RENZO TONIN & ASSOCIATES
inspired to achieve

Acoustics
Vibration
Structural Dynamics

CORRIMAL COKE WORKS STAGE 2A BUILT FORM

Noise and Vibration Report for SSDA

10 November 2025

Legpro 70 Pty Ltd ATF Legpro Unit Trust c/- Legacy Property c/- Chester Project Management Pty Ltd

TK577-14F03 Stage 2a Built Form (r2)

40 YEARS 1982-2022 ACOUSTIC ENGINEERING EXCELLENCE

Sydney Melbourne Brisbane Gold Coast Canberra Kuwait Singapore
Renzo Tonin & Associates ABN 29 117 462 861
Level 1/418A Elizabeth St SURRY HILLS NSW 2010 | PO Box 877 STRAWBERRY HILLS NSW 2012
P (02) 8218 0500 F (02) 8218 0501 sydney@renzotonin.com.au www.renzotonin.com.au

Document details

Detail	Reference
Doc reference:	TK577-14F03 Stage 2a Built Form (r2)
Prepared for:	Legpro 70 Pty Ltd ATF Legpro Unit Trust c/- Legacy Property c/- Chester Project Management Pty Ltd
Address:	PO Box 302 Turramurra NSW 2074
Attention:	Harrison Morgan

Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Reviewed / Authorised
20.10.2025	Draft	0	1	C. Chan	-	M. Gange
10.11.2025	Incorporate planner comments	-	2	C. Chan	-	M. Gange

File Path: R:\AssocSydProjects\TK551-TK600\TK577 mg Corrimal Cokeworks\Task 14 - Stage 2 SSDA\1 Docs\TK577-14F03 Stage 2a Built Form (r2).docx

Executive summary

This Noise and Vibration report has been prepared by Renzo Tonin & Associates to accompany a State Significant Development Application (**SSDA**) which seeks development consent for the construction of four (4) residential flat buildings, providing a total of 206 x residential apartments (including 57 affordable housing apartments).

The SSDA is referred to as the Stage 2a Built Form SSDA (SSD-83789711).

The Stage 2a Built Form SSDA implements the second built form stage of the urban renewal of the former Corrimal Coke Works site. The project will deliver vibrant and contemporary residential-led urban renewal, which celebrates the site's industrial history and leverages its highly accessible and strategic location in proximity to Corrimal town centre and local amenities and services. The proposal will deliver high amenity residential dwellings of various sizes and typologies, including a dedicated affordable housing building.

The Stage 2a Built Form SSDA is submitted concurrently with a separate (but interrelated) Stage 2-4 civil works SSDA (SSD-86131212), which comprises the construction of the Central Park, the Southern Park, and roads, drainage and stormwater infrastructure, and paper subdivision.

This Noise and Vibration report has been prepared to address the requirements of Item 10 of the SEARS which is reproduced below.

> ***10. Noise and Vibration***
>
> - *Provide a noise and vibration impact assessment prepared in accordance with the relevant NSW Environmental Protection Authority (EPA) guidelines. The assessment must detail construction and operational noise and vibration impacts on nearby sensitive receivers and structures and outline the proposed management and mitigation measures that would be implemented.*

This Stage 2a Built Form SSDA was declared as State Significant Development (**SSD**) in the State Significant Development Declaration Ministerial Order (No 10) 2025 (dated 30 June 2025) at Clause 5(1)(n) in Schedule 1 (Amendment SSD Declaration Order 2025 (No 5))."

Impact onto development

Section 3 of this report is an assessment of road and rail noise impact onto the proposed residential development. Noise mitigation has been recommended in the form of acoustic facade treatments to the residential flat buildings and mechanical ventilation to satisfy the internal noise criteria set out in the NSW *State Environmental Planning Policy (Transport and Infrastructure) 2021*.

Section 4 is an assessment of potential vibration impact from train pass-bys to the residential development. The assessment found ground-borne vibration to satisfy the tactile vibration criteria set

out in British Standard BS 6472:1992 *Evaluation of Human Exposure to Vibration in Buildings (1Hz to 80Hz)* and the *NSW Assessing Vibration – A Technical Guideline ("AVTG") (DEC, 2006)*. Regenerated (ground-borne) noise from train pass-bys was also found to satisfy the internal noise criteria for set out in the NSW *Development near Rail Corridors and Busy Roads – Interim Guideline* ("the Interim Guideline") (Department of Planning, 2008).

Section 5 considers noise from the railway level crossing and operation of train horns. Train horns were found to have the greater impact and an assessment of potential sleep disturbance was undertaken. It is concluded that noise levels inside residential apartments would be below 50dB(A) and therefore sleep disturbance is unlikely.

Section 6 sets out noise emission goals, in accordance with the NSW Protection of the Environment Operations (Noise Control) Regulation 2017, for mechanical plant servicing the Stage 2a residential flat buildings. As the selection and location of plant have not been finalised at the SSDA stage, this report provides in-principle noise mitigation measures. The consideration of mechanical plant selection, specific locations for plant items and any noise controls (if required) are to be confirmed at detailed design stage.

Section 7 considers noise and vibration impact to surrounding receivers during the construction phase of the development. Nosie mitigation in the form of temporary hoardings / barriers along the site boundary have been considered to minimise noise impacts. Potential vibration impacts have been assessed and vibration monitoring has been recommended upon construction commencement to determine site specific buffer distances for sensitive receivers and heritage items.

Contents

List of tables

List of figures

1 Introduction

1.1 Purpose of this report

Renzo Tonin & Associates was engaged to undertake a noise and vibration assessment of the Stage 2a built form development at the Corrimal Coke Works site (27 Railway Street, Corrimal). This noise and vibration report serves to support the State Significant Development Application relating to the proposed development (SSD-83789711).

This assessment has been prepared to address the Planning Secretary's Environmental Assessment Requirements ("SEARs") and NSW EPA requirements. As part of preparing this assessment of noise and vibration impacts, the following policies, guidelines, and standards have been considered:

- NSW *Noise Policy for Industry* ("NPfI") (EPA, 2017)
- NSW *Road Noise Policy* ("RNP") (DECCW, 2011)
- NSW *State Environmental Planning Policy (Transport and Infrastructure) 2021* ("Transport and Infrastructure SEPP")
- NSW *Development near Rail Corridors and Busy Roads – Interim Guideline* ("the Interim Guideline") (Department of Planning, 2008)
- NSW *Interim Construction Noise Guideline* ("ICNG") (DECCW, 2009)
- NSW *Assessing Vibration – A Technical Guideline* ("AVTG") (DEC, 2006)

APPENDIX A contains a glossary of acoustic terms used in this report.

1.2 Project description

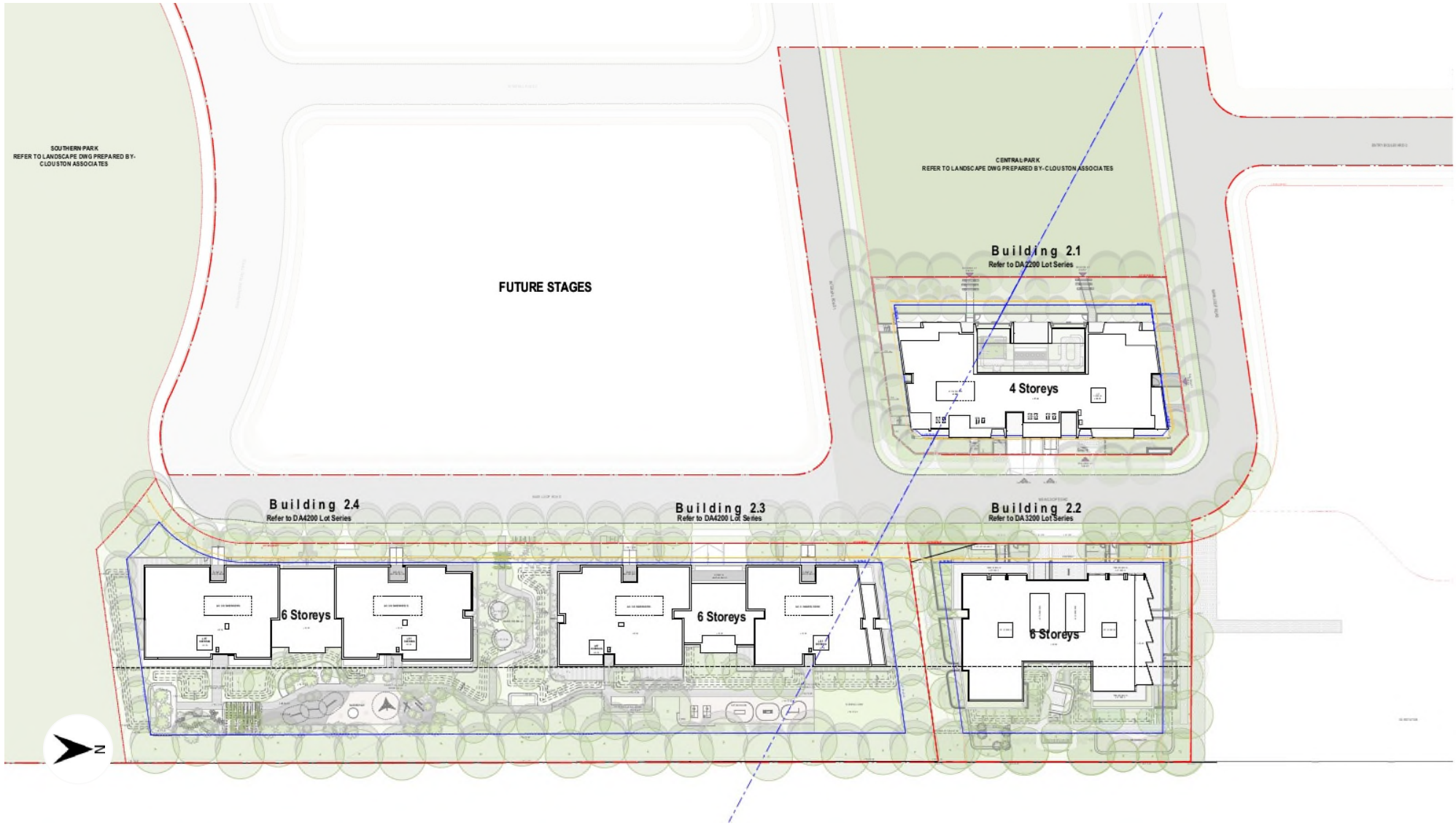
The former Corrimal Coke Works site is located at 27 Railway Street, Corrimal which is bound by:

- Memorial Drive to the west which is a four-lane divided road;
- South Coast Rail Line to the east which carries both passenger and freight trains;
- Railway Street to the north which is a two-lane undivided road; and
- Towragdi Creek to the south. Further to the south are existing residential properties fronting Carr Street, Towragdi.

At the present time, the site is mostly vacant as demolition of the former coke work production plant (except for structures that are being retained for heritage purposes such as the C1N Stack, C1 Coke Oven Battery, Brick Stack and Powerhouse building) (DA-2022/1249) has been completed.

We are advised that the redevelopment of the Corrimal Coke Works site into a residential precinct will be over four stages. This report relates to the SSDA of Stage 2a which is located towards the eastern side of the site and will comprise of four residential flat buildings. Figure 1-1 presents an extract of the Stage 2a Site Plan prepared by DKO Architecture (NSW) Pty Ltd (project no. 13687, drawing no. DA1104, revision A, dated 8 September 2025) which illustrates the layout of the Stage 2a residential flat buildings.

Figure 1-1: Extract of Stage 2a site plan



1.3 Assessment objectives

The assessment objects are to:

- Determine the potential levels of impact from the intrusion of road and rail traffic noise / vibration into the apartments of the Stage 2a residential flat buildings, and acoustic facade treatments (if any) to enable compliance with the current NSW requirements.

- Determine the potential levels of noise and vibration impacts from the construction of the Stage 2a built form to the surrounding residential receivers and the heritage structures within the Corrimal Coke Works site, and noise mitigation / management measures to minimise any potential impacts.

- Establish criteria for operational noise from the development (ie. mechanical plant / equipment servicing the Stage 2a residential flat buildings) with respect to future residential receivers within the Corrimal Coke Works site, as well as existing sensitive receivers surrounding the site.

This assessment refers to measurements of the existing ambient background and traffic noise / vibration levels undertaken for previous stages of the Corrimal Coke Works site.

Three-dimensional noise modelling software was used to create a noise model of the Project to predict road and rail traffic noise levels external to the Stage 2a residential apartment buildings and assess the requirements for acoustic facade treatments, and noise emission from construction of the built form to surrounding residential receivers.

2 Summary of existing ambient noise monitoring

Criteria for the assessment of operational and construction noise are usually derived from the existing noise environment of an area. To determine the ambient background and traffic noise levels of the area and establish operational / construction noise criteria, this assessment relies upon previous long-term noise measurements conducted for the planning proposal to rezone the former Corrimal Coke Works site and enable residential development (PP-2021-472).

For the planning proposal, an assessment of noise and vibration impacts onto the Corrimal Coke Works site from the adjacent South Coast Rail Line corridor and surrounding road network was undertaken in accordance with the NSW State Environmental Planning Policy (Infrastructure) 2007 ('ISEPP') to determine any potential constraints with rezoning the site for residential use[1]. As part of the planning proposal assessment, long-term noise monitoring was conducted at three residential premises surrounding the Corrimal Coke Works site (Locations N1 – N3) between 12 November and 20 November, 2018 to quantify the existing background noise levels and ambient L_{eq} noise levels from road / rail traffic.

Additional long-term noise monitoring was conducted between 25 June and 7 July, 2025 to confirm rail traffic noise intrusion levels for Stage 1 of the Corrimal Coke Works site[2]. The monitoring was conducted adjacent to the eastern boundary of the Stage 1 area (Location N4) to capture ambient background noise levels and rail traffic noise associated with trains arriving / departing Corrimal Station.

2.1 Measurement locations

The long-term noise monitoring locations are described in Table 2-1 and presented in Figure 2-1.

Table 2-1: Long-term noise monitoring locations

ID	Location	Description
N1	60 Duff Parade, East Corrimal	The monitor was located approximately 22m to the east of the rail line. The acoustic environment was controlled by rail noise from passing trains, and by distant road traffic noise at other times.
N2	33 Railway Street, Corrimal	The noise monitor was located on the front veranda of the property approximately 20m from Railway Street. The acoustic environment was controlled by road traffic noise from Railway Street and Memorial Drive.
N3	12 Carr Street, Towradgi	The noise monitor was located approximately 90m east of Memorial Drive. The acoustic environment was controlled by road traffic noise from Memorial Drive, with occasional passing passenger and freight trains also audible.

[1] Renzo Tonin & Associates, *Corrimal Coke Works rezoning – Environmental noise and vibration assessment*, ref: TK577-01F03 Corrimal acoustic and vibration assessment (r4), dated 20 May 2019

[2] Renzo Tonin & Associates, *Corrimal Coke Works – Stage 1 DA acoustic and vibration assessment*, ref: TK577-02F02 DA acoustic and vibration assessment (r7), dated 25 Juily 2025

ID	Location	Description
N4	Eastern boundary of Stage 1 development	The monitor was located at the eastern boundary of the Stage 1 development and utilised an extension pole to elevate the microphone above the boundary fence so that measurements had a direct line-of-sight to the rail traffic noise. The acoustic environment was controlled by rail noise from passing trains and trains arriving / departing Corrimal Station, with distant road traffic noise at other times. Construction works at the Corrimal Coke Works site were paused during this noise monitoring.

Figure 2-1: Noise and vibration measurement locations

2.2 Noise monitoring results

A summary of the long-term noise monitoring results are presented in . The noise monitoring methodology and noise monitoring graphs are reproduced in APPENDIX B and APPENDIX C respectively.

Table 2-2: Noise monitoring results

ID	Location	L_{Aeq} road/rail noise levels[3]		L_{A90} Rating Background Level (RBL)		
		Day[1]	Night[2]	Day	Evening	Night
N1	60 Duff Parade	58	60	39	39	36
N2	33 Railway Street	60	55	50	45	37
N3	12 Carr Street	57	54	46	44	37
N4	Corrimal Coke Works site (eastern boundary)	64	62	45	45	40

Notes:
1. Day is 7:00am to 10:00pm
2. Night is 10:00pm to 7:00am
3. Noise levels include +2.5dB facade correction

3 Road / rail traffic noise intrusion

3.1 Noise criteria

3.1.1 NSW Road Noise Policy (RNP)

The NSW *Road Noise Policy* (RNP) was introduced in July 2011 and replaced the NSW *Environmental Criteria for Road Traffic Noise* (ECTRN). Table 3 of the RNP outlines criteria to be applied to particular types of road development and land use. The criteria apply when assessing noise impact and determining mitigation measures for existing developments that are potentially affected by road traffic noise, with the aim of preserving the amenity appropriate to the land use.

Unlike the ECTRN, the RNP no longer stipulates noise criteria for new land use developments potentially impacted by road traffic noise. Criteria for new developments affected by existing roads are now addressed through the State Environmental Planning Policy (Transport and Infrastructure) 2021 ('Transport and Infrastructure SEPP') and the associated NSW Department of Planning 'Development Near Rail Corridors and Busy Roads – Interim Guideline'.

3.1.2 State Environmental Planning Policy (Transport and Infrastructure) 2021

The NSW State Environmental Planning Policy (Transport and Infrastructure) 2021 commenced on 1 March 2022 and consolidated a number of former state environmental planning policies. The former State Environmental Planning Policy (Infrastructure) 2007 (known as 'ISEPP') has been integrated into "Chapter 2 Infrastructure" of the Transport and Infrastructure SEPP.

Chapter 2 of the Transport and Infrastructure SEPP aims to facilitate the effective delivery of infrastructure across NSW. The aim of the Chapter includes identifying the environmental assessment category into which different types of infrastructure and services development fall and identifying matters to be considered in the assessment of development adjacent to particular types of infrastructure.

Pertinent to noise assessment, the Transport and Infrastructure SEPP includes the following sections:

2.100 Impact of rail noise or vibration on non-rail development

(1) This section applies to development for any of the following purposes that is on land in or adjacent to a rail corridor and that the consent authority considers is likely to be adversely affected by rail noise or vibration-

(a) a building for residential use,

(b) a place of public worship,

(c) a hospital,

(d) an educational establishment or centre-based child care facility.

(2) Before determining a development application for development to which this section applies, the consent authority must take into consideration any guidelines that are issued by the Planning Secretary for the purposes of this clause and published in the Gazette.

(3) If the development is for the purposes of residential accommodation, the consent authority must not grant consent to the development unless it is satisfied that appropriate measures will be taken to ensure that the following LAeq levels are not exceeded-

(a) in any bedroom in the residential accommodation - 35 dB(A) at any time between 10 pm and 7am,

(b) anywhere else in the residential accommodation (other than a garage, kitchen, bathroom or hallway) - 40 dB(A) at any time.

2.120 Impact of road noise or vibration on non-road development

(1) This section applies to development for any of the following purposes that is on land in or adjacent to the road corridor for a freeway, a tollway or a transitway or any other road with an annual average daily traffic volume of more than 20,000 vehicles (based on the traffic volume data published on the website of TfNSW) and that the consent authority considers is likely to be adversely affected by road noise or vibration:

(a) Residential accommodation,

(b) a place of public worship,

(c) a hospital,

(d) an educational establishment or centre-based child care facility.

(2) Before determining a development application for development to which this section applies, the consent authority must take into consideration any guidelines that are issued by the Planning Secretary for the purposes of this clause and published in the Gazette.

(3) If the development is for the purposes of residential accommodation, the consent authority must not grant consent to the development unless it is satisfied that appropriate measures will be taken to ensure that the following LAeq levels are not exceeded:

(c) in any bedroom in the residential accommodation - 35 dB(A) at any time between 10 pm and 7am,

(e) anywhere else in the residential accommodation (other than a garage, kitchen, bathroom or hallway) - 40 dB(A) at any time.

(3A) Subsection (3) does not apply to a building to which State Environmental Planning Policy (Housing) 2021, Chapter 3, Part 7 applies.

(4) In this section, "freeway", "tollway" and "transitway" have the same meanings as they have in the Roads Act 1993.

3.1.2.1 Department of Planning publication 'Development near rail corridors and busy roads – Interim guideline'

To support the ISEPP (which is now consolidated into the Transport and Infrastructure SEPP), the NSW Department of Planning released the *Development near Rail Corridors and Busy Roads – Interim Guideline* (December 2008). The Guideline assists in the planning, design and assessment of developments in, or adjacent to, major transport corridors in terms of noise, vibration and air quality. While the Transport and Infrastructure SEPP applies only to roads with an AADT greater than 20,000 vehicles, the guideline is also recommended for other road traffic noise affected sites.

3.1.2.2 Clarification of Transport and Infrastructure SEPP noise limits

The Guideline clarifies the time period of measurement and assessment. Section 3.4 '*What Noise and Vibration Concepts are Relevant*' and Table 3.1 of Section 3.6.1 confirms that noise assessment is based over the following time periods:

- Daytime 7:00am - 10:00pm $L_{Aeq(15hr)}$
- Night-time 10:00pm - 7:00am $L_{Aeq(9hr)}$

The noise criteria nominated in the Transport and Infrastructure SEPP apply to internal noise levels with windows and doors closed. However, as the preliminary noise assessment is based on predictions at external locations, equivalent external noise criteria has been established. The equivalent external noise criterion is used to determine which areas of the development may require acoustic treatment in order to meet the internal noise requirements of the Transport and Infrastructure SEPP. The equivalent external goals have been determined on the following basis:

- The Guideline states: "*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 occupants can leave windows closed, if they so desire, and also to meet the ventilation requirements of the Building Code of Australia*." The internal criteria with windows open are therefore 10dB(A) above the criteria explicitly outlined in the Transport and Infrastructure SEPP.
- The generally accepted noise reduction through an open window from a free-field external position is 10dB(A). Windows/doors are assumed to be open no more than 5% of room floor area, in accordance with the Building Code of Australia (BCA) ventilation requirements.

Table 3-1 presents the Transport and Infrastructure SEPP internal noise criteria along with the equivalent external noise criteria for residential premises.

Table 3-1: Transport and Infrastructure SEPP noise criteria for new residential development

Room	Location	$L_{Aeq, 15hr}$ Day 7am – 10pm	$L_{Aeq, 9hr}$ Night 10pm – 7am
Living rooms*	Internal, windows closed	40	40
	Internal, windows open	50	50

Room	Location	$L_{Aeq, 15hr}$ Day 7am – 10pm	$L_{Aeq, 9hr}$ Night 10pm – 7am
	External free-field (allowing windows to remain open)^	60	60
Bedrooms*	Internal, windows closed	40	35
	Internal, windows open	50	45
	External free-field (allowing windows to remain open)^	60	55

Notes: * Requisite for 20,000AADT Roads only under Transport and Infrastructure SEPP 2021.

^ Guideline states that where internal noise criteria are exceeded by more than 10dB(A) with windows open mechanical ventilation is required. External goals have been calculated on the basis of nominal 10dB(A) reduction through an open window to a free-field position. Windows open to 5% of floor area in accordance with the BCA 2011 requirements.

3.2 Noise modelling and treatment recommendations

3.2.1 Noise modelling methodology

A 3D noise model of the site and surrounding area was setup using the CadnaA noise modelling software package for previous stages of the Corrimal Coke Works site.

With respect to road traffic noise, the model takes into consideration the noise emission from Railway Street and Memorial Drive (adjacent to the northern and western boundaries of the Corrimal Coke Works site respectively), and also Harbinger Street, High Street and Ruddock Street (local roads to the north of the site). The road noise predictions are based on a method developed by the United Kingdom Department of Environment entitled "Calculation of Road Traffic Noise (1988)" known as the CoRTN (1988) method. This method has been adapted to Australian conditions and extensively tested by the Australian Road Research Board and as a result it is recognised and accepted by the EPA. The model predicts noise levels for steady flowing traffic and noise from high truck exhausts is also taken into account.

Noise emissions from passenger and freight trains on the South Coast Rail Line (adjacent to the eastern boundary of the Corrimal Coke Works site) have been predicted using the Nordic Prediction Method (NPM)1996.

The CORTN and NPM 1996 algorithms are contained within the CadnaA noise modelling software which has been used to calculate road and rail traffic noise levels across the site.

The noise model was validated to the four long-term noise monitoring locations (Locations N1 – N4). The model predicts road and rail traffic noise levels that are generally within 2dB of the measurement results and therefore, the model is deemed to be validating well and acceptable for predicting noise levels across the site.

For this assessment of road and rail traffic noise impacts on the Stage 2a development, the existing validated noise model has been updated to the latest design of the Stage 2a residential flat buildings as illustrated in the drawings prepared by DKO Architecture (NSW) Pty Ltd (project no. 13687, revision A).

The noise model includes the buildings of the approved Stage 1 development (Wollongong City Council Development Application No. DA-2023/550) which are located towards the northern end of the Corrimal Coke Works site and will provide acoustic shielding of road traffic noise from Railway Street, Harbinger Street, High Street and Ruddock Street to the subject Stage 2a development.

There are future development stages of the Corrimal Coke Works site location to the west and north-west of Stage 2a development. It is expected that the Stage 2a development will be subject to shielding of road traffic noise from Memorial Drive by the intervening buildings of these future development stages. However, the degree of acoustic shielding that Stage 2a will experience is currently unknown as the building locations, layouts and heights of these future development stages have not been finalised. As a conservative approach, the noise model does not include any buildings / structures in the future development stages.

3.2.2 Noise prediction results

Noise predictions have been conducted for both the day and night-time periods and at the residential facades for each building level.

To provide an example of the noise prediction results, APPENDIX D shows a noise contour map of the cumulative road and rail traffic noise levels across the site during the critical night-time period. The noise levels have been presented at a height of 1.5m above the ground level which is representative of ground level receivers. The predicted levels are “free field” levels and do not include a +2.5dB correction for facade reflections.

The results of the noise modelling were used to calculate the internal noise levels within the future dwellings, based on standard building design assumptions contained within the Guideline. Noise calculations were performed using acoustic design software which takes into account external noise levels, facade transmission loss and room sound absorption characteristics.

For facades that are exposed to rail noise levels from the South Coast Rail Line and road traffic noise level from Memorial Drive that are above the external Transport and Infrastructure SEPP noise criteria, appropriate design of the building envelope (eg. external walls, doors and windows) will be required to satisfy the internal noise criteria.

3.2.3 Building treatments

APPENDIX E presents indicative acoustic treatment categories that would be required to meet the Transport and Infrastructure SEPP criteria inside the future residential apartment.

Typical construction details for each treatment category are provided in Table C-1. These construction details are broadly in line with the standard measures recommended in Appendix C of the *Development near Rail Corridors and Busy Roads – Interim Guideline* (December 2008).

3.2.4 Mechanical ventilation

To meet the Transport and Infrastructure SEPP internal noise level requirements, the following buildings will require mechanical ventilation to allow windows to remain closed if so desired by the resident. This is due to the Guideline requirement that '*…if internal noise level with windows or doors open exceed the criteria by more than 10dBA, the design of ventilation for these rooms should be such that occupants can leave windows closed, if they so desire*'.

- Building 2.2 - Bedrooms and habitable rooms along the eastern facade that face the South Coast Rail Line
- Building 2.3 - Bedrooms and habitable rooms along the eastern facade that face the South Coast Rail Line
- Building 2.4 - Bedrooms and habitable rooms along the eastern facade that face the South Coast Rail Line

4 Rail vibration assessment

4.1 Vibration criteria

4.1.1 Regenerated noise

The *Development near Rail Corridors and Busy Roads – Interim Guideline* ("the Interim Guideline") (Department of Planning, 2008) provides recommended criteria for ground-borne or regenerated rail noise. Table 4-1 below provides a summary of the noise limits for sleeping and living spaces.

Table 4-1: Internal noise criteria for regenerated rail noise

Occupancy	Period	L_{Amax} noise limit[1]
Sleeping areas (Bedrooms)	10pm – 7am	35 dB(A)
Other habitable rooms (excluding garages, kitchens, bathrooms and hallways)	At any time	40 dB(A)

Note: 1. L_{Amax} is the weighted maximum sound pressure level measured using a "slow" response time

4.1.2 Rail tactile vibration

Section 3.6.3 of the Interim Guideline provides recommended vibration criteria in accordance with the following documents:

- NSW *Assessing Vibration – A Technical Guideline* ("AVTG") (DEC, 2006)
- German Standard DIN 4150 Part 3 1992
- British Standard BS 7385 Part 2 1993
- Australian Standard AS 2670.2 1990

The above documents have been reviewed and the criteria for assessing tactile vibration from trains passing the proposed development is quantified in accordance with:

- NSW *Assessing Vibration – A Technical Guideline* ("AVTG") (DEC, 2006)
- British Standard BS 6472:1992 *Evaluation of Human Exposure to Vibration in Buildings (1Hz to 80Hz)*

The criteria curves presented in British Standard BS 6472:1992 are identical to those in Australian Standard AS 2670.2 1990 and the International Standard ISO 2631-2:1989.

Criteria for continuous vibration from the British Standard BS 6472:1992 for residential spaces are shown in Figure 4-1 below.

Figure 4-1:Tactile Vibration Criteria for Residential Buildings

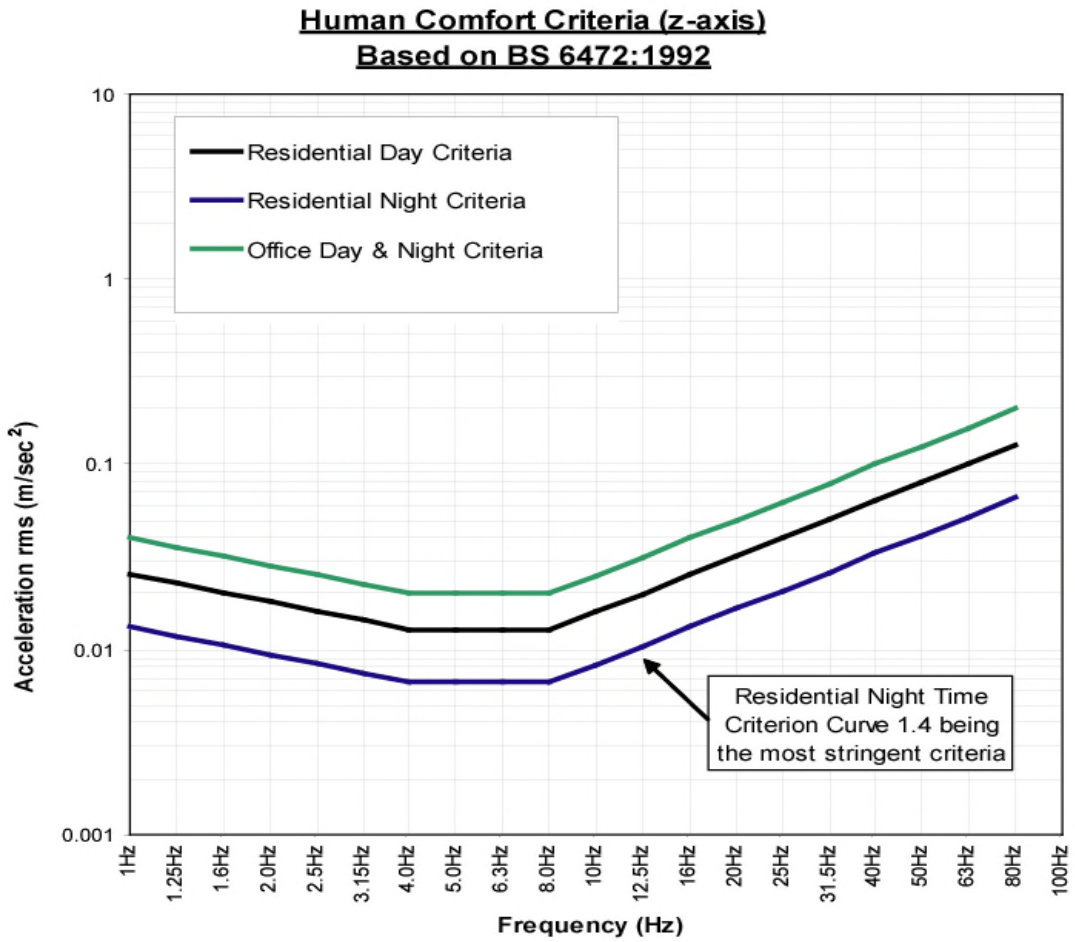


Table 2.4 of the AVTG presents acceptable vibration dose values ("VDVs") for intermittent vibration. Table 4-2 below outlines AVTG requirements.

Table 4-2: Acceptable VDVs for intermittent vibration in residential buildings m/s$^{1.75}$

Location	Period	Preferred VDV m/s$^{1.75}$
Residence	Day time (7am – 10pm)	0.20
	Night time (10pm – 7am)	0.13

4.2 Measured tactile train vibration and assessment to BS 6472 / AVTG

As set out in the previous noise and vibration assessment to rezone the former Corrimal Coke Works site[1], attended vibration measurements were undertaken at the site on 10 August 2018 at two locations, approximately 23m and 30m to the west of the South Coast Rail Corridor. The vibration level of passing trains were measured using a Sinus Soundbook multi-channel analyser and PCB accelerometers. Three

[1] Renzo Tonin & Associates, *Corrimal Coke Works rezoning – Environmental noise and vibration assessment*, ref: TK577-01F03 Corrimal acoustic and vibration assessment (r4), dated 20 May 2019

accelerometers (x, y and z) were fixed to a steel bracket and metal spike impaled into the soil ground on site.

Results of the train vibration survey were plotted against night and day criterion of British Standard BS 6472-1992 *Evaluation of Human Exposure to Vibration in Buildings (1Hz to 80Hz)*. The measured train vibration levels were also used to calculate the vibration dosage values ("VDVs") which were then compared to the acceptable levels from the Table 2.4 of the AVTG.

Results from the measurements of passing trains demonstrate that the floor induced vibration within the worst-affected apartments are predicted to be compliant with British Standard BS 6472:1997 for human comfort during the day and night-time periods. Similarly, the calculated vibration dosage values ("VDVs") complied with the preferred day and night VDV criterion as defined in the AVTG.

It is noted that the eastern facade of Building 2.2 is approximately 36m from the rail line, while the eastern facade of Buildings 2.3 and 2.4 are approximately 43m from the rail line (nearest receivers in the Stage 2a development). Therefore, the vibration level of passing trains that will be experienced by the future residential receivers in the Stage 2a development will be less than the measured vibration levels.

4.3 Calculated ground-borne rail noise inside proposed development

Regenerated or ground-borne rail noise is the low frequency rumble that can be heard inside buildings in close proximity to railway lines due to ground vibration generated by passing trains, which propagates through soil / rock up into the building elements (foundations, wall and floors) and then re-radiated as audible sound.

Train vibration levels measured on site were used to predict the regenerated rail noise inside the proposed residential apartments along the eastern facade of Buildings 2.2, 2.3 and 2.4 (nearest receivers to the rail corridor). These calculated noise levels inside the apartments are summarised in Table 4-3 below and compared to ground-borne noise criteria.

Table 4-3: Calculated regenerated rail noise levels inside residence

Receiver	Distance from rail line, m	Floor level	Calculated ground-borne rail noise inside residence, dB(A)	Interim Guideline criteria[1] for ground-borne rail noise inside dwellings, dB(A)	Compliance
Building 2.1 – sleeping area of residential apartment	91	Ground	21	35	Yes
Building 2.2 – sleeping area of residential apartment	36	Ground	34	35	Yes
Building 2.3 – sleeping area of residential apartment	43	Ground	32	35	Yes
Building 2.4 – sleeping area of residential apartment	43	Ground	32	35	Yes

Receiver	Distance from rail line, m	Floor level	Calculated ground-borne rail noise inside residence, dB(A)	Interim Guideline criteria[1] for ground-borne rail noise inside dwellings, dB(A)	Compliance

Note: 1. Ground-borne noise calculations based on 95th percentile of measured L_{ASmax} noise level from passing trains as per Interim Guideline

The calculated level of ground-borne rail noise at the critical residential receivers reveals compliance with the Interim Guideline criterion. In addition, it is likely that the airborne component of noise from passing trains will be greater than the ground-borne component inside the future residential apartments. Therefore, ground-borne rail noise is not likely to give rise to an acoustic impact as it would be masked by the airborne component of the rail noise. Acoustic impacts from ground-borne rail noise are more commonly associated with underground rail tunnels where there is no airborne noise to provide masking.

5 Noise from level crossing

To the north-east of the Corrimal Coke Works site is a level crossing on Railway Street. During train pass-bys, the signal alarms of the level crossing operate to warn vehicles / pedestrians on Railway Street of the approaching train. The trains have also been observed to sound their horn when approaching the level crossing as an additional waning. As the signal alarms and train horns are intermittent, short-duration noise sources, this assessment considers the critical acoustic issue with respect to the level crossing relates to potential sleep disturbance impacts from the maximum noise level events of night-time signal alarm and train horn operations.

5.1 NSW Noise Policy for Industry (NPfI) – sleep disturbance noise criteria

The potential for sleep disturbance from maximum noise level events from premises during the night-time period needs to be considered. In accordance with NPfI, a detailed maximum noise level event assessment should be undertaken where the subject development night-time noise levels at a residential location exceed:

- $L_{Aeq,15min}$ 40dB(A) or the prevailing RBL plus 5dB, whichever is the greater, and/or
- L_{AFmax} 52dB(A) or the prevailing RBL plus 15dB, whichever is the greater.

Where there are noise events found to exceed the initial screening level, further analysis is undertaken to identify:

- The likely number of events that might occur during the night assessment period,
- The extent to which the maximum noise level exceeds the rating background noise level.

The sleep disturbance noise levels for the project are presented in Table 5-1.

Table 5-1: Sleep disturbance assessment levels

Receiver type	Assessment Level $L_{Aeq,15min}$	Assessment Level L_{AFmax}
Residential	36 + 5 = 41	52

5.2 Short-term (attended) measurements of rail crossing noise

To assess the potential sleep disturbance impacts from the night-time operations of the level crossing, attended short-term noise monitoring was undertaken near the north-eastern corner of the Corrimal Coke Works site (Location N5) to measure noise emission levels of the signal alarm and train horns as trains pass the level crossing. The measurement location was approximately 26m from the level crossing and outside of the site boundary so that a clear view of the rail line could be established with no acoustic losses from boundary fencing.

The attended short-term noise monitoring was undertaken between 12:45pm and 2:21pm on Monday, 7 July 2025, where seven trains were observed passing the measurement location over this period. Table

5-2 presents the measured maximum signal alarm and train horn noise levels associated with the seven pass-bys.

Table 5-2: Measured L_{AFmax} signal alarm and train horn noise levels at Location N5

Train pass-by	Time	Signal alarm, L_{AFmax} dB(A)	Train horn, L_{AFmax} dB(A)
1	1:07pm	72	70
2	1:17pm	72	77
3	1:20pm	73	69
4	1:48pm	73	86
5	1:50pm	75	80
6	2:05pm	74	70
7	2:17pm	75	79

5.3 External noise level predictions

The predicted maximum noise levels at the identified assessment locations are presented in Table 5-3 below, which are based on the measured levels at Location N5 and corrections for distance attenuation to the nearest facade of the Stage 2a residential flat buildings.

The calculations identify that the noise level of the level crossing signal alarm complies with the NPfI sleep disturbance criteria at the external facade of the Stage 2a residential flat buildings. However, the operation of a train horn as the train approaches the level crossing can give rise to maximum noise levels that exceed the NPfI sleep disturbance criteria. Therefore, a detailed maximum noise level event assessment is required to be undertaken (see Section 5.4).

Table 5-3: Sleep disturbance noise assessment - external

Receiver	Distance from level crossing, m	Calculated external noise level, L_{AFmax} dB(A)		Sleep disturbance criterion, L_{AFmax} dB(A)
Building 2.1 North-eastern corner	270	Level crossing – signal alarm: Level crossing – train horn:	52-55 48-66	52
Building 2.2 North-eastern corner	259	Level crossing – signal alarm: Level crossing – train horn:	52-55 49-66	52
Building 2.3 North-eastern corner	317	Level crossing – signal alarm: Level crossing – train horn:	50-53 47-64	52
Building 2.4 North-eastern corner	401	Level crossing – signal alarm: Level crossing – train horn:	48-51 45-62	52

5.4 Internal noise level predictions

With respect to internal maximum noise level criteria, Section 5.4 of the NSW *Road Noise Policy* (RNP) identifies several investigations into the impacts of intermittent and emerging noise sources on the disturbance of sleep. The RNP references the further studies conducted by the enHealth Council (2004)

and guidelines published by the World Health Organisation (1999) which were reviewed and analysed in terms of the guidance on noise exposure and sleep disturbance. The enHealth report states that:

> *'as a rule in planning for short-term or transient noise events, for good sleep over 8 hours the indoor sound pressure level measured as a maximum instantaneous value should not exceed approximately 45dB(A) LAmax more than 10 or 15 times per night'.*

The RNP concludes as follows:

> *From the research on sleep disturbance to date it can be concluded that:*
>
> - *maximum internal noise levels below 50–55 dB(A) are unlikely to awaken people from sleep*
> - *one or two noise events per night, with maximum internal noise levels of 65–70 dB(A), are not likely to affect health and wellbeing significantly.*

It is noted that the assessment of road and rail traffic noise impacts on the proposed Stage 2a residential flat buildings (with respect to the Transport and Infrastructure SEPP internal noise level criteria) identified that the Stage 2a residential flat buildings will require acoustic facade treatments.

Taking into consideration attenuation through the building envelope with closed doors / window, the maximum noise level of train horns inside the most affected bedrooms of Buildings 2.1 – 2.4 (along northern facade of buildings which face the level crossing and have a lower acoustic facade treatment category than then eastern facade) are set out in Table 5-4.

Table 5-4: Sleep disturbance noise assessment – internal

Assessment location	Predicted internal noise level, L_{Amax} dB(A)	
Bedroom along northern facade Building 2.1	Level crossing – train horn:	29 – 46
Bedroom along northern facade Building 2.2	Level crossing – train horn:	25 – 43
Bedroom along northern facade Building 2.3	Level crossing – train horn:	24 – 41
Bedroom along northern facade Building 2.4	Level crossing – train horn:	21 – 39

Due to the facade treatments recommended for the Stage 2a residential buildings to address road and rail traffic noise intrusion, the maximum noise levels of level crossing activities inside the bedrooms are less than the 50-55dB(A) internal noise levels referenced in the RNP. Therefore, level crossing activities are unlikely to impact sleep and cause awakenings to the future residences in the Stage 2a development.

The NSW EPA's Rail Infrastructure Noise Guideline (RING) is a guideline for the evaluation of noise and vibration impacts associated with rail development projects (ie, construction of new rail lines or upgrades to existing lines). For safety warning devices such as horns and bells at level crossings, the RING identifies that the noise emission from these devices should not exceed the L_{Amax} (95^{th} percentile) trigger level of 85dB(A). Although RING generally applies to rail development projects and not noise

sensitive developments affected by existing rail corridors, we note that the predicted levels are below the L_{Amax} 85dB(A) external criteria for existing rail lines / operations.

6 Operational noise from development

6.1 Noise emission criteria – Protection of the Environment Operations (Noise Control) Regulation 2007

Noise emission from air conditioners and heat pump water heaters serving residential premises is required to comply with Clauses 45 and 53 of the NSW Protection of the Environment Operations (Noise Control) Regulation 2017, which state:

> *45 Use of air conditioners on residential premises*
>
> *A person is guilty of an offence if–*
>
> *(a) the person causes or permits an air conditioner to be used on residential premises in such a manner that it emits noise that can be heard within any room in any other residential premises (that is not a garage, storage area, bathroom, laundry, toilet or pantry) whether or not any door or window to that room is open–*
>
> *(i) before 8 am or after 10 pm on any Saturday, Sunday or public holiday, or*
>
> *(ii) before 7 am or after 10 pm on any other day.*
>
> *53 Use of heat pump water heaters*
>
> *(1) A person is guilty of an offence if–*
>
> *(a) the person causes or permits a heat pump water heater to be used on residential premises in such a matter that it emits noise that can be heard within any room in any other residential premises (that is not a garage, storage area, bathroom, laundry, toilet or pantry) whether or not any door or window to that room is open–*
>
> *(i) before 8 am or after 10 pm on any Saturday, Sunday or public holiday, or*
>
> *(ii) before 7 am or after 10 pm on any other day.*

If the future residential flat buildings of the Stage 2a development have air-conditioning units and / or heat pump water heaters that are to operate during the above periods, noise from the outdoor units need to be 'inaudible' inside any habitable room (with door and windows open or closed) of any other residential premises. This includes the future residential premises within the Corrimal Coke Works site, as well as the existing residential premises surrounding the Precinct.

While inaudibility is subjective, in order for a quantitative assessment to be carried out, Renzo Tonin & Associates set inaudibility noise goals as 5dB below the measured background noise level in each 1/1 octave band between 31.5Hz and 8kHz.

Based on the noise monitoring undertaken within the Corrimal Coke Works site at Location N4 (presented in Section 2), the design noise emission limits for residential air-conditioning condenser units and heat pump water heaters have been established in Table 6-1.

Table 6-1: Inaudibility criterion for AC condenser units and heat pump water heaters

Assessment/receiver location	Octave band centre frequency (Hz) - dBZ								
	31.5	63	125	250	500	1k	2k	4k	8k
Outside habitable room[1] of any other residential premises (within the development and at neighbouring properties)	74^	48^	36	35	32	29	22	15	15^

Notes: 1. Habitable room is defined in the POEO as any room other than a garage, storage area, bathroom, laundry, toilet or pantry

Where an external assessment location is used, it is assumed that if inaudibility is achieved outside, it will also be achieved inside via an open window.

^ Threshold of hearing in accordance with AS3657.1, taken as the highest third octave level for the respective octave band.

Compliance with the inaudibility criterion of the POEO regulation would also result in compliance with the EPA NSW's *Noise Policy for Industry* criteria which are less stringent.

6.2 Mechanical plant noise considerations

The selection and location of plant have not been finalised at the SSDA stage. Normally, the consideration of mechanical plant selection, the specific location of plant items and any noise controls (if required) occur at detailed design stage.

Provided that appropriate mechanical plant items are selected, the emission of mechanical plant noise from the Stage 2a residential flat buildings are unlikely to adversely impact future residential premises within the Corrimal Coke Works site as well as the existing residential premises surrounding the site. As details of the mechanical plant are not currently available, in-principle noise mitigation measures are provided below.

- The acoustic assessment of mechanical plant noise is to be undertaken at detailed design to ensure compliance with the noise criteria set out in the Protection of the Environment Operations (Noise Control) Regulation 2017 (Table 6-1).
- Examples of common methods of controlling mechanical plant noise that could be implemented to the mechanical design of the Stage 2a residential flat buildings (if required) include:
    - Procurement of mechanical plant items that have lower noise source levels;
    - Positioning plant items away from noise sensitive receivers to maximum distance attenuation;
    - Installing commercially available silencers / attenuators to the air discharge and air intakes of plant items;
    - Lag ductwork and / or line ductwork with acoustically absorptive material; and

- Install screens or enclosures around plant items to acoustically shield noise sensitive receivers from mechanical plant noise.

7 Construction noise and vibration assessment

7.1 Background

The scope of this assessment covers the construction works of the built form for the four residential flat buildings of the Stage 2a development (Buildings 2.1 to 2.4) which include single-level basements for parking and waste / recycling storage.

We are advised that the construction activities will be staged to complete one residential flat building before moving onto the next, except for Buildings 2.3 and 2.4 which will be constructed concurrently as they share a common basement. Each residential flat building / construction stage will have an approximate duration of 20 months.

We are advised that there will be no construction activities associated with other development stages of the Corrimal Coke Works site that will be undertaken concurrently with the Stage 2a built form works.

The proposed built-from works will generally occur during the standard construction hours as follows:

- Mondays to Friday 7:00am to 6:00pm
- Saturdays 8:00am to 1:00pm
- Sundays and public holidays No work performed

The primary anticipated need for out-of-hours work is for concrete pouring which could not be completed during the daytime period and cannot be interrupted. However, we are advised that out-of-hours works for concrete pouring will only occur in exceptional circumstances.

7.2 Construction noise criteria

The NSW *Interim Construction Noise Guideline* (ICNG, 2009) provides guidelines for assessing noise generated during the construction phase of developments.

The key components of the guideline that are incorporated into this assessment include:

- Use of L_{Aeq} as the descriptor for measuring and assessing construction noise.

  NSW noise policies, including the INP, RNP and RING have moved to the primary use of L_{Aeq} over any other descriptor. As an energy average, L_{Aeq} provides ease of use when measuring or calculating noise levels since a full statistical analysis is not required as when using, for example, the L_{A10} descriptor.

- Application of reasonable and feasible noise mitigation measures
- As stated in the ICNG, a noise mitigation measure is feasible if it is capable of being put into practice, and is practical to build given the project constraints.

- Selecting reasonable mitigation measures from those that are feasible involves making a judgement to determine whether the overall noise benefit outweighs the overall social, economic and environmental effects.

The ICNG provides two methods for assessment of construction noise, being either a quantitative or a qualitative assessment. A quantitative assessment is recommended for major construction projects of significant duration, and involves the measurement and prediction of noise levels, and assessment against set criteria. A qualitative assessment is recommended for small projects with a duration of less than three weeks and focuses on minimising noise disturbance through the implementation of reasonable and feasible work practices, and community notification.

Given the scale of the proposed Stage 2a built form works, a quantitative assessment is carried out herein, consistent with the ICNG requirements.

Table 7-1, reproduced from the ICNG, sets out the noise management levels and how they are to be applied for residential receivers.

Table 7-1: Noise management levels at residential receivers

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

Time of day	Management level $L_{Aeq\ (15\ min)}$ *	How to apply

* Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence. Noise levels may be higher at upper floors of the noise affected residence.

7.2.1 Residential assessment locations

Due to the size of the Corrimal Coke Works site, there are a large number of residential dwellings surrounding the site that could potentially be impacted by the proposed built form work. Therefore, the residential receivers have been grouped into noise catchment areas according to shared background noise conditions (controlled by road traffic noise from Railway Street and Memorial Drive) and common exposure to the noise emanating from the proposed built form work.

Figure 7-1 and Table 7-2present the noise catchment area groupings and the identified assessment locations (considered representative of the most affected receiver locations in each noise catchment area) used for this assessment of noise emission from built form work at the Corrimal Coke Works site.

Figure 7-1 Residential noise catchment areas and assessment locations

Table 7-2: Assessment locations - residential

ID	Address
NCA 1	54-62 Railway Street, Corrimal
NCA 2	6 Duff Parade, East Corrimal
NCA 3	16 Duff Parade, East Corrimal
NCA 4	26 Duff Parade, East Corrimal
NCA 5	6 Carr Street, Towragdi
NCA 6	79 Cross Street, Corrimal

7.2.2 Construction noise management levels

Construction noise management levels for the identified noise catchment areas are set out in Table 7-3 which have been established from the ICNG and the measured ambient background noise levels set out in Section 2.

Table 7-3: Construction noise management levels at residential receivers

ID	Daytime L_{A90} rating background level (RBL)	Construction noise management level $L_{Aeq(15min)}$	Highly noise affected level
NCA 1	50	60	75
NCA 2	45	55	75
NCA 3	45	55	75
NCA 4	39	49	75
NCA 5	46	56	75
NCA 6	50	60	75

7.3 Construction vibration criteria

Construction vibration is associated with three main types of impact:

- disturbance to building occupants;
- potential damage to buildings; and
- potential damage to sensitive equipment in a building.

Generally, if disturbance to building occupants is controlled, there is limited potential for structural damage to buildings.

Vibration amplitude may be measured as displacement, velocity, or acceleration.

- Displacement (x) measurement is the distance or amplitude displaced from a resting position. The International System of Units (SI unit) for distance is the metre (m), although common industrial standards include mm.
- Velocity ($v=\Delta x/\Delta t$) is the rate of change of displacement with respect to change in time. The SI unit for velocity is metres per second (m/s), although common industrial standards include mm/s. The Peak Particle Velocity (PPV) is the greatest instantaneous particle velocity during a given time interval. If measurements are made in 3-axis (x, y, and z) then the resultant PPV is the vector sum (i.e. the square root of the summed squares of the maximum velocities) regardless of when in the time history those occur.
- Acceleration ($a=\Delta v/\Delta t$) is the rate of change of velocity with respect to change in time. The SI unit for acceleration is metres per second squared (m/s2). Construction vibration goals are summarised below.

Construction vibration goals are summarised below.

7.3.1 Disturbance to buildings occupants

Assessment of potential disturbance from vibration on human occupants of buildings is made in accordance with the EPA's (ex DEC's) '*Assessing Vibration; a technical guideline*' (DEC, 2006). The guideline provides criteria which are based on the British Standard BS 6472-1992 '*Evaluation of human exposure to vibration in buildings (1-80Hz)*'. Sources of vibration are defined as either 'Continuous', 'Impulsive' or 'Intermittent'. Table 7-4 provides definitions and examples of each type of vibration.

Table 7-4: Types of vibration

Type of vibration	Definition	Examples
Continuous vibration	Continues uninterrupted for a defined period (usually throughout the day-time and/or night-time)	Machinery, steady road traffic, continuous construction activity (such as tunnel boring machinery).
Impulsive vibration	A rapid build-up to a peak followed by a damped decay that may or may not involve several cycles of vibration (depending on frequency and damping). It can also consist of a sudden application of several cycles at approximately the same amplitude, providing that the duration is short, typically less than 2 seconds	Infrequent: Activities that create up to 3 distinct vibration events in an assessment period, e.g. occasional dropping of heavy equipment, occasional loading and unloading.
Intermittent vibration	Can be defined as interrupted periods of continuous or repeated periods of impulsive vibration that varies significantly in magnitude	Trains, nearby intermittent construction activity, passing heavy vehicles, forging machines, impact pile driving, jack hammers. Where the number of vibration events in an assessment period is three or fewer, this would be assessed against impulsive vibration criteria.

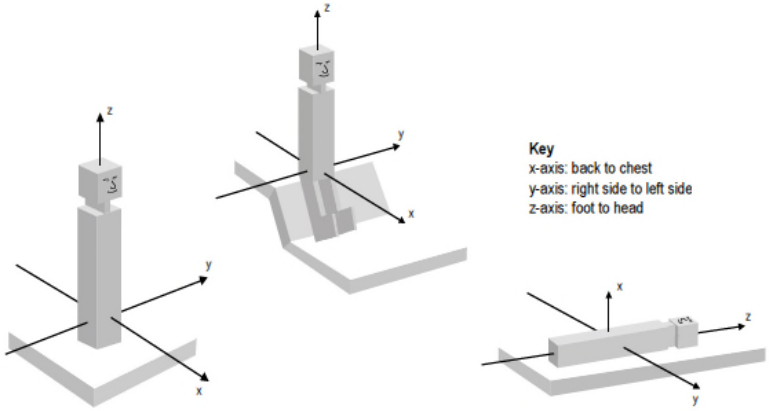
Source: Assessing Vibration; a technical guideline, Department of Environment & Climate Change, 2006

The vibration criteria are defined as a single weighted root mean square (rms) acceleration source level in each orthogonal axis. Section 2.3 of the guideline states:

> *'Evidence from research suggests that there are summation effects for vibrations at different frequencies. Therefore, for evaluation of vibration in relation to annoyance and comfort, overall weighted rms acceleration values of the vibration in each orthogonal axis are preferred (BS 6472).'*

When applying the criteria, it is important to note that the three directional axes are referenced to the human body, i.e. x-axis (back to chest), y-axis (right side to left side) or z-axis (foot to head). Vibration may enter the body along different orthogonal axes and affect it in different ways. Therefore, application of the criteria requires consideration of the position of the people being assessed, as illustrated in Figure 7-2. For example, vibration measured in the horizontal plane is compared with x- and y-axis criteria if the concern is for people in an upright position, or with the y- and z- axis criteria if the concern is for people in the lateral position.

Figure 7-2: Orthogonal axes for human exposure to vibration



The preferred and maximum values for continuous and impulsive vibration are defined in Table 2.2 of the guideline and are reproduced in Table 7-5.

Table 7-5: Preferred and maximum levels for human comfort (weighted RMS acceleration, m/s$^{2)}$

Location	Assessment period[1]	Preferred values		Maximum values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
Continuous vibration (weighted RMS acceleration, m/s^2, 1-80Hz)					
Critical areas[2]	Day- or night-time	0.005	0.0036	0.010	0.0072
Residences	Daytime	0.010	0.0071	0.020	0.014
	Night-time	0.007	0.005	0.014	0.010
Offices, schools, educational institutions and places of worship	Day- or night-time	0.020	0.014	0.040	0.028
Workshops	Day- or night-time	0.04	0.029	0.080	0.058
Impulsive vibration (weighted RMS acceleration, m/s^2, 1-80Hz)					
Critical areas[2]	Day- or night-time	0.005	0.0036	0.010	0.0072
Residences	Daytime	0.30	0.21	0.60	0.42
	Night-time	0.10	0.071	0.20	0.14
Offices, schools, educational institutions and places of worship	Day- or night-time	0.64	0.46	1.28	0.92
Workshops	Day- or night-time	0.64	0.46	1.28	0.92

Notes:
- Daytime is 7:00am to 10:00pm and night-time is 10:00pm to 7:00am
- Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. There may be cases where sensitive equipment or delicate tasks require more stringent criteria than the human comfort criteria specify above. Stipulation of such criteria is outside the scope of their policy and other guidance documents (e.g. relevant standards) should be referred to. Source: BS 6472-1992

Similarly, the preferred and maximum levels for human comfort can be expressed in velocity (mm/s) and decibel levels (dBv re 1nm/s). These are defined in Table C1.1 of the guideline and reproduced in Table 7-6.

Table 7-6: Preferred and maximum levels for human comfort

Location	Assessment period[1]	Preferred values		Maximum values	
Continuous vibration (velocity, mm/s, 1-80Hz)					
Critical areas[2]	Day- or night-time	0.10	0.29	0.20	0.57
Residences	Daytime	0.20	0.57	0.40	1.14
	Night-time	0.14	0.40	0.28	0.80
Offices, schools, educational institutions, and places of worship	Day- or night-time	0.40	1.14	0.80	2.28
Workshops	Day- or night-time	0.80	2.28	1.60	4.56
Continuous vibration (velocity, dB_V re 1nm/s. 1-80Hz)					
Critical areas[2]	Day- or night-time	100	109	106	115
Residences	Daytime	106	115	112	121
	Night-time	103	112	109	118
Offices, schools, educational institutions, and places of worship	Day- or night-time	112	121	118	127
Workshops	Day- or night-time	118	127	124	133

Notes: 1. Daytime is 7:00am to 10:00pm and night-time is 10:00pm to 7:00am

2. Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. There may be cases where sensitive equipment or delicate tasks require more stringent criteria than the human comfort criteria specify above. Stipulation of such criteria is outside the scope of their policy and other guidance documents (e.g. relevant standards) should be referred to. Source: BS 6472-1992

The acceptable vibration dose values (VDV) for intermittent vibration are defined in Table 2.4 of the guideline and are reproduced in Table 7-7.

Table 7-7: Acceptable vibration dose values for intermittent vibration (m/s$^{1.75}$)

Location	Daytime[1]		Night-time[1]	
	Preferred value	Maximum value	Preferred value	Maximum value
Critical areas[2]	0.10	0.20	0.10	0.20
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

Notes:
- Daytime is 7:00am to 10:00pm and night-time is 10:00pm to 7:00am
- Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. These criteria are only indicative, and there may be a need to assess intermittent values against the continuous of impulsive criteria for critical areas.
  Source: BS 6472-1992

For vertical vibration and for frequencies greater than 8 Hz, the estimated Vibration Dose Value (eVDV) can be calculated using the following formula:

$$eVDV = 0.07 \times v_{rms} \times t^{0.25} \quad \text{m/s}^{1.75}$$

where
v_{rms} = vibration level in mm/s; and
t = time in seconds

7.3.2 Building Damage

Potential structural damage of buildings as a result of vibration is typically managed by ensuring vibration induced into the structure does not exceed certain limits and standards, such as British Standard 7385 Part 2 and German Standard DIN4150-3. Currently there is no existing Australian Standard for assessment of structural building damage caused by vibration energy.

It is noted that vibration levels required to cause minor cosmetic damage are typically 10 x higher than levels that will cause disturbance to building occupants. Many building occupants assume that building damage is occurring when they feel vibration or observe rattling of loose objects, however the level of vibration at which people perceive vibration or at which loose objects may rattle is far lower than vibration levels that can cause damage to structures.

Within British Standard 7385 Part 1: 1990, different levels of structural damage are defined:

- *Cosmetic - The formation of hairline cracks on drywall surfaces, or the growth of existing cracks in plaster or drywall surfaces; in addition the formation of hairline cracks in mortar joints of brick/concrete block construction.*
- *Minor - The formation of large cracks or loosening of plaster or drywall surfaces, or cracks through bricks/concrete blocks.*
- *Major - Damage to structural elements of the building, cracks in supporting columns, loosening of joints, splaying of masonry cracks, etc.*

The vibration limits in Table 1 of British Standard 7385 Part 2 (1993) are for the protection against cosmetic damage, however guidance on limits for minor and major damage is provided in Section 7.4.2 of the Standard:

> *7.4.2 Guide values for transient vibration relating to cosmetic damage*
>
> *Limits for transient vibration, above which cosmetic damage could occur are given numerically in Table 1 and graphically in Figure 1. In the lower frequency region where strains associated with a given vibration velocity magnitude are higher, the guide values for the building types corresponding to line 2 are reduced. Below a frequency of 4 Hz, where a high displacement is associated with a relatively low peak component particle velocity value a maximum displacement of 0.6 mm (zero to peak) should be used.*
>
> *Minor damage is possible at vibration magnitudes which are greater than twice those given in Table 1, and major damage to a building structure may occur at values greater than four times the tabulated values.*

Within DIN4150-3, damage is defined as "*any permanent consequence of an action that reduces the serviceability of a structure or one of its components*" (p.4). The Standard also outlines:

> *"For buildings as in lines 2 and 3 of Tables 1, 4 or B.1, the serviceability is considered to have been reduced if, for example*
>
> - *cracks form in plastered or rendered surfaces of walls;*
> - *existing cracks in a structure are enlarged;*
> - *partitions become detached from load-bearing walls or floor slabs.*
>
> *These effects are deemed 'minor damage. " (DIN4150.3:2016, p.6)*

While the DIN Standard defines the above damage as 'minor', based on the definitions provided in BS7385, the DIN standard is considered to deal with cosmetic issues rather than major structural failures.

7.3.2.1 British Standard

British Standard 7385: Part 2 '*Evaluation and measurement of vibration in buildings*', can be used as a guide to assess the likelihood of building damage from ground vibration. BS7385 suggests levels at which 'cosmetic', 'minor' and 'major' categories of damage might occur.

The cosmetic damage levels set by BS 7385 are considered 'safe limits' up to which no damage due to vibration effects has been observed for certain particular building types. Damage comprises minor non-structural effects such as hairline cracks on drywall surfaces, hairline cracks in mortar joints and cement render, enlargement of existing cracks and separation of partitions or intermediate walls from load bearing walls. 'Minor' damage is considered possible at vibration magnitudes which are twice those given and 'major' damage to a building structure may occur at levels greater than four times those values.

BS7385 is based on peak particle velocity and specifies damage criteria for frequencies within the range 4Hz to 250Hz, being the range usually encountered in buildings. At frequencies below 4Hz, a maximum displacement value is recommended. The values set in the Standard relate to transient vibrations and to low-rise buildings. Continuous vibration can give rise to dynamic magnifications due to resonances and may need to be reduced by up to 50%. Table 7-8 sets out the BS7385 criteria for cosmetic, minor and major damage.

Table 7-8: BS 7385 structural damage criteria

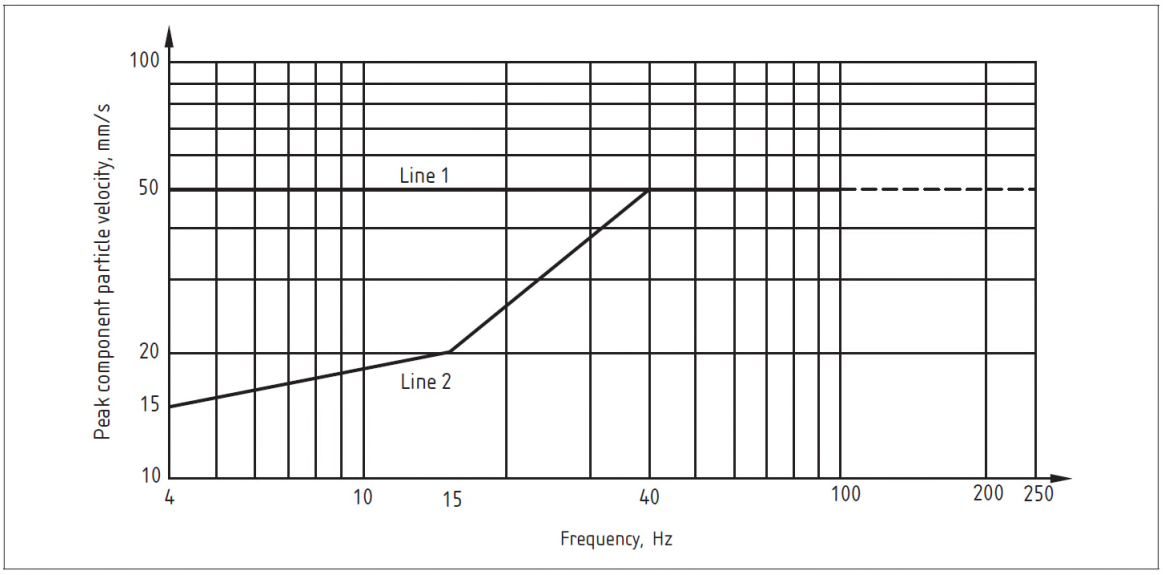
Group	Type of structure	Damage level	Peak component particle velocity, mm/s		
			4Hz to 15Hz	15Hz to 40Hz	40Hz and above
1	Reinforced or framed structures Industrial and heavy commercial buildings	Cosmetic	50		
		Minor*	100		
		Major*	200		

Group	Type of structure	Damage level	Peak component particle velocity, mm/s		
			4Hz to 15Hz	15Hz to 40Hz	40Hz and above
2	Un-reinforced or light framed structures Residential or light commercial type buildings	Cosmetic	15 to 20	20 to 50	50
		Minor*	30 to 40	40 to 100	100
		Major*	60 to 80	80 to 200	200

Notes: Peak Component Particle Velocity is the maximum Peak particle velocity in any one direction (x, y, z) as measured by a tri-axial vibration transducer.

* Minor and major damage criteria established based on British Standard 7385 Part 2 (1993) Section 7.4.2

Figure 7-3: BS 7385:2 (1993) structural damage criteria



Vibration screening criteria – Rail infrastructure and residential dwellings

The limits presented in Table 7-8 relate predominantly to transient vibration which does not give rise to resonant responses in structures, and to low-rise buildings. Where the dynamic loading caused by continuous vibration gives rise to dynamic magnification due to resonance, then the guide values in Table 7-8 may need to be reduced by up to 50 percent. This is especially applicable at the lower frequencies where lower guide vales apply.

On this basis, a conservative vibration screening criteria per receiver type is given below:

- Reinforced or framed structures (Group 1): 25.0mm/s
- Unreinforced or light framed structures (Group 2): 7.5mm/s

7.3.2.2 German Standard

German Standard DIN 4150 - Part 3 (2016) '*Vibration in buildings - Effects on Structures*' (DIN 4150-3:2016), also provides recommended maximum levels of vibration that reduce the likelihood of building damage caused by vibration and are generally recognised to be conservative.

DIN 4150-3:2016 presents the recommended maximum limits over a range of frequencies (Hz), measured at the foundations, in the plane of the uppermost floor of a building or structure or vertically on floor slabs. The vibration limits at the foundations increase as the frequency content of the vibration increases. The criteria are presented in Table 7-9.

Table 7-9: DIN 4150-3:2016 structural damage criteria

Group	Type of structure	Vibration velocity, mm/s				
		At foundation in all directions at frequency of			Plane of floor uppermost storey in horizontal direction	Floor slabs, vertical direction
		1Hz to 10Hz	10Hz to 50Hz	50Hz to 100Hz	All frequencies	All frequencies
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40	20
2	Residential buildings and buildings of similar design and/or occupancy	5	5 to 15	15 to 20	15	20
3	Structures that because of their particular sensitivity to vibration, cannot be classified under Groups 1 and 2 and are of great intrinsic value (eg listed buildings)	3	3 to 8	8 to 10	8	20

Vibration screening criteria – Heritage structures

As noted in BS 7385, heritage building and structures should not be assumed to be more sensitive to vibration, unless structurally unsound.

The more stringent criterion in German Standard DIN 4150 of 3mm/s (peak component particle velocity) has been used in this assessment as a conservative vibration damage screening level for heritage buildings / structures. This screening level will allow potentially impacted heritage buildings to be identified. If a heritage building is predicted to be exposed to vibration levels above the conservative screening level of 3mm/s, further investigation would be undertaken to determine whether the building is structurally unsound. Where a heritage structure is deemed to be sensitive to vibration impacts, the more stringent DIN 4150 3 guideline values can be applied. Otherwise, structural damage vibration limits based on BS 7385 (Section 7.3.2 and 7.3.2.1) can be applied.

7.4 Built form works noise assessment

7.4.1 Proposed built form works noise sources

A schedule of equipment / machinery likely to be used for all stages of the built form work at Stage 2a of the Corrimal Coke Works site (as advised by Chester Project Management Pty Ltd) is set out in Table 7-10.

Table 7-10: Typical built form work equipment and sound power levels

Plant item	Equipment / machinery	Sound power level, dB(A) re 1pW
1.	Small excavator (15T) with hydraulic hammer	118
2.	Small excavator (15T) with ripper attachment	103
3.	Trench roller	109
1.	Piling rig - bored	107
1.	Concrete pump	103
2.	Concrete agitator	108
3.	Tower crane - electric	106
4.	Mobile crane	107
5.	Telehandler	106
6.	Delivery truck	106
7.	Hand tools - powered	108

The sound power levels for the built form work equipment / machinery presented Table 7-10 are based on maximum noise levels given in Table A1 of Australin Standard 2346 – 2010 'Guide to Noise Control on Construction, Demolition and Maintenance Site', the Interim Construction Nosie Guideline (ICNG), and information for past projects and/or information held in our library files.

7.4.2 Predicted noise levels

Noise levels at any receiver location resulting from the built form works would depend on the location of the receiver with respect to the location of the built form work equipment, shielding from intervening structures / topography and the type / duration of the built form works being undertaken. Furthermore, noise levels at receivers would vary significantly over the total built form works program due to the transient nature and large range of plant and equipment that could be used.

Table 7-11 presents noise levels likely to be experienced at the nearby affected receivers based on the built form work activities and plant/equipment associated with the proposed development, where the range represents the plant items operating at a location furthest away and a location closest to each receiver. The predictions include the acoustic shielding effects from existing fences and hoardings / temporary barriers recommended for the previous construction works at the site (illustrated in APPENDIX I and described below).

- The Corrimal Coke Works site has existing corrugated metal fences with an approximate height of 1.8m along a portion of the northern boundary (from the existing entry gate to the north-eastern corner of site) and along the common boundaries with the residential premises fronting Cross Street, Corrimal (NCA 6). Along the eastern boundary of the Corrimal Coke Works site is an existing corrugated metal fence with an approximate height of 2.5m (extending from the north-eastern corner of the site to the alignment of the Powerhouse building).
- 2.4m high hoardings (constructed from 17mm plywood or similar solid material) were proposed along the eastern site boundary for the previous demolition stage of the project. These hoardings are to be retained for the Stage 2 built form works.
- Additional hoardings (17mm plywood or similar solid material) or temporary acoustic barriers (such as Echo Barrier) with a height of 2.0m were proposed along the northern and western site boundaries for the previous Stage 1 Bulk Earthworks to increase acoustic shielding to the residential receivers to the north-west of the site which front Cross Street, Corrimal. These hoardings are to be retained for the Stage 2 built form works.

Results for the assessment of airborne built form work noise were determined using a CadnaA computer noise model developed for the project. The CadnaA model takes into account sound radiation patterns, ground elevation contours, acoustic shielding and potential reflections from intervening building elements and noise attenuation due to distance to predict the noise of the built form works in accordance with International Standard ISO 9613.

Table 7-11: Predicted $L_{Aeq,15min}$ noise levels at residential receivers for typical built form work plant, dB(A) – with hoarding/temporary barriers

Plant item	Plant description	Predicted $L_{Aeq,\ 15min}$ construction noise levels					
		NCA 1	NCA 2	NCA 3	NCA 4	NCA 5	NCA 6
Noise management level		*60*	*55*	*55*	*49*	*56*	*60*
Building 2.1							
1.	Small excavator (15T) with hydraulic hammer	53-56	50-54	57-63	58-64	44-49	55-59
2.	Small excavator (15T) with ripper attachment	38-41	35-39	42-48	43-49	29-34	40-44
3.	Trench roller	44-47	41-45	48-54	49-55	35-40	46-50
4.	Piling rig - bored	42-45	39-43	46-52	47-53	33-38	44-48
5.	Concrete pump	38-41	35-39	42-48	43-49	29-34	40-44
6.	Concrete agitator	43-46	40-44	47-53	48-54	34-39	45-49
7.	Tower crane - electric	41-44	38-42	45-51	46-52	32-37	43-47
8.	Mobile crane	42-45	39-43	46-52	47-53	33-38	44-48
9.	Telehandler	41-44	38-42	45-51	46-52	32-37	43-47
10.	Delivery truck	41-44	38-42	45-51	46-52	32-37	43-47
11.	Hand tools - powered	43-46	40-44	47-53	48-54	34-39	45-49
Up to three activities (noisiest) operating concurrently		**54-57**	**51-55**	**58-63**	**59-65**	**45-50**	**56-60**

Plant item	Plant description	Predicted $L_{Aeq, 15min}$ construction noise levels					
		NCA 1	NCA 2	NCA 3	NCA 4	NCA 5	NCA 6
Building 2.2							
1.	Small excavator (15T) with hydraulic hammer	52-56	53-57	62-67	61-69	44-50	52-56
2.	Small excavator (15T) with ripper attachment	37-41	38-42	47-52	46-54	29-35	37-41
3.	Trench roller	43-47	44-48	53-58	52-60	35-41	43-47
4.	Piling rig - bored	41-45	42-46	51-56	50-58	33-39	41-45
5.	Concrete pump	37-41	38-42	47-52	46-54	29-35	37-41
6.	Concrete agitator	42-46	43-47	52-57	51-59	34-40	42-46
7.	Tower crane - electric	40-44	41-45	50-55	49-57	32-38	40-44
8.	Mobile crane	41-45	42-46	51-56	50-58	33-39	41-45
9.	Telehandler	40-44	41-45	50-55	49-57	32-38	40-44
10.	Delivery truck	40-44	41-45	50-55	49-57	32-38	40-44
11.	Hand tools - powered	42-46	43-47	52-57	51-59	34-40	42-46
Up to three activities (noisiest) operating concurrently		**53-56**	**53-58**	**63-67**	**62-70**	**45-51**	**53-57**
Buildings 2.3 and 2.4							
1.	Small excavator (15T) with hydraulic hammer	49-54	47-53	52-62	56-67	48-52	52-56
2.	Small excavator (15T) with ripper attachment	34-39	32-38	37-47	41-52	33-37	37-41
3.	Trench roller	40-45	38-44	43-53	47-58	39-43	43-47
4.	Piling rig - bored	38-43	36-42	41-51	45-56	37-41	41-45
5.	Concrete pump	34-39	32-38	37-47	41-52	33-37	37-41
6.	Concrete agitator	39-44	37-43	42-52	46-57	38-42	42-46
7.	Tower crane - electric	37-42	35-41	40-50	44-55	36-40	40-44
8.	Mobile crane	38-43	36-42	41-51	45-56	37-41	41-45
9.	Telehandler	37-42	35-41	40-50	44-55	36-40	40-44
10.	Delivery truck	37-42	35-41	40-50	44-55	36-40	40-44
11.	Hand tools - powered	39-44	37-43	42-52	46-57	38-42	42-46
Up to three activities (noisiest) operating concurrently		**50-54**	**48-54**	**53-63**	**57-68**	**49-53**	**52-57**

Based on the predicted noise emission levels from Stage 2a built form works presented in Table 7-11, the residential receivers in NCAs 3 and 4 are in close proximity to the built form work areas and most likely to be impacted by construction noise. Exceedances of the noise management level are also predicted at NCA 2 when a hydraulic hammer is being used for excavations of the basement, services trenches, etc. of Building 2.2.

There are no exceedances of the highly noise affected level of 75dB(A) at any of the surrounding residential receivers.

Section 7.5 sets out noise management measures to address the remaining exceedances of the noise management levels.

The Stage 2a built form works are not proposed to be conducted concurrently with other development stages of the Corrimal Coke Works site. Therefore, there is not expected to be any cumulative construction noise impacts.

7.5 Built form works noise mitigation measures

7.5.1 General engineering noise controls

Implementation of noise control measures such as those suggested in Australian Standard 2436-2010 'Guide to Noise Control on Construction, Demolition and Maintenance Sites', are expected to reduce predicted built form work noise levels.

Reference to Australian Standard 2436-2010, Appendix C, Table C1 suggests passible remedies and alternatives to reduce noise emission levels from typical construction equipment. Table C2 in Appendix C presents typical examples of noise reduction achievable after treatment of various noise sources. Table C3 in Appendix C presents the relative effectiveness of various forms of noise control treatment.

Table 7-12 presents noise control methods, practical examples and expected noise reductions according to AS2436 and according to Renzo Tonin & Associates' opinion based on experience with past projects.

Table 7-12: Relative effectiveness of various forms of noise control

Noise control method	Practical examples	Typical noise reduction possible in practice, dB(A)		Maximum noise reduction possible in practice, dB(A)	
		AS2436	Renzo Tonin & Assoc.	AS2436	Renzo Tonin & Assoc.
Distance	Doubling of distance between source and receiver	6	6	6	6
Screening	Acoustic barriers such as temporary or permanent noise barriers where barriers breaks line-of-sight between the source and receiver	5 to 10	5 to 10	15	15
Acoustic enclosures	Engine casing lagged with acoustic insulation and plywood	15 to 25	10 to 20	50	30
Engine silencing	Residential class mufflers	5 to 10	5 to 10	20	20
Substitution by alternative process	Use electric motors in preference to diesel or petrol	-	15 to 25	-	40

The Renzo Tonin & Associates' listed noise reductions are conservatively low, and should be referred to in preference to those of AS2436.

With respect to the above noise control methods, we note in general that:

- Increasing distance as a noise control method is not feasible for this project as the Stage 2a residential apartment buildings that are to be constructed and the surrounding residential receiver locations are fixed. However, the different distances between the work locations and residential receivers have been taken into account and reflected in the range of predicted levels presented in Table 7-11. The assessment reveals that the occurrence of built form works furthest from the residential receiver is likely to result in noise emission levels less than the noise management levels (except for built form works for Building 2.2 and the use of hydraulic hammers to NCA 4).

  With respect to concrete pouring activities, concrete agitators and pumps are to be located towards the western end of the work areas where practical to maximise the distance of these construction plant from the nearest residential receivers to the east of the site (NCAs 3 and 4).

- Predicted construction noise levels with hoardings / temporary barriers along the site boundary are set out in Table 7-11. If there are plant / equipment that will be in a fixed location for long periods of time, additional temporary barriers could be considered adjacent to the plant / equipment to provide further screening.

  Additional screening could also be achieved by staging the construction works to erect the external walls of the Stage 2a residential flat buildings as soon as possible so that the building envelope provide acoustic shielding to the surrounding noise sensitive receivers.

- Due to the size and movement of equipment undertaking the proposed built form works, the use of acoustic enclosures is not feasible for this project.

- Engine silencing and substitution by alternative process is feasible to an extent – the use of a ripper to undertake excavation works for the basement and service trenches is significantly quieter and recommended in place of hydraulic hammers where possible. However, the ripper cannot be used in all situations (dependent upon the soil / rock conditions).

7.5.2 Noise management recommendations

The following recommendations provide feasible and reasonable noise control solutions to reduce noise impacts to sensitive receivers. A strong justification must be provided for not implementing the proposed measures if they are later determined on-site to not be feasible or reasonable.

The advice provided here is in respect to acoustic only. Supplementary professional advice may need to be sought in respect to fire ratings, structural design, buildability, fitness for purpose and the like.

General noise management measures

The following general noise management measures are recommended for all receiver locations:

- Regularly inspect and maintain equipment to ensure it is in good working order.

- Provide special attenuation to any use and maintenance of 'noise control' or 'silencing' kits fitted to machines to ensure they perform as intended.
- Avoid any unnecessary noise when carrying out manual operations and when operating plant.
- Simultaneous operation of noisy plant within discernible range of a sensitive receiver is to be limited/avoided where possible.
- The offset distance between noisy plant and adjacent sensitive receivers is to be maximised where practical.
- Where practical, plant and equipment that are used intermittently are to have throttle setting reduced or shut down when not in use. Any plant and equipment that will not be used for extended periods of time are to be switched off.
- Trucks engines should be turned off as opposed to idling, if feasible. Also, non-tonal reversing beacons should be considered for the on-site vehicles.
- In addition to the noise mitigation measures outlined above, a management procedure will need to be put in place deal with noise complaints that may arise from built form work activities. Each complaint will need to be investigated, and appropriate noise amelioration measures put in place to mitigate future occurrences, where the noise in question is in excess of allowable limits. See APPENDIX F for detailed noise monitoring procedure and APPENDIX H for an example of a complaint handling procedure.
- Good relations with people living and working in the vicinity of the Corrimal Coke Works site should be established at the beginning of a project and be maintained throughout the project, as this is of paramount importance. Keeping people informed of progress and taking complaints seriously and dealing with them expeditiously is critical. The person selected to liaise with the community must be adequately trained and experienced in such matters.

Specific noise management measures

Other potential mitigation measures include:

- Neighbour notification
    - Community consultation procedures and site point-of-contact must be established.
    - Notify surrounding residential areas (at a minimum, NCAs 2 to 4 along Duff Parade, East Corrimal which are closest to the built form works) of the estimated dates, locations during each day and typical duration of noisy activities so a given receiver will have an understanding of the duration of works that is in closest proximity to them.
- Respite periods

- The construction noise level predictions identify the use of a hydraulic hammer during the excavation works for the basement, service trenches and footings to have the highest potential of exceeding the noise management levels and giving rise to noise impacts.
- Community consultation should occur to determine whether it is preferable to adopt respite periods (which may have the effect of increasing the overall duration of built form work), or to have the built form work completed as quickly as possible.
- Respite periods could potentially be adopted by having noisy activities being carried out a continuous block of up to three hours, with a minimum of one hour between each block where no noisy equipment are used.
- Alternative respite periods could be negotiated if agree upon with potentially impacted receivers. For example, use of hydraulic hammers could be limited to 9:00am – 5:00pm on weekdays when the surrounding residents are likely to not be at home.

- All employees, contractors and subcontractors are to receive site induction, toolbox talks and ongoing training so that the above noise management measures are implemented accordingly. Content within toolbox talks will include location of nearest noise sensitive receivers, relevant project specific and standard noise / vibration mitigation measures, permissible hours of work, truck route and truck loading restrictions and employee parking areas.

7.6 Built form work vibration assessment

7.6.1 Proposed vibration generating activities

Vibration levels at the receiver locations from the built form works for the Stage 2a development of the Corrimal Coke Works site will vary depending upon the type of activities being carried out, separation distances, the intervening soil and rock strata, dominant frequencies of vibration, and construction/structure of the receiver building.

With respect to the typical plant and equipment we are instructed that would be on site for the works (set out in Table 7-10), this assessment considers the critical vibration generating equipment to be the hydraulic hammer for excavation of the basements and service trenches, vibratory roller for the compaction of basement backfill and piling works for the piling works for the construction of the building footings. The recommended minimum working distances for vibration intensive plant are presented in Table 7-13.

Table 7-13: Recommended minimum working distances for vibration intensive plant

Plant item	Rating / description	Minimum working distance (m)		
		Structural damage		Human response
		Rail infrastructure	Heritage dwellings	Residential premises
Excavator	Small excavator (15T) with hydraulic hammer	5	10	20

Plant item	Rating / description	Minimum working distance (m)		
		Structural damage		Human response
		Rail infrastