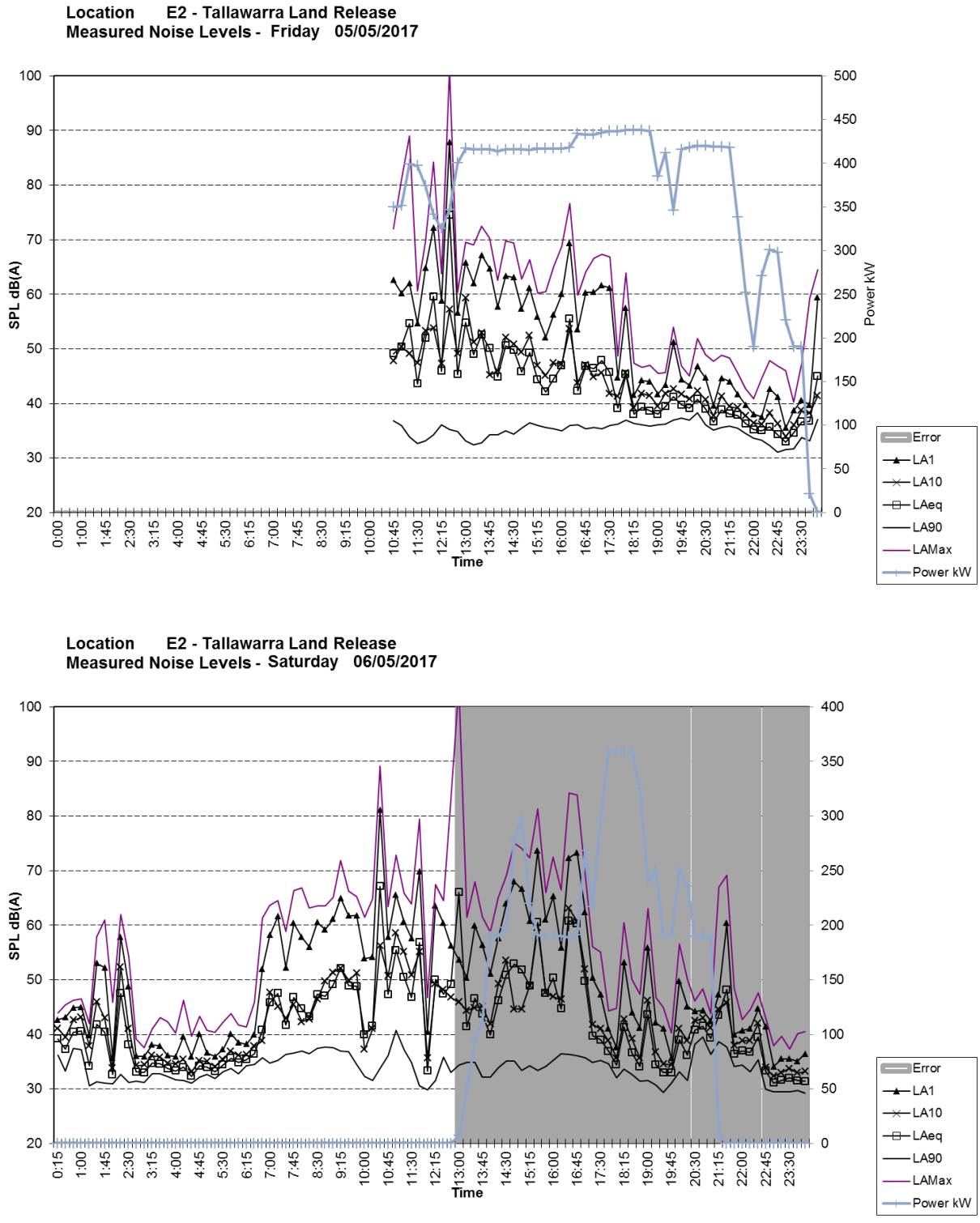


Figure 5-2: *Start Up and Shut down activities and measured noise levels at E2*

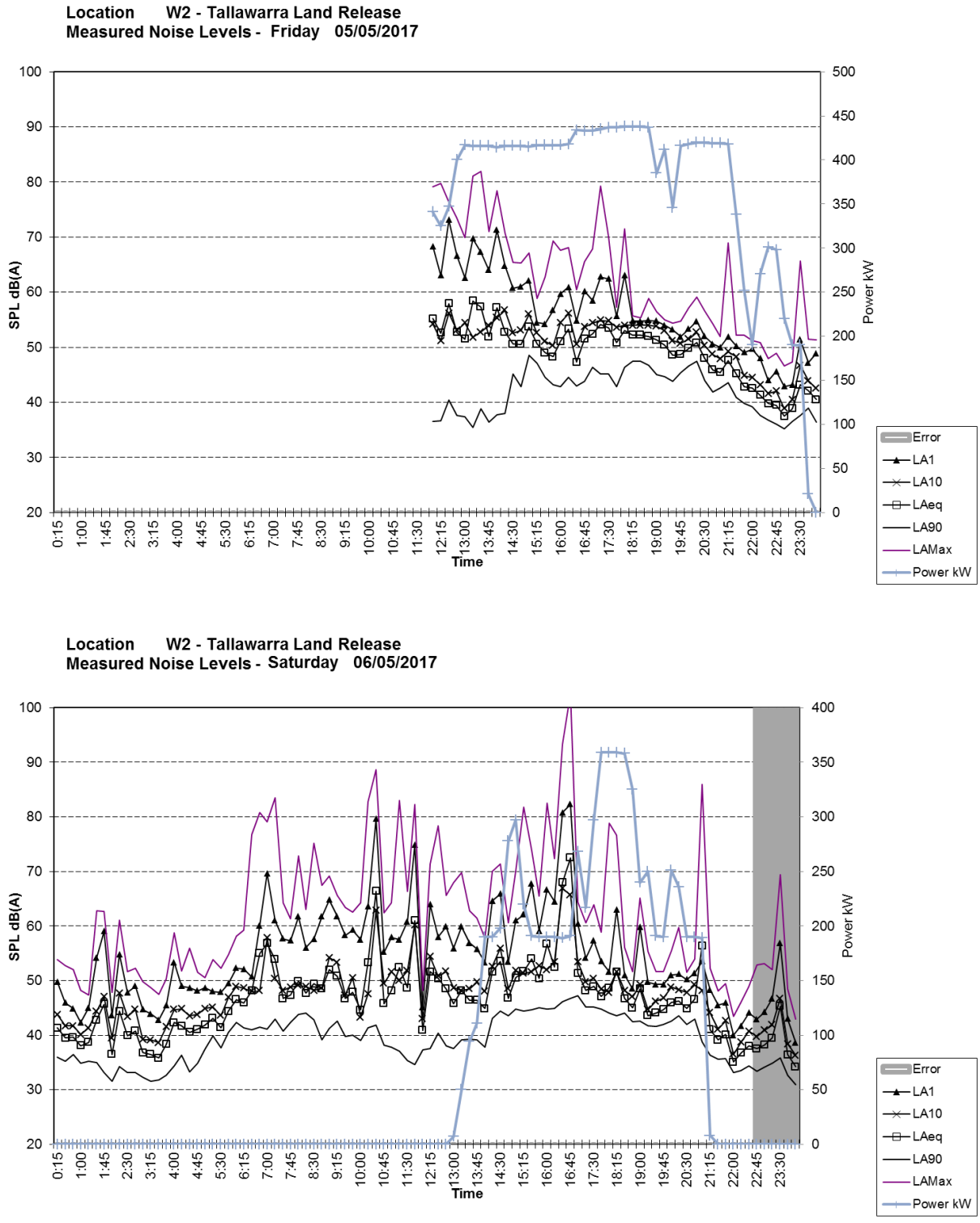


Figure 5-3: *Start Up and Shut down activities and measured noise levels at W2*

6 Noise design goals

Noise design goals have been recommended based on 2017 ambient profiles

The NSW Government's policy and guidelines for the assessment of industrial noise is presented in the NSW INP. The NSW INP recommends intrusiveness criteria for residential receivers to address the potential for intrusive noise and amenity criteria to maintain acoustic amenity appropriate to the relevant land use category of the area.

Noise designs goals previously established, and current recommendations based on 2017 conditions, have been outlined.

Goals for transportations (road, rail) sources have also been recommended.

6.1 2007 measurements

The Sinclair Knight Mertz (undated) *Environmental Assessment Tallawarra Stage B Power Station Appendix E Noise Assessment (unreferenced)* recommended project specific noise criteria for existing residential receivers. Night time criteria (which is more stringent) were established as follows:

- **Northshore precinct**
  Night: $L_{Aeq, 15min}$ 36 dB(A)
- **Central precinct**
  Night: $L_{Aeq, 15min}$ 43 dB(A)

6.2 2010 measurements

The noise assessment *Tallawarra Lands Part 3A Concept Plan* Application (EN02773, Final v5) (SKM (2011)), based on measurements taken in 2010, recommended the following night time noise design goals:

- **Northshore precinct**
  Night: $L_{Aeq, 15min}$ 38 dB(A)
- **Central precinct**
  Night: $L_{Aeq, 15min}$ 40 dB(A)

6.3 Environment Protection Licence

The Tallawarra power station (station A) operations are required to meet the noise limits specified in the Condition L6 of Environment Protection Licence (EPL) number 555. Night time noise limits ($L_{Aeq, 15 min}$) for surrounding catchments range from 28 dB(A) (Coronet Place, Koonawarra, Existing urban catchment) up to 37 dB(A) (Haywards Bay Estate, Yallah, Southern precinct).

EPL noise limits have not been established for noise catchments representative of the Northshore precinct and Central precinct.

6.4 Tallawarra Stage B Approval

The conditions of approval for the Tallawarra Stage B includes noise limits for the combined impact of Tallawarra A and B power stations on residential receivers located in the suburbs of Koonawarra, Oak Flats, Mt Warrigal and Hayward Bay and the Tallawarra Lands concept plan. The Tallawarra lands noise criteria are presented in Table 6-1.

Table 6-1 Noise Limits for Tallawarra residential areas

Location	Day 7:00 am to 6:00 pm Mondays to Saturdays 8:00 am to 6:00 pm Sundays and public holidays	Evening 6:00 pm to 10:00 pm on any day	Night 10:00 pm to 7:00 am Mondays to Saturdays 10:00 pm to 8:00 am Sundays and public holidays	
	LAeq(15 minute)	LAeq(15 minute)	LAeq(15 min)	LAmax
Northshore precinct				
Most affected residence	38 dB(A) (40 with LFN)	38 dB(A) (40 with LFN)	38 (40 with LFN)	50dB(A)
Central precinct				
Most affected residence	40 dB(A)	40 dB(A)	40 dB(A)	50dB(A)

Notes to Table 6-1:
LFN: If the Industrial Noise Policy (INP) Modification Factors for Low Frequency Noise apply

The Tallawarra Lands concept approval was previously based on residential development outside the $L_{Aeq\ 15minute}$ 40 dB(A) and L_{Amax} 50 dB(A) noise contours, this approval assumes no acoustic mitigation will be undertaken for residential dwellings within the Northern or Central Precinct.

The section 75W application seeks to relocate the boundary of the Northshore precinct such that it will include land between the L_{Aeq} 40 dB(A) and L_{Aeq} 50 dB(A) noise contours. Lots within this new area are predicted to have acceptable residential amenity with the implementation of at receiver mitigation measures detailed in section 7 and section 8 of this report. The noise limits in Table 6-1 only apply in relation to the currently approved precinct boundaries and should not be extended to apply to the new area proposed within the Northshore precinct.

Although the boundaries of the central precinct are proposed to be expanded all new residential land within the expanded precinct will be located outside the 40 dB(A) noise contour and it will therefore be possible to comply with the noise limits in Table 6-1 for new these new residential lots.

6.5 2017 recommended values

Measurements of current conditions (2017 noise profiles) have been referenced, with reasonable and feasible noise design goals recommended. Night time noise levels have been referenced and both intrusive and amenity noise design goals recommended in accordance with the requirements of the NSW INP.

Compliance with the night time noise goals will drive the land use compatibility.

Table 6-2 Recommended noise design goals (2017)

Location	Measured Level (night)				Amenity Goal (ANL with NSW INP modification)	Intrusive goal (L_{A90} + 5)
	L_{Aeq}	L_{A90}	Ind Infl`	ANL		
Northshore precinct						
E1	37	27	nil	40	40	**35**
E2	39	31	37	40	37	36
Central precinct						
W1	47	30	nil	45	45	**35**
W2	44	34	37	45	45	39

Notes to Table 6-1:
Ind Infl: adopted level of existing industrial influence
ANL is NSW INP recommended Acceptable Nosie Level
Where measured L_{A90} is below 30 dB(A), Rating Background Level set to 30 dB(A)

The intrusive goals are more stringent and therefore are applicable. A noise design goal of 35 dB(A) is consistent with previous studies for the area and is considered appropriate.

The recommended values maintain consistency with historical data, and reflect current noise environs.

The goal assumes there are no annoying characteristics associated with received noise levels.

6.5.1 Note on noise design goals

The NSW Industrial Noise Policy (INP, 2000) has been referenced. The INP was developed by the NSW EPA principally for the assessment of noise emissions from industrial sites regulated by the NSW EPA. An important point to note in the policy is presented in Section 1.4.1, which states:

> *'The industrial noise source criteria set down in Section 2 are best regarded as planning tools. They are not mandatory… …other factors need to be taken into account… … factors include economic consequences, other environmental effects and the social worth of the development.'*

Compliance with the broad requirements of the NSW INP would maintain the acoustic amenity for the area.

6.6 Road

The Road Noise Policy (RNP) (DECCW, 2011) provides guidance, criteria and procedures for assessing noise impacts from existing, new and redeveloped roads and traffic generating developments.

For existing roads where no redevelopment is taking place, the RNP provides a basis for measuring and defining the extent of existing traffic noise impacts. Target levels are outlined in Table 6-3.

Table 6-3: *Noise abatement levels for existing roads (not subject* to redevelopment)

Existing road category	Target noise level (dB(A))	
	Day $L_{Aeq\ 15\ hr}$ (0700-2200)	Night $L_{Aeq\ 9\ hr}$ (2200 – 0700)
Freeway/arterial/sub-arterial road	60	55

Notes to Table 6-2:
L_{Aeq} is the equivalent continuous (energy average) A-weighted sound pressure level. It is defined as the steady sound level that contains the same amount of acoustic energy as the corresponding time-varying sound.

The assessment criteria are external noise levels and apply at the façade of the affected residential receiver.

The RNP states that these noise levels are provided as a guide to assessing impacts rather than as achievable targets.

6.7 Rail

Trigger levels for rail borne noise are provided in the Rail Infrastructure Noise Guideline (RING) (NSW EPA, 2013). The RING specifies noise trigger levels to protect the community from the adverse effects of noise and vibration from rail infrastructure projects.

For planned development, including staged development that identifies building locations, the RING requires noise impacts to be considered. For existing rail lines, the RING provides noise trigger levels for residential land uses. Although the trigger levels apply to rail development activities, the RING provides a basis for assessing potential rail noise issues Trigger levels are outlined in Table 6-4.

Table 6-4: *Noise abatement levels for existing rail (not subject* to redevelopment)

Existing road category	Target noise level (dB(A))	
	Day $L_{Aeq\ 15\ hr}$ (0700-2200)	Night $L_{Aeq\ 9\ hr}$ (2200 – 0700)
Redevelopment of existing rail lines	65	60

Notes to Table 6-3:
L_{Aeq} is the equivalent continuous (energy average) A-weighted sound pressure level. It is defined as the steady sound level that contains the same amount of acoustic energy as the corresponding time-varying sound.

L_{AFMax} noise goals of 85 dB(A) are also recommended.

6.8 Internal noise

The NSW Department of Planning and Environment (DoP) *State Environmental Planning Policy (Infrastructure) 2007* (Infrastructure SEPP) (DoP, 2007) specifies noise criteria for development near rail corridors and busy roads.

The noise criteria are reproduced in the *Development of New Rail Corridors and Busy Roads – Interim Guideline* (interim guideline) (DoP, 2008). This criteria is to be considered where development is proposed in, or adjacent to, specific railway corridors. The interim guideline relates to Infrastructure SEPP clauses 85, 86 and 87.

For new residential and noise-sensitive developments alongside transportation infrastructure, mitigation measures to be considered to meet mandatory internal noise levels. The Infrastructure SEPP specifies internal noise levels of 35 dB(A) $L_{Aeq(9h)}$ for bedrooms during night-time and 40 dB(A) $L_{Aeq(9h)}$ for other habitable rooms

The interim guideline (DOP, 2008) provides advice to developers on how to achieve these levels.

These internal noise criteria are consistent with AS2107-2000 *Acoustics – Recommended Design Sound Levels and Reverberation Times for Building Interiors* (Australian Standards, 2000).

The NSW government has therefore taken the official view that internal noise levels of 35 dB(A) for bedrooms and 40 dB(A) for other habitable rooms will result in acceptable residential amenity.

7 Area of affectation

Future residential properties will need to comply with recommended external noise levels (L_{Aeq}) to maintain amenity

Comment on expected noise impact issues, based on existing works, has been provided. The previous impact assessments relied upon have not been peer reviewed by Pacific Environment.

7.1 Industrial

Modelled noise levels for Tallawarra Stage A and Tallawarra Stage B (SKM, 2011) indicate that received noise levels within the Northshore precinct would be expected between 35 – 45 dB(A).

Within the Central precinct and Southern precinct, modelled noise levels were predicted below 40 dB(A).

Predictions were made under noise enhancing meteorological conditions with both temperature inversion (3 ^{0}C/100 metre) and source to receiver wind speeds (2 metres per second) adopted. This is worst-case. It is not known if these conditions are a feature for the area. Assessing both noise enhancing conditions together (rather than in isolation) may also provide additive impacts.

Potential internal noise levels have been considered. These are based on predicted external and assuming a 10 dB reduction from internal to external as per assumptions typically applied to determine internal noise level with windows open 10% for ventilation.

7.2 Transportation

7.2.1 External – road

Nosie modelling was undertaken for the Albion Park Bypass (Renzo Tonnin and Associates, 2015). Day time $L_{Aeq\ 15\ hr}$ and night time $L_{Aeq,\ 9\ hr}$ predictions have been referenced for 2030 design year (build scenario).

Noise levels have the potential to be at or above the adopted road traffic noise goals extend into the western boundary of the Central precinct.

7.2.2 External – rail

Modelled train pass-by events for the Illawarra Rail line were reported in the range of 45 – 54 dB(A). Maximum noise levels were predicted between 69 – 79 dB(A).

Compliance with current rail noise goals was predicted.

No land use planning issues from existing rail noise are expected for the Northshore precinct and Central precinct.

7.2.3 External – aircraft

The Tallawarra lands are located outside the Illawarra Regional Airport indicated 20 ANEC contour.

In accordance with AS2021-2000 *Acoustics – Aircraft Noise Intrusion – Building Siting and Construction*, the site is considered acceptable for residential purposes.

No land use planning issues from existing aircraft noise are expected for the Northshore precinct and Central precinct.

7.3 Urban

The Central precinct is located approximately 400 metres from an area that has been flagged for future industrial and commercial development. Compliance with the recommended noise design goals will need to be achieved. Although noise emissions from the power station are expected to dominate, it will be important to ensure cumulative issues do not occur.

At 400 metres separation, industrial noise (assuming an industrial boundary level of 70 dB(A) – to meet compliance with NSW INP requirements), would be expected to result in incremental received noise levels of less than 15 dB(A) and would not contribute to existing industrial noise levels. This would be at the closest potentially affected receiver within the Central precinct.

No land use planning issues from cumulative industrial operations are expected for the Northshore precinct and Central precinct. For any proposed high noise generating activity within the designated future development area, specific assessment will be required at development application stage.

7.4 Validation

The 2017 day time attended noise monitoring observed an industrial noise influence of 37 dB(A) at Location E2 within the Northshore precinct. This observed level closely aligns with previous predictions. Although it should be noted that the previous predictions referenced (SKM 2001) are presented in increments of 5 dB(A) only.

Referencing night time noise levels during the unattended monitoring program (with review of the corresponding audio file), L_{Aeq} noise levels in the Northshore precinct were measured at 32 dB(A) (Location E1) and 40 dB(A) (Location E2). These measurements are consistent with previous predictions referenced (SKM 2011).

Referencing night time noise levels during the unattended monitoring program (with review of the corresponding audio file), L_{Aeq} noise levels in the Central precinct were measured at 50 dB(A) (Location W1) and 46 dB(A) (Location W2). These measurements are more than 10 dB(A) above predictions, The influence of existing road traffic noise is expected to result in the elevated noise measurements.

7.5 Statement of potential impact

Noise impact profiles undertaken for previous approvals have been included in Figure 7-1. The contours do not represent all impacts at all times, but rather the extent of potential noise impact. The L_{Aeq} noise levels that may occur are presented for comparison to the adopted site-specific noise design goals.

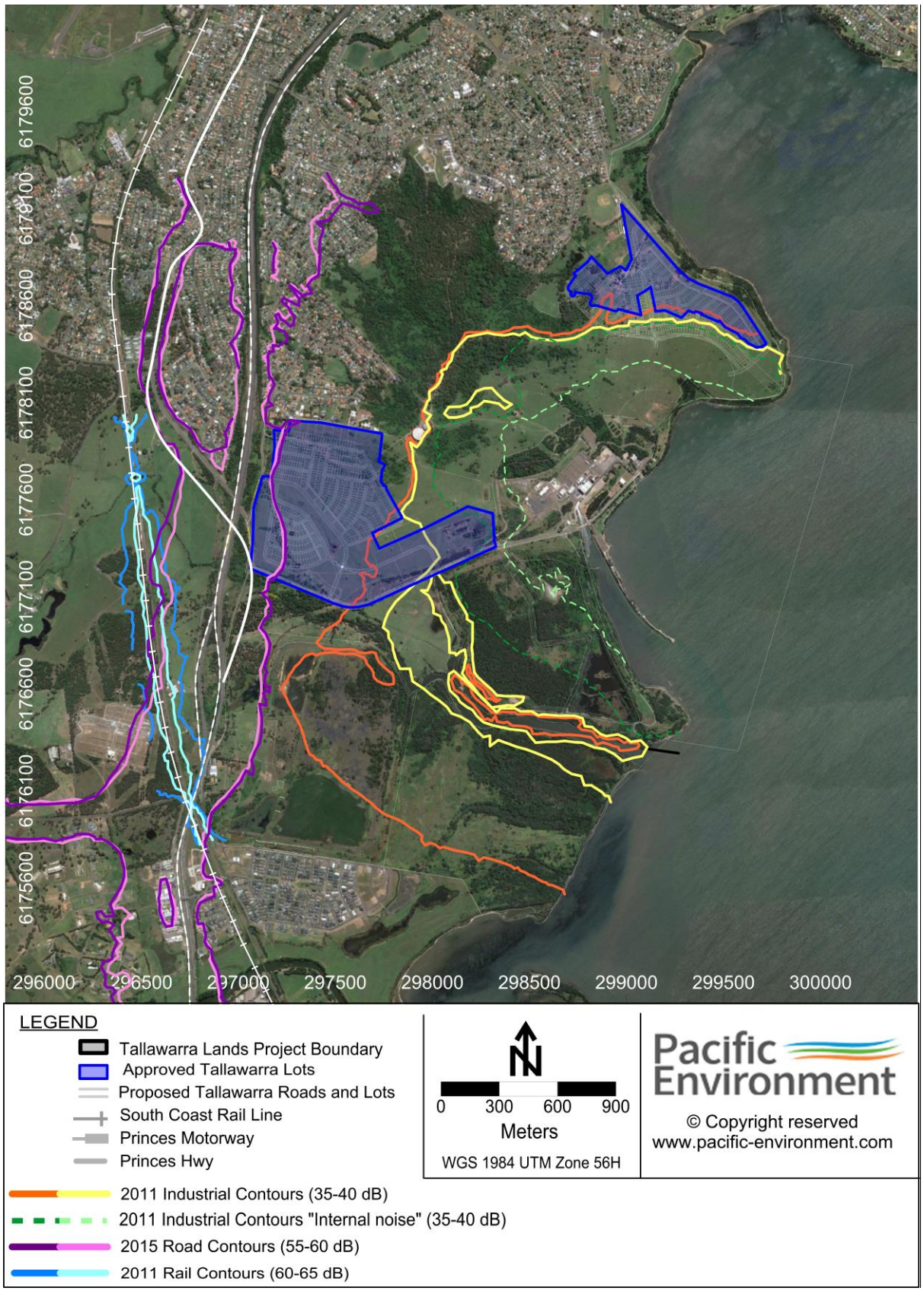


Figure 7-1: *Predicted noise impact profiles (by others)*

7.6 Noise Levels and Noise Mitigation

Comparison of the noise levels across the central and northern precincts (Figure 7-1) identifies areas with potential noise impact above the assessment criteria. Areas in these zones will require noise management and mitigation measures.

7.6.1 Central Precinct

The section 75W application does not seek to add new residential land within the 40dB(A) $L_{Aeq\ 15min}$ power station noise contour. However, receivers in the already approved south western corner of the central precinct are predicted to experience road noise levels above the 60 dB(A)$L_{Aeq\ 15\ hour}$ day time and 55 dB(A) $L_{Aeq\ 9hour}$ night time road noise contour. Noise mitigation measures for residential receivers in this area are required. This is consistent with the Tallawarra Lands Concept Approval, however the shape of the zone of impact has changed with proposed road alignments associated with the proposed Albion Park Bypass.

Noise mitigation for future receivers impacted by road noise should include the following at the detailed design stage of Tallawarra Lands:

- Up to date traffic flow and noise modelling for the future alignment and operation of Albion Park Bypass Project.
- Site specific acoustic design for dwellings to predict the external façade noise levels.
- Noise intrusion modelling through the façades, roof and glazing.
- Design for each dwelling to ensure internal noise levels meet the requirements of *AS2107 Acoustics – Recommended Design Sound Levels and Reverberation Times for Building Interiors*.

It is expected that the proposed residential dwellings can readily achieve the required internal noise level with upgrades to the building facades and glazing. Acoustic upgrades to facades should be implemented on a case by case basis and would depend on proposed building layout and proposed design.

7.6.2 Northshore Precinct

Receivers within the new area of land proposed to be included within the Northshore precinct, at the southern extent of the northern precinct are predicted to experience industrial noise levels between 45 and 50 dB(A), during night time periods. Noise mitigation measures for residential receivers in this area are required.

Noise mitigation for future receivers impacted by industrial noise in this area should include the following at the detailed design stage of Tallawarra Lands:

- Cumulative industrial noise modelling results from the Tallawarra A and Tallawarra B Power Station operations for both L_{Aeq} and L_{AMax} noise impacts.
- Site specific acoustic design for dwellings to predict the external façade noise levels.
- Noise intrusion modelling through the façades, roof and glazing.
- Design for each dwelling to ensure internal noise levels meet the requirements of *AS2107 Acoustics – Recommended Design Sound Levels and Reverberation Times for Building Interiors.*
- *Operational noise limits for Tallawarra B to be based on predicted noise impacts on the revised layout of the Northern precinct*

It is expected that the proposed residential dwellings can readily achieve the required internal noise level with consideration of building orientation, layout and design. Closing doors and windows provides approximately 10 dB of attenuation, with further reductions possible from upgrades to the building facades and glazing, and provision of mechanical ventilations where required.

Acoustic upgrades to dwellings should be implemented on a case by case basis and would depend on proposed building layout and proposed design.

8 Conclusion and Outcomes

Safeguards to manage potential environmental noise impact are recommended.

Based on the works carried out for this land use planning study, buffer zones have been recommended and are provided on Figure 8-1.

To maintain future amenity, and limit the potential for noise intrusion, management zones have been recommended. These have been based on previous predictions, with consideration to 2017 ambient profiles. The recommended zones are based on adverse meteorological conditions and assume there are no annoying characteristics associated with the received noise levels.

- **Zone 1**: Acceptable (green). This is based on areas with a potential received noise level below 35 dB(A) $L_{Aeq,\ 15\ min}$. This is the adopted intrusive noise goal.
  Minimal potential for land use conflicts or land use incompatibility (noise issues). Development can take place with appropriate planning provisions.
  Potential noise issues are considered to be negligible in this zone.
  Received noise levels would be unlikely to be discernible by the average (reasonable) listener and therefore would not warrant further consideration.
- **Zone 2**: Moderate (khaki). This is based on areas with a potential received noise level between 35-40 dB(A). This is the zone between the adopted intrusive $L_{Aeq,\ 15\ min}$ noise design goal and the NSW INP recommended acceptable noise level $L_{Aeq,\ 9h}$ for a rural area (night time).
  Potential noise issues are marginal to moderate in this zone.
  Development may be able to take place with appropriate planning controls and options for active treatment to maintain internal noise levels.
  Zone 3. Provisional (orange). This is based on areas with a potential received noise level of between 40-45 dB(A) (industrial). This is the zone between the NSW INP recommended acceptable noise level ($L_{Aeq,\ 9h}$) for a rural area (night time) and recommended acceptable noise level for a suburban area ($L_{Aeq,\ 9h}$).
  This is also the area were road traffic noise levels may be greater than 60 dB(A) ($L_{Aeq,\ 15hr}$) and 55 dB(A) ($L_{Aeq,\ 9hr}$).
  The potential for internal noise levels greater than 35 dB(A) is also present in this area.

  Subject to the external noise level, building orientation and layout, provide mechanical ventilation / comfort condition systems to enable windows to be closed without compromising internal air quality / amenity. Upgraded façade elements may also be required (windows, doors, roof insulation) to provide further attenuation.

- Zone 4. Mitigation (red). This is based on areas with a potential received noise level of greater than 45 dB(A)(industrial).
  Noise levels in this area have the potential to result in land use issues.
  No residential development recommended without further site-specific (dwelling specific) acoustic assessments to confirm suitable dwelling design.
- Zone 5. Significant (magenta). This is based on areas with a potential received noise level of greater than 50 dB(A) (industrial).
  Noise levels in this area have the potential to result in land use issues.
  - No residential development recommended without further additional mitigation assessment to manage noise intrusion. External noise levels impacted by industrial noise.

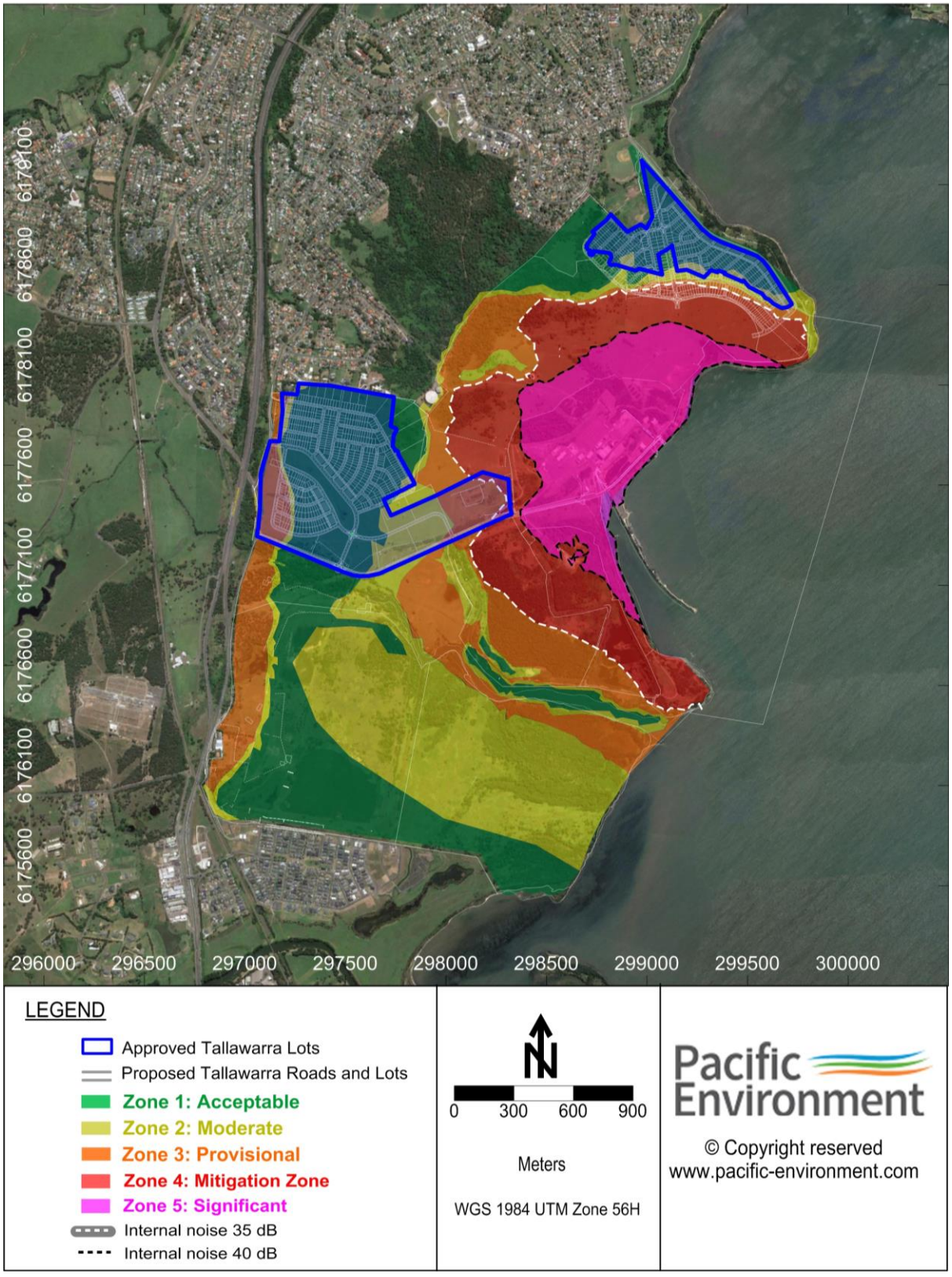


Figure 8-1: *Recommended buffer zones*

8.1 Outcome

Noise impacts within areas of the Northshore precinct and Central precinct have the potential to be at or above an $L_{Aeq, 15\ minute}$ noise level of 40 dB(A).

During the day time attended monitoring, the Tallawarra Power Station was observed at a noise level of approximately 38 dB(A) $L_{Aeq, 15\ minute}$ within the Northshore precinct. Within the Central precinct Tallawarra Power Station operations were not audible.

Low frequency components may be present for areas closest to the Tallawarra Power Station. The extent of potential annoying characteristics cannot be commented on at this stage.

Planning measures to mitigate or reduce potential land use conflicts for the new land to be added to the Northshore precinct (development options) include:

- Noise levels and associated attenuation should be re-evaluated as the development progresses southwards towards the Power Station(s). This will allow further refinement of received and potential noise levels as the built environment changes.
- Include a covenant on the title for properties with potential external noise levels above 40 dB(A) – this will make it clear to prospective purchasers that the land may be subject to noise impacts from the existing Tallawarra Power Station.
- Include provisions on the 88B Instrument for the design and construction of properties where internal noise levels have the potential to be above the recommendations of Australian Standard (2000), *AS2107 Acoustics – Recommended Design Sound Levels and Reverberation Times for Building Interiors.*
  At property mitigation can include measures to increase the acoustic performance of residences, with the focus to protect the internal amenity of the property. Upgrades to facades should be implemented on a case by case basis and would depend on proposed building layout and proposed design.

Although the application proposes to add residential uses to an area not currently approved for residential uses, and subject to 45 - 50 dB(A) noise levels from Tallawarra power station in the Northshore precinct, this new residential area proposed as part of the Northshore precinct will be able to comply with acceptable night time internal noise goals. These lots will be less noise affected than already approved parts of the central precinct and other development adjacent to major transport corridors.

9 References

Published documents relied upon as part of this study.

Australian Standard (1997), *AS1055.1 Acoustics – Description environmental noise – Part1: General procedures*

Australian Standard (2000), AS2107 *Acoustics – Recommended Design Sound Levels and Reverberation Times for Building Interiors*

Australian Standard (2000), AS2021 *Acoustics – Aircraft Noise Intrusion – Building Siting and Construction*

Energy Australia (2017) *EPA MONTHLY MONITORING 2017 January* (unreferenced) – measurements taken in 2016

NSW Department of Environment Climate Change and Water (2011), *Road Noise Policy*

NSW Department of Planning and Environment (2008), *Development of New Rail Corridors and Busy Roads – Interim Guideline* (interim guideline)

NSW Department of Planning and Environment (2007), *State Environmental Planning Policy (Infrastructure) 2007* (Infrastructure SEPP)

NSW Department of Planning and Environment (2017), *Tallwarra Concept Plan (MP 09_0131 Mod 1)*

NSW Environmental Protection Authority (2000), Industrial Noise Policy

NSW Environmental Protection Authority (2013), Rail Infrastructure Noise Guideline

NSW Environmental Protection Authority (2016), *Environment Protection Licence for Tallawarra Power Station* (Licence number: 555; Licensee Energy Australia Tallawarra Pty Limited)

NSW Environmental Protection Authority (1999), Environmental Criteria for Road Traffic Noise

Peter R Knowland & Associated Pty Ltd (2011) *Acoustic Report Northern Residential Precinct Tallawarra Lands Part 3A* (211 106 R01 v1-1 Acoustic report)

Renzo Tonin & Associates (2015) *Albion Park Rail ByPass Noise and Vibration Assessment* (TH508-01F02 NV Assessment (r5)

Sinclair Knight Mertz (undated) *Environmental Assessment Tallawarra Stage B Power Station Appendix E Noise Assessment (unreferenced)*

SKM (2011) *Tallawarra Lands Part 3A Concept Plan* Application (EN02773, Final v5) – measurements taken in 2010

Appendix A

Acoustic terminology

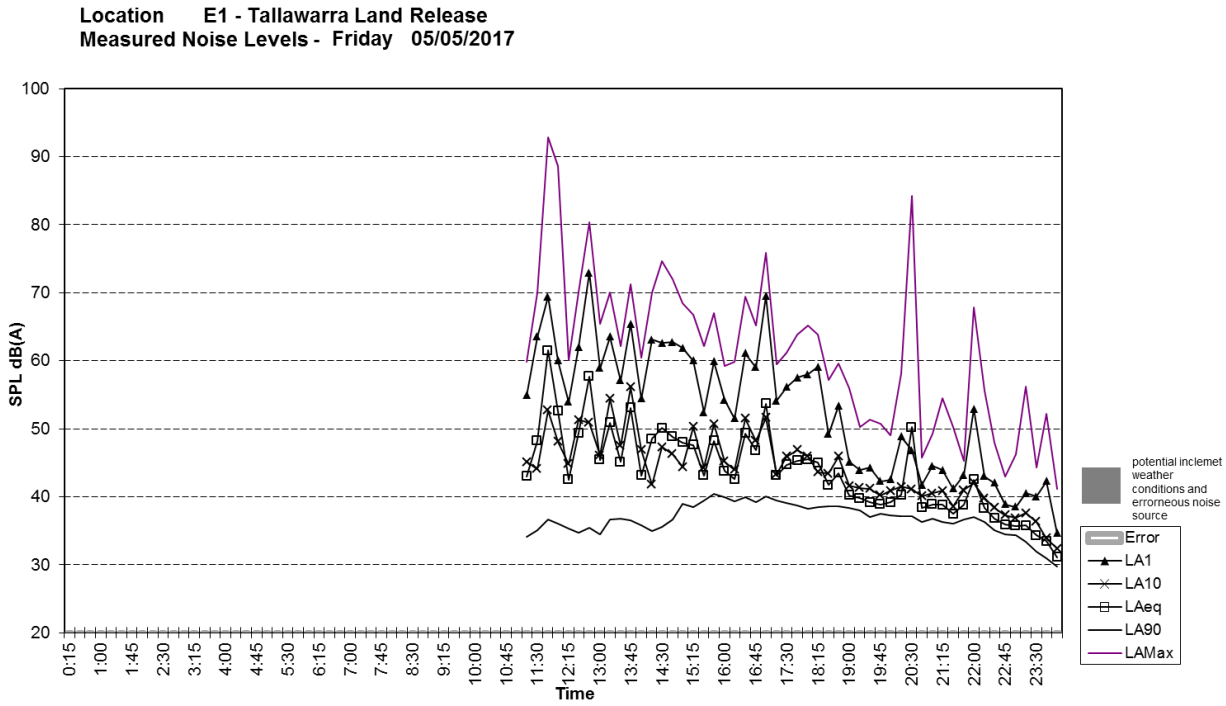
Acronyms, Abbreviations, Glossary

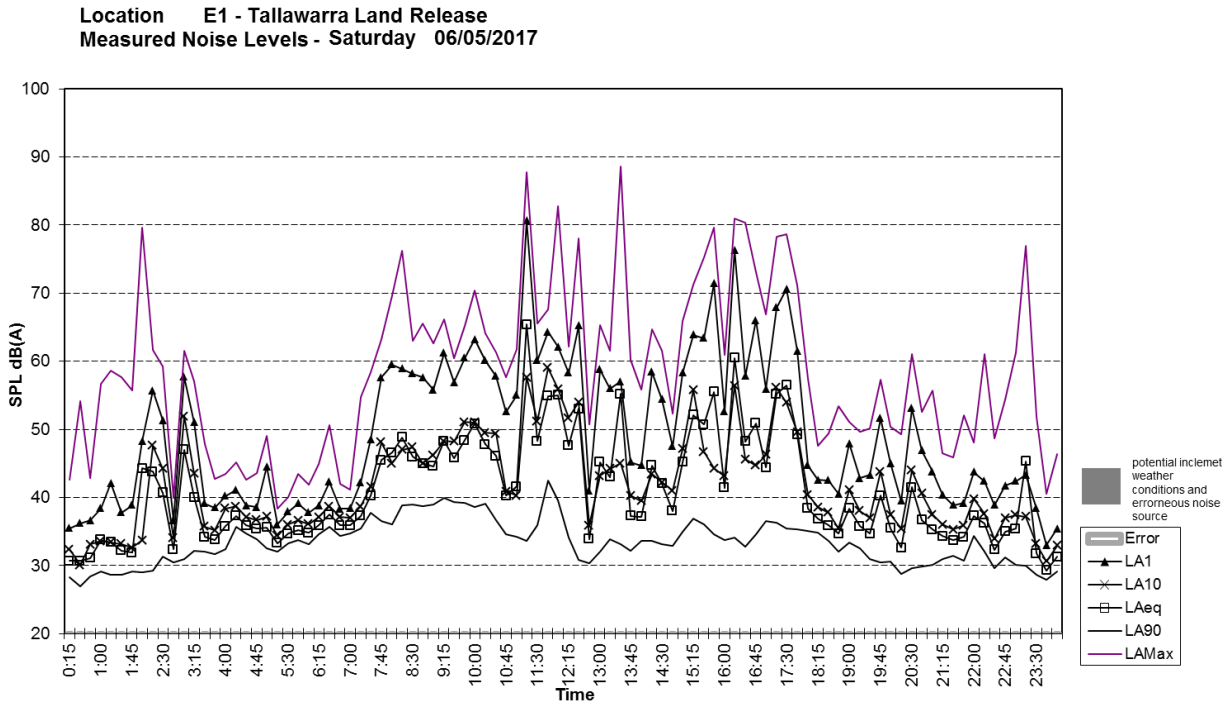
Term	Description
Adverse weather	Weather conditions that affect noise measurements (wind, rain and temperature inversions) that occur at a particular site for a significant period of time. The maximum wind speed allowed during acoustics measurements are in process is 5m/s at microphone height. No rain is allowed.
Ambient noise	The all-encompassing noise environment at a given location, made up of many sources in the near and far field.
Assessment period	The period in a day over which assessments are made.
A-weighting	Adjustment made to a noise level based on international standards. Approximates a human's hearing response to frequency at lower sound levels.
Background noise	Background noise is the term used to describe the underlying level of noise present in an area, measured in the absence of any extraneous noise. Typically when measured with a sound level meter is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period (LA90,T).
dB	Decibel, the logarithmic ratio of a given sound pressure to a reference pressure.
dB(A)	A-weighted decibels.
dB(C)	C-weighted decibels.
DECC	Department of Environment and Climate Change (now EPA)
DP&I	(NSW) Department of Planning and Infrastructure
EA	Environmental Assessment
EPA	Environment Protection Authority
Feasible and reasonable	Consideration of best practice taking into account the benefit of proposed measures and their technological and associated operational application in the NSW and Australian context. Feasible relates to engineering considerations and what is practical to build. Reasonable relates to the application of judgement in arriving at a decision, taking into account mitigation benefits and cost of mitigation versus benefits provided, community views and nature and extent of potential improvements..
Free-field	A sound field where the effects of reflection are negligible throughout the region of interest.
Heavy vehicle	A truck or other vehicle with either two or three axles, two groups or three or more axles, more than two groups.
INP	Industrial Noise Policy (EPA 2000)
Light vehicle	Passenger vehicles (cars, vans, utilities, motorcycles etc.).
$L_{A90,T}$	The noise level exceeded for 90% of the time period, T. Commonly referred to as the background noise level.
$L_{Aeq,T}$	The A-weighted equivalent continuous average sound pressure level of the time period, T. Excludes other noise sources such as from industry, road, rail and the community.
$L_{Amax,T}$	The A-weighted maximum noise level measured during the period, T, measured using the fast time weighting on a sound level meter.
RBL	Rating Background Level. The background noise level is the medium value of the ABL values for the period over all of the measurement days. RBL calculated for each period, day, evening or night.

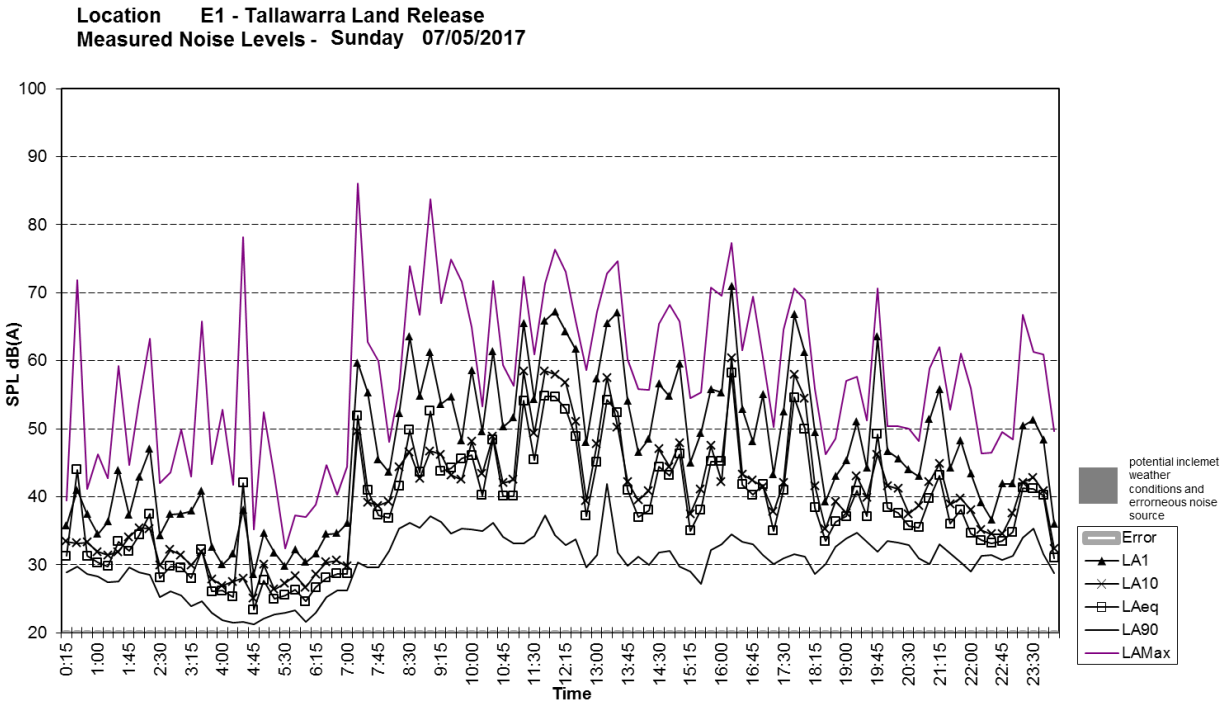
Term	Description
RING	Rail Infrastructure Noise Guideline (EPA 2013)
RNP	NSW Road Noise Policy (DECCW, 2011)
Sound Pressure Level (SPL)	Is the difference between the pressure produced by a sound wave and the barometric (ambient) pressure at the same point in space. Typically expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound Power Level (Lw)	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power. Typically associated with noise sources.

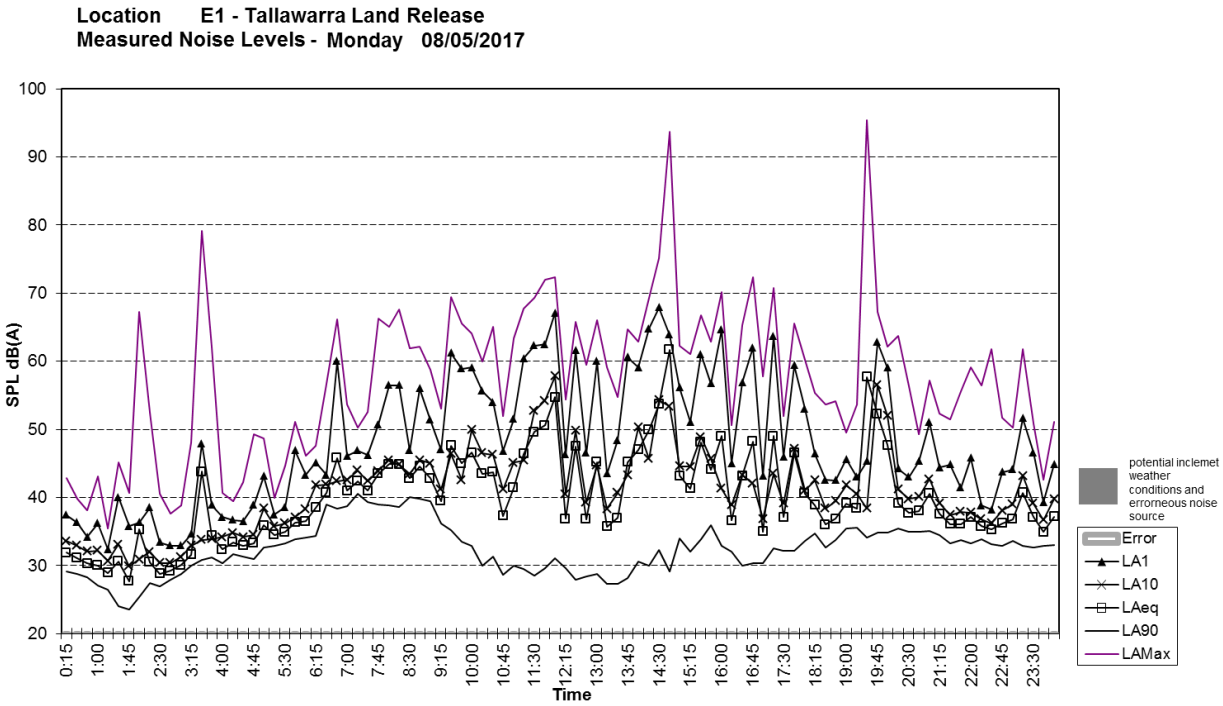
Appendix B

Daily noise logger graphs

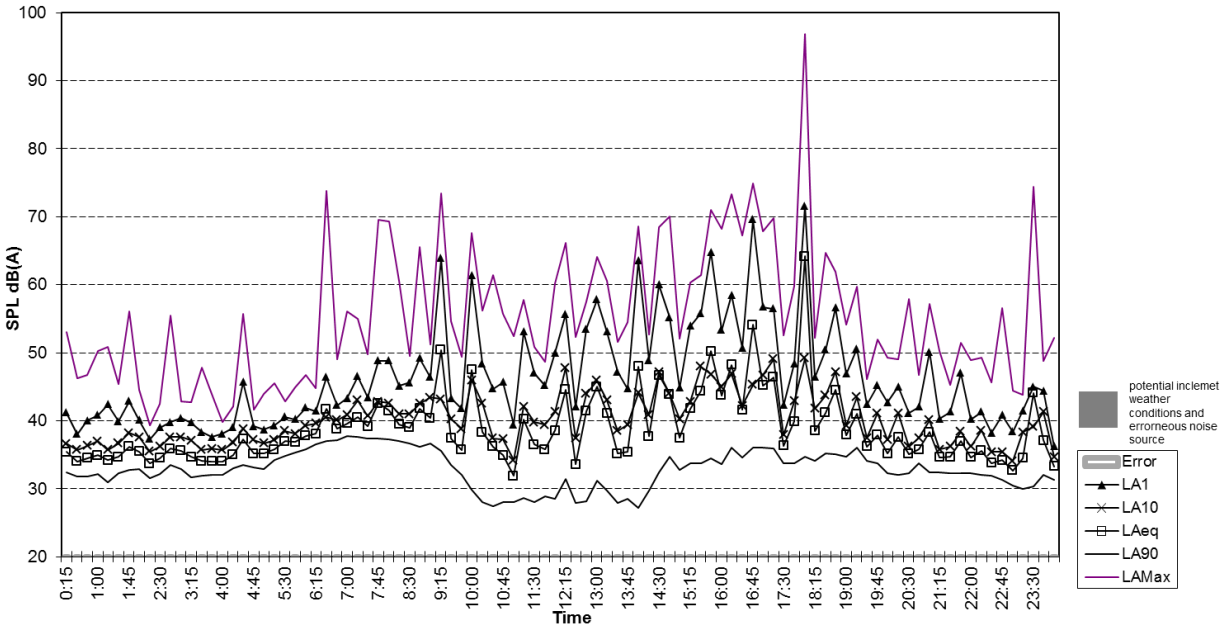








Location E1 - Tallawarra Land Release
Measured Noise Levels - Tuesday 09/05/2017



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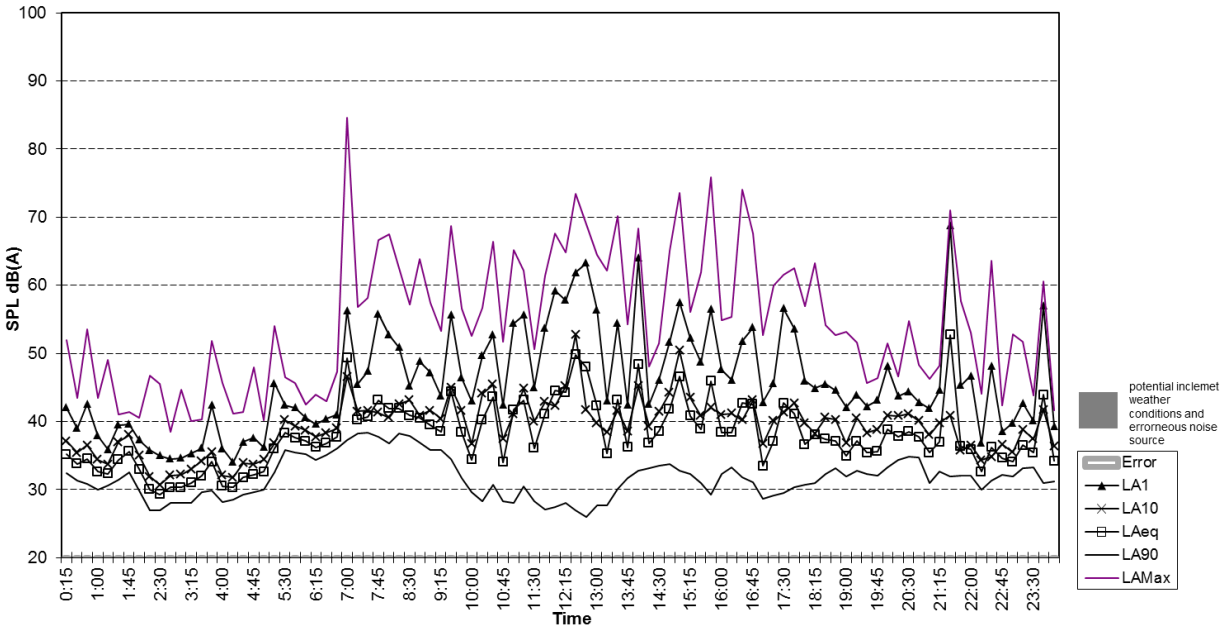
Measured Noise Levels - Wednesday 10/05/2017



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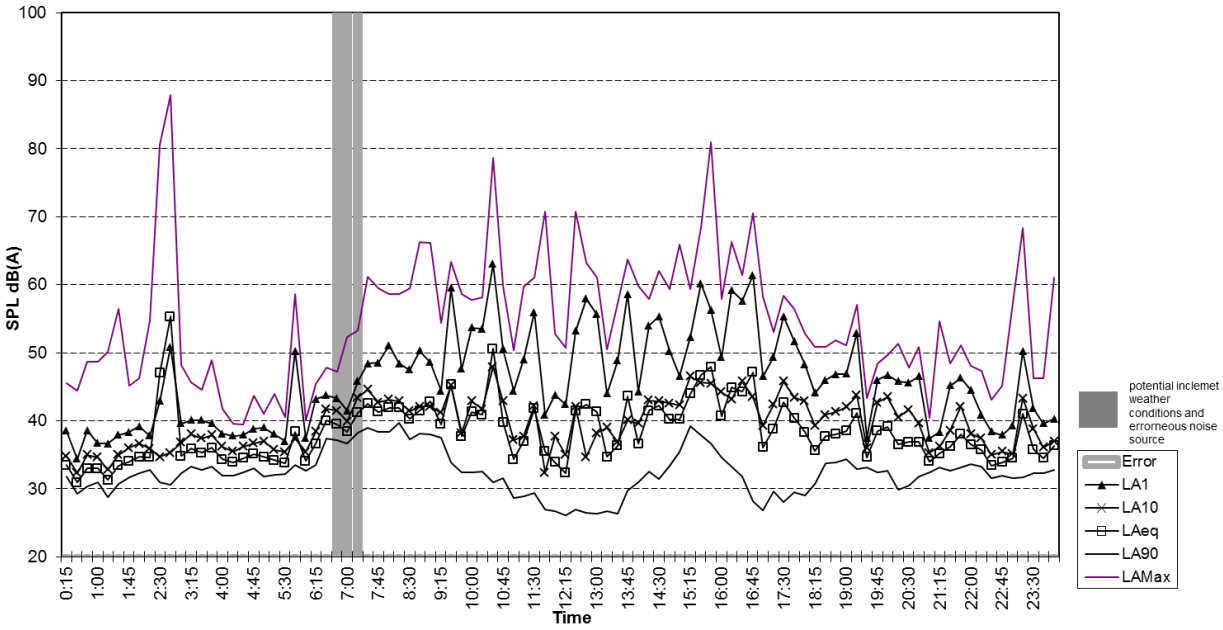
Measured Noise Levels - Thursday 11/05/2017



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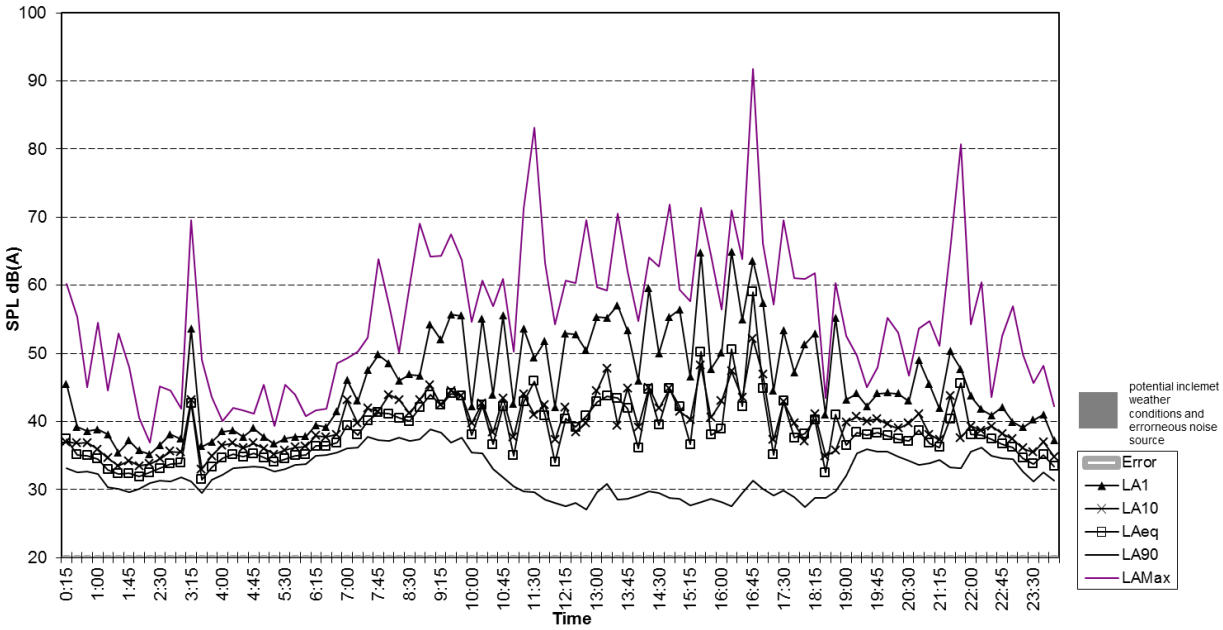

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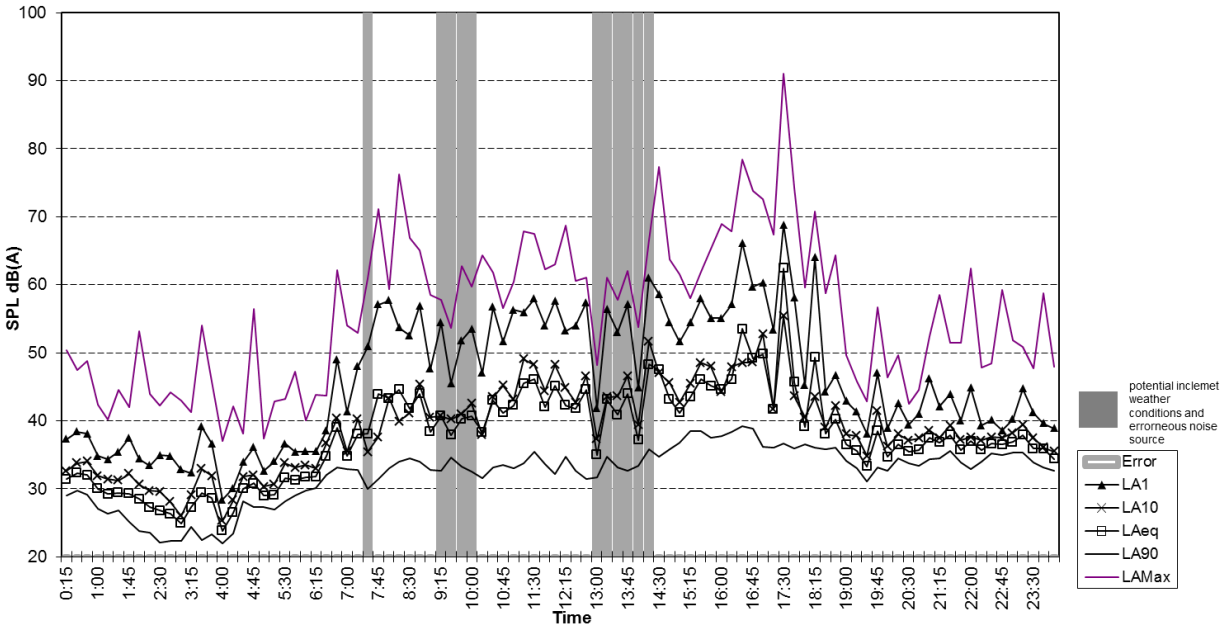

Location E1 - Tallawarra Land Release
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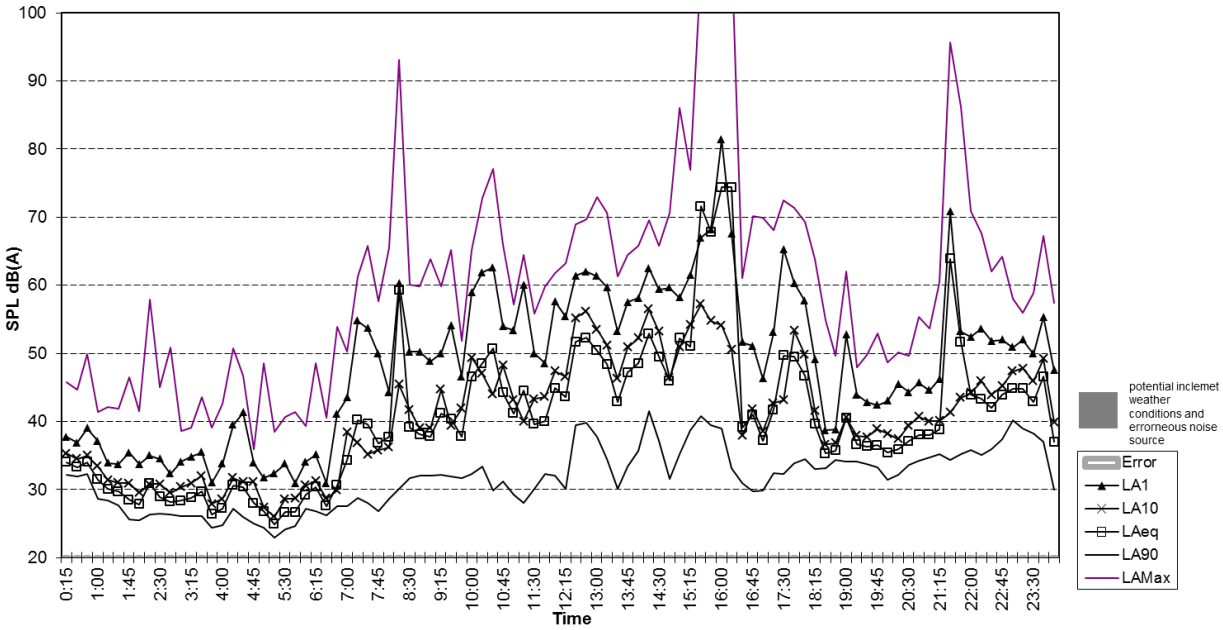

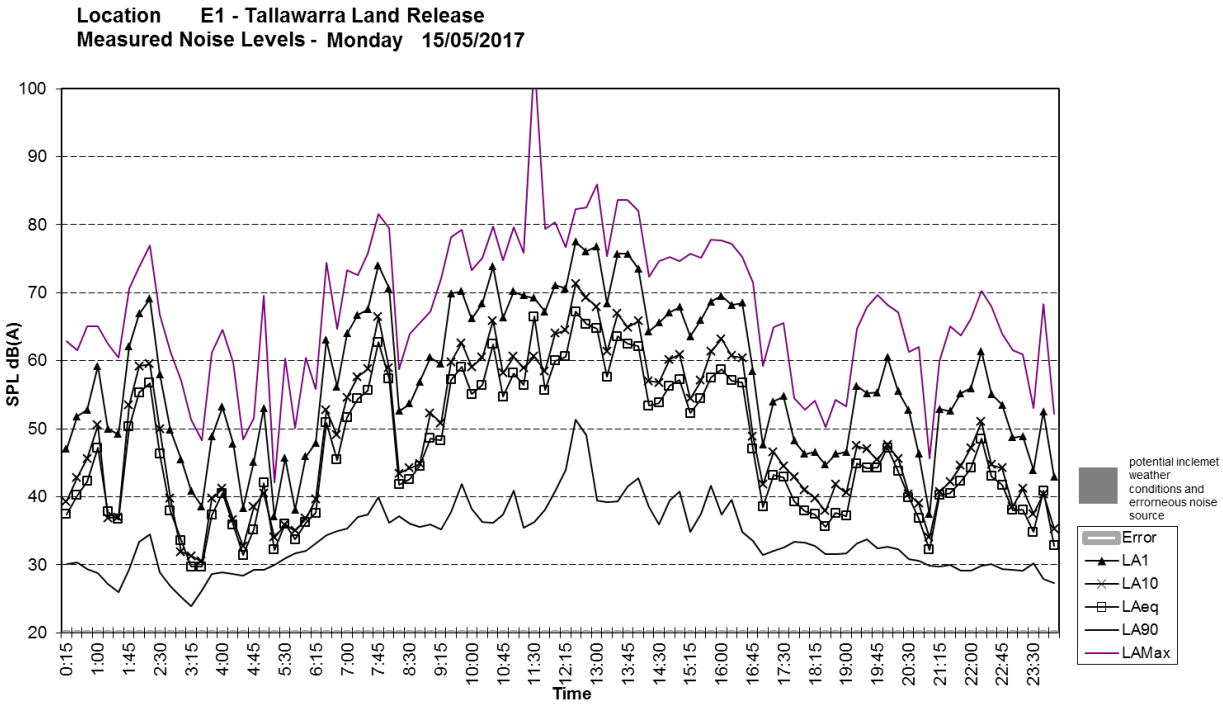

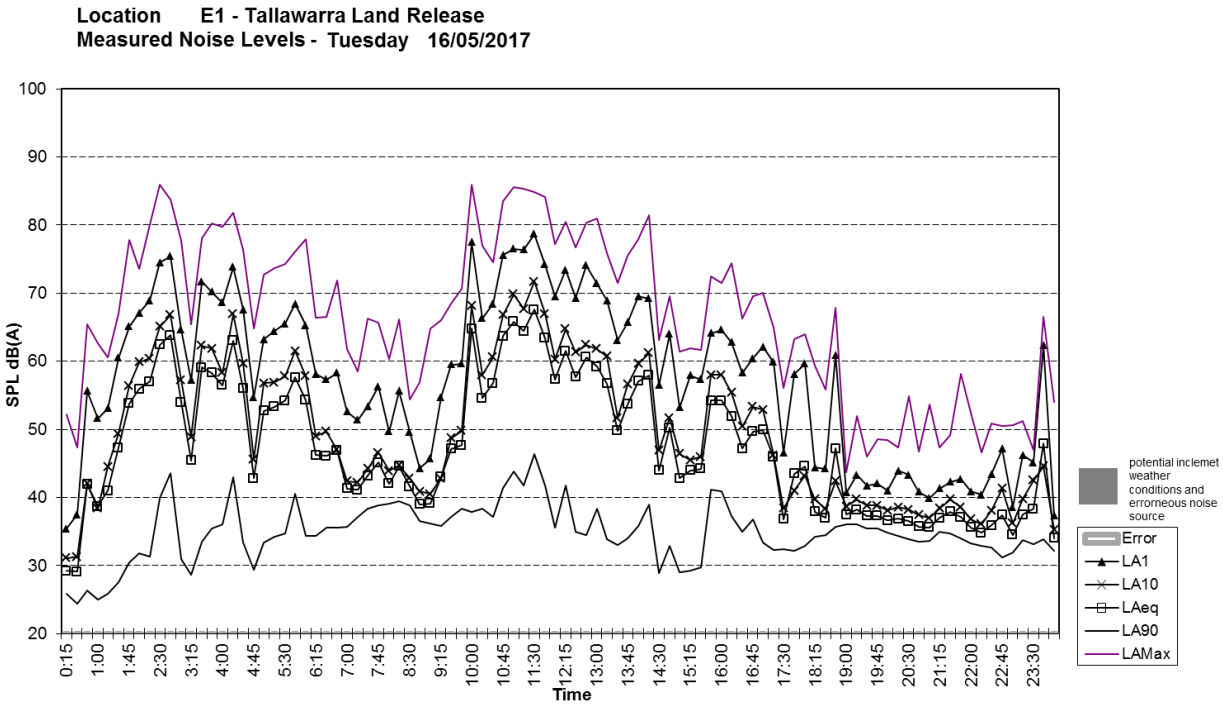

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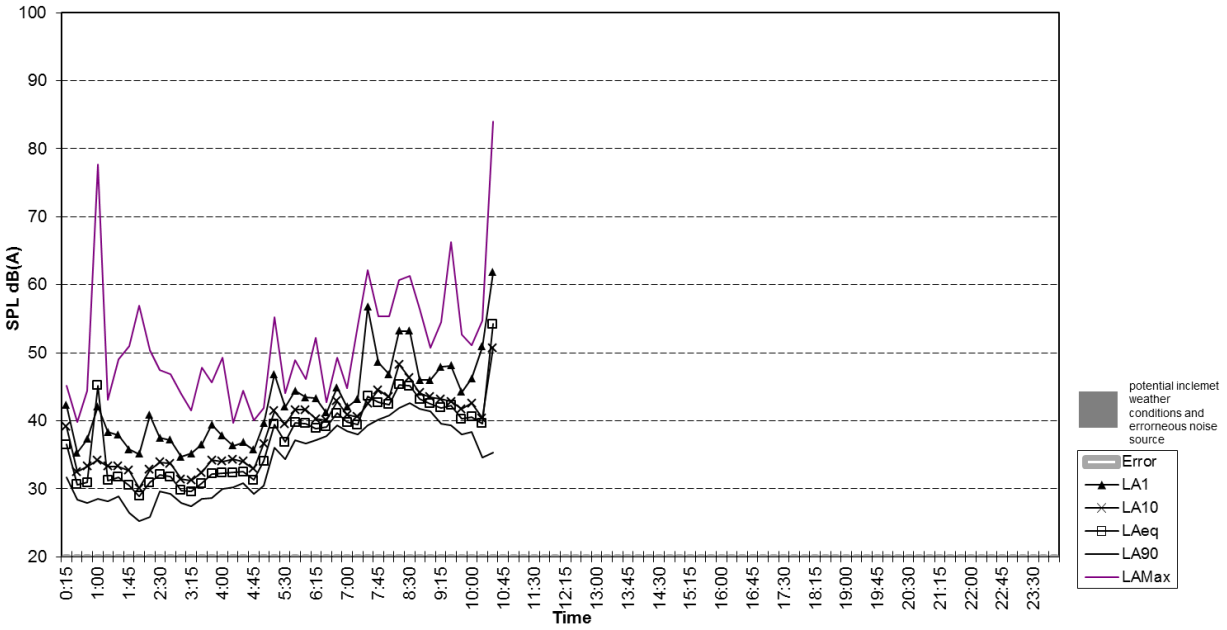

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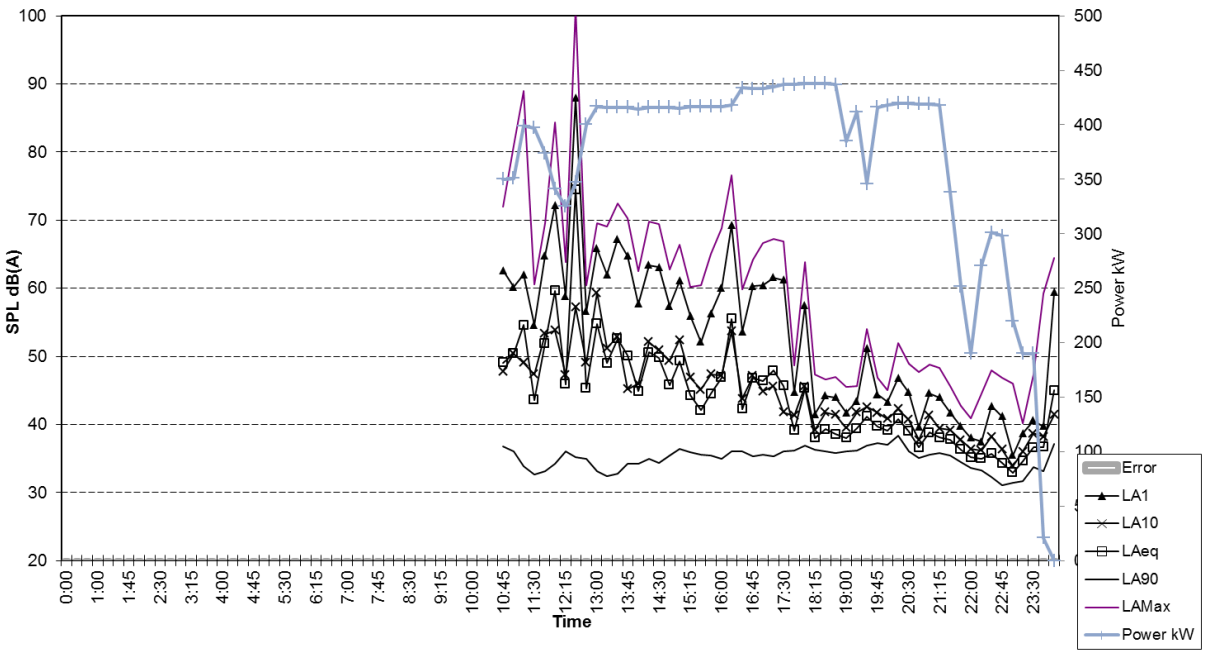
Measured Noise Levels - Friday 05/05/2017



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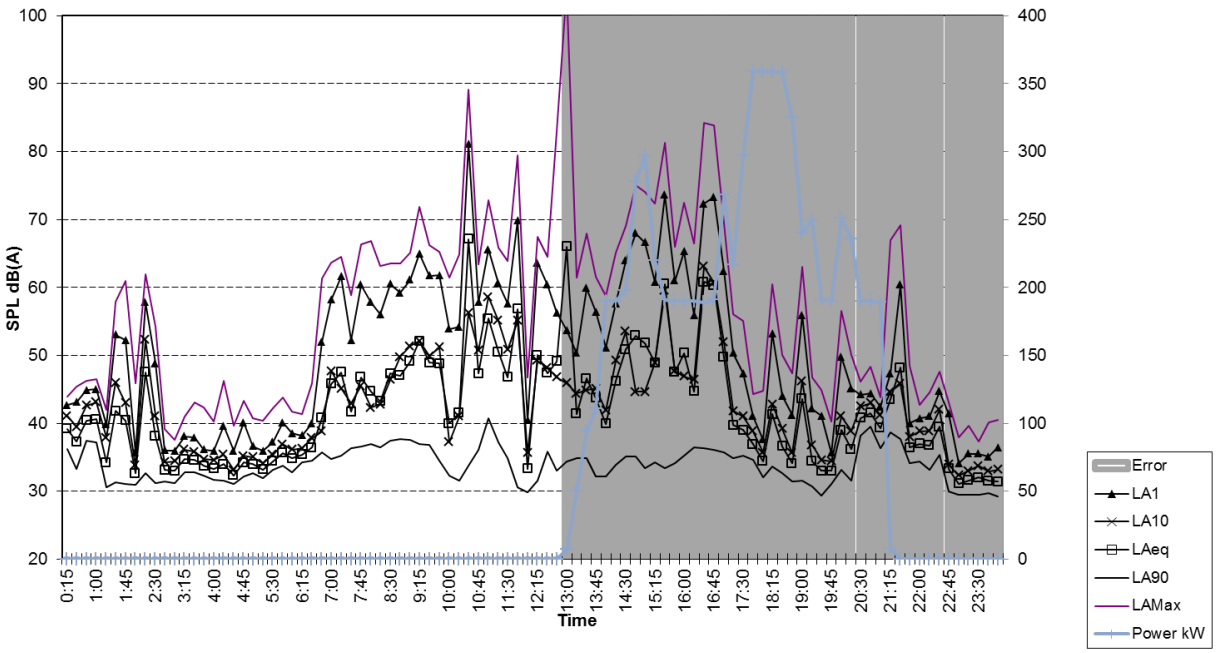

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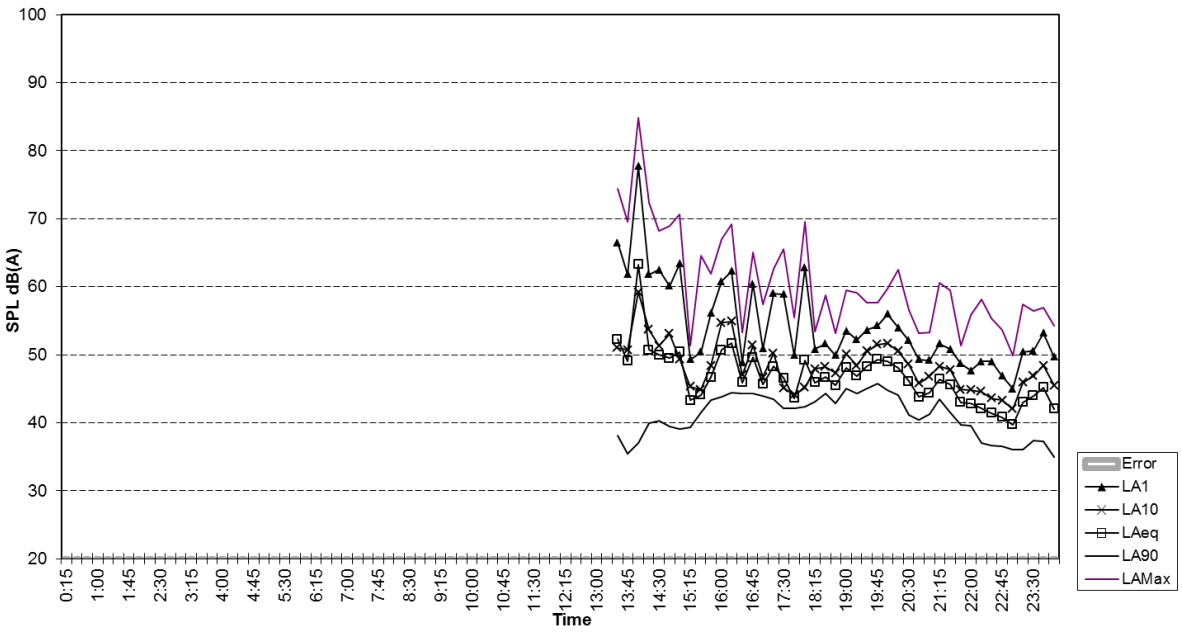

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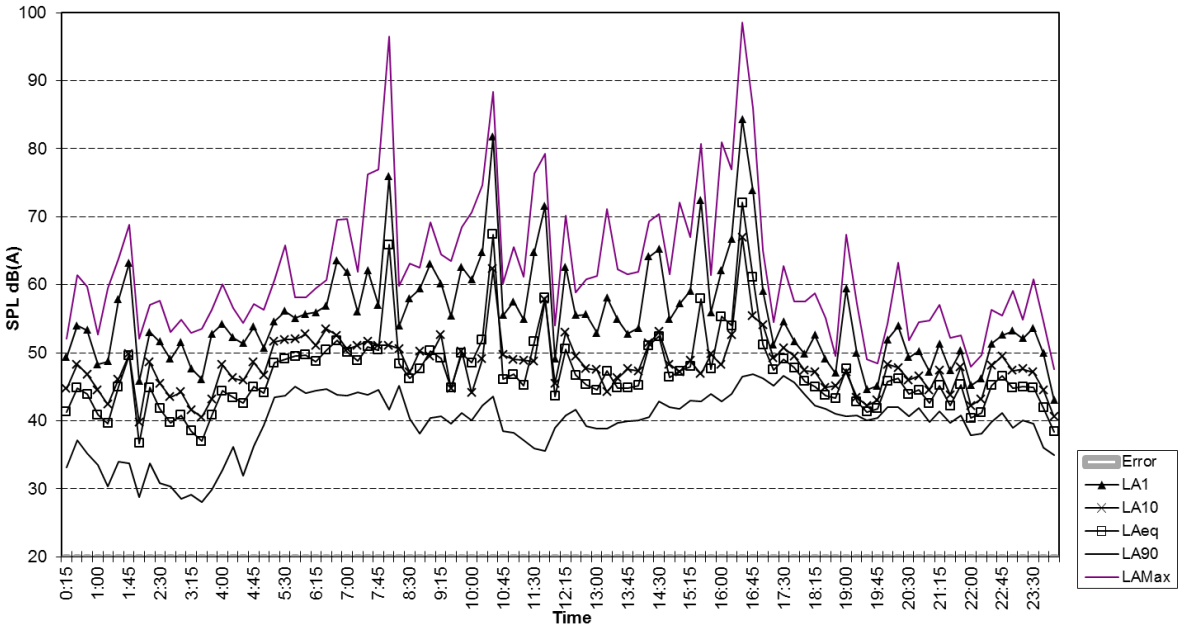
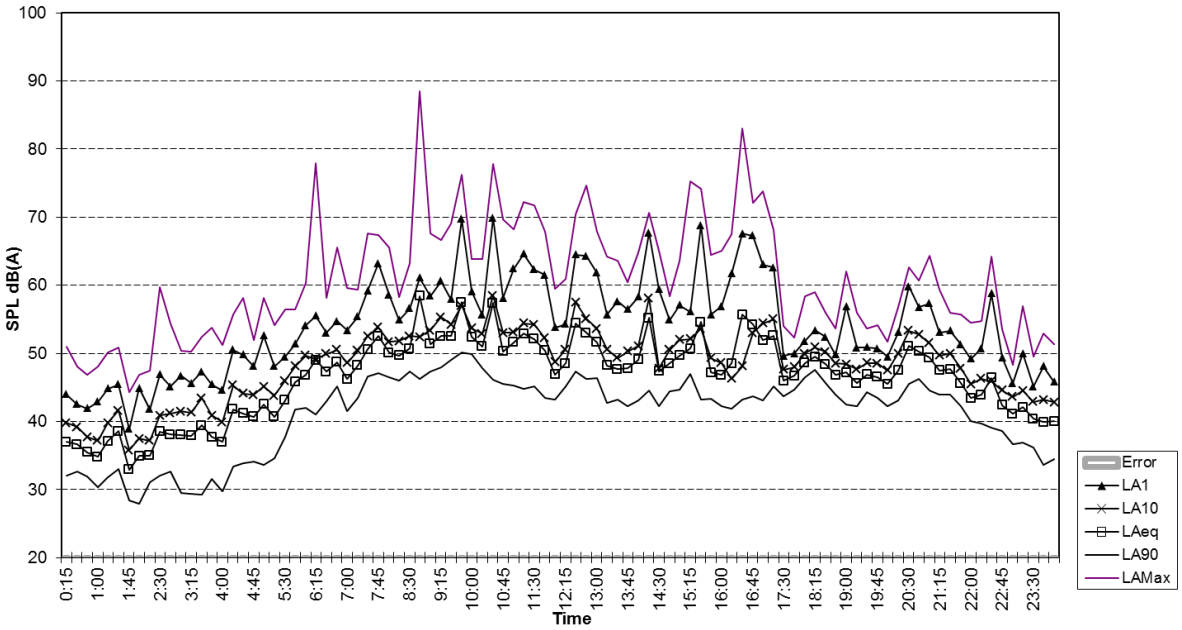
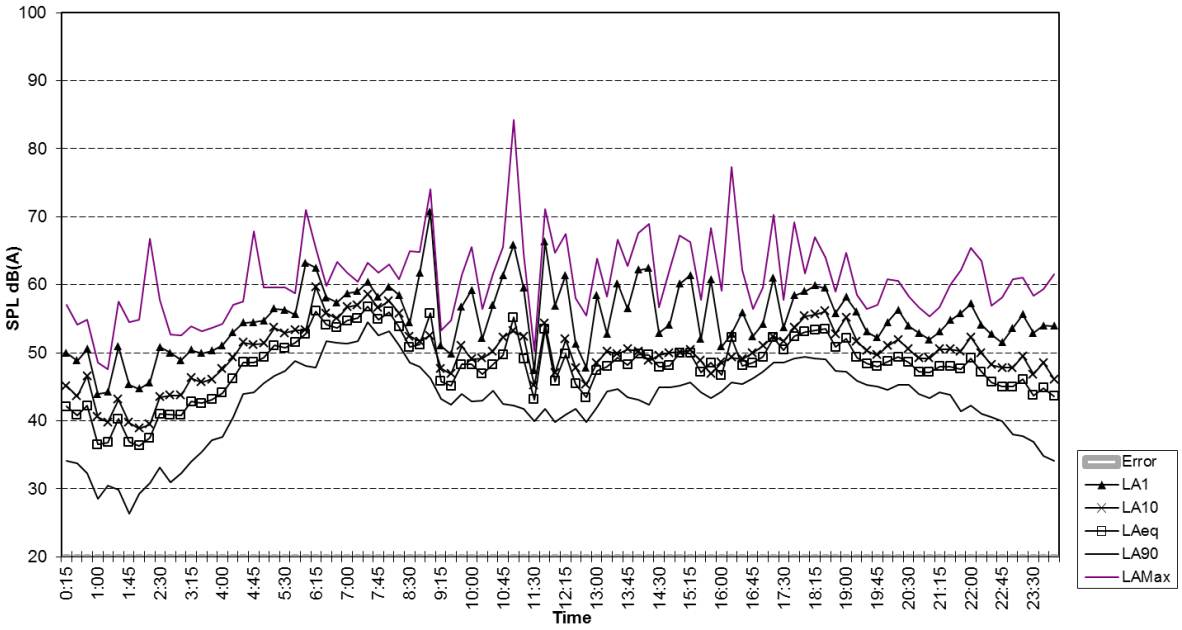


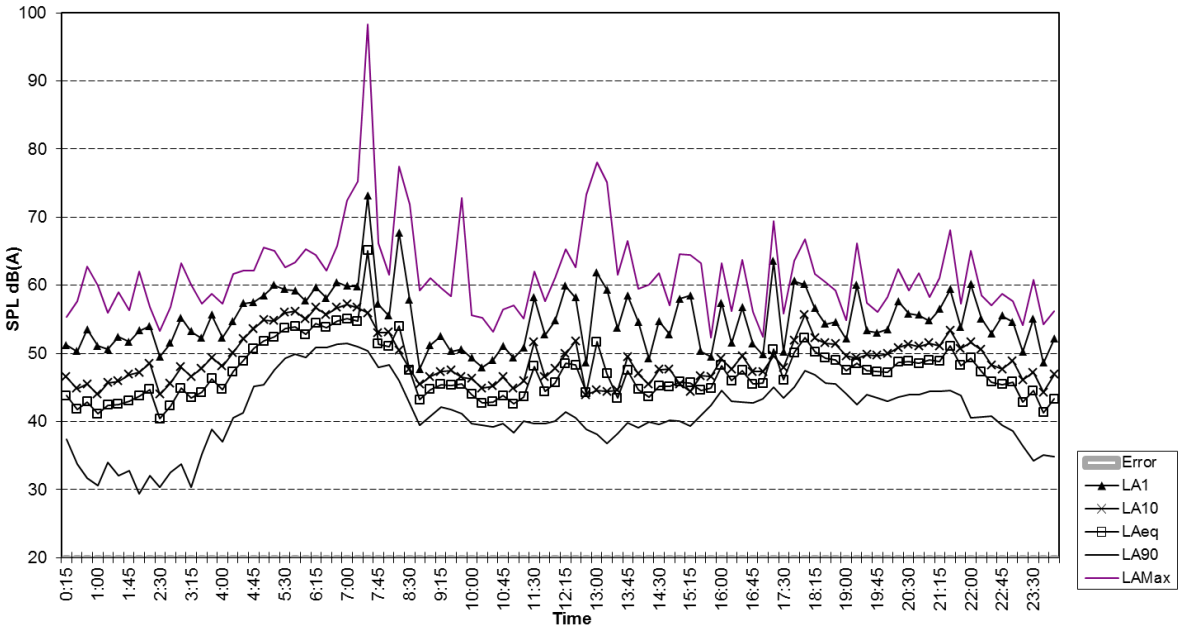
Location W1 - Tallawarra Land Release
Measured Noise Levels - Sunday 07/05/2017



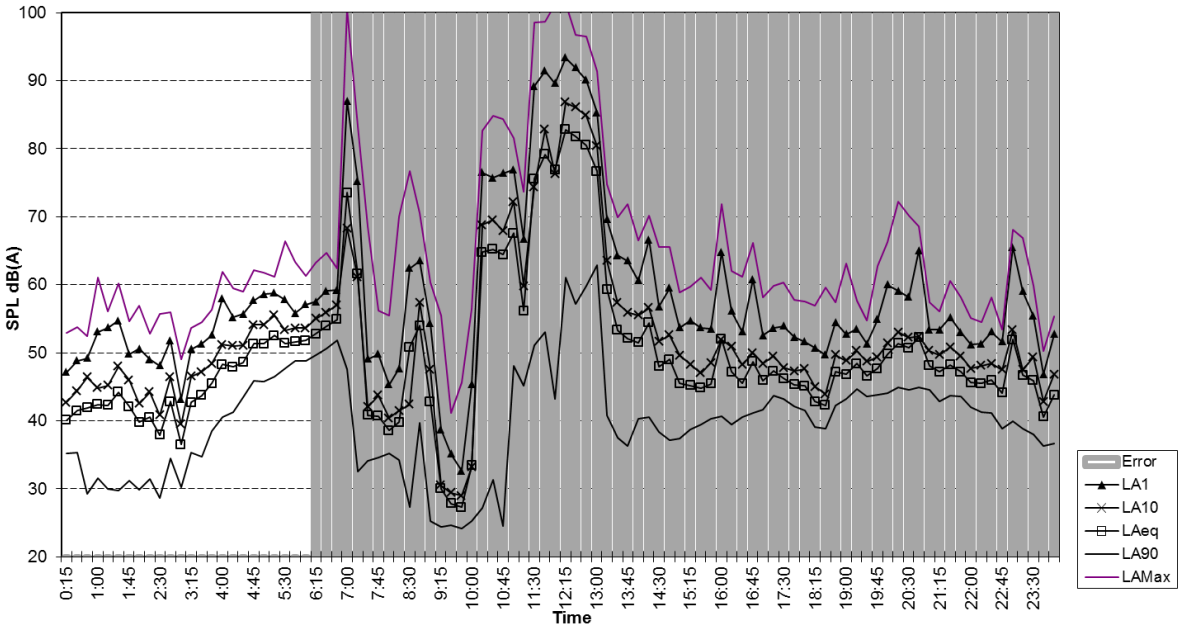
Location W1 - Tallawarra Land Release
Measured Noise Levels - Monday 08/05/2017



Location W1 - Tallawarra Land Release
Measured Noise Levels - Tuesday 09/05/2017



Location W1 - Tallawarra Land Release
Measured Noise Levels - Wednesday 10/05/2017



Location W2 - Tallawarra Land Release
Measured Noise Levels - Friday 05/05/2017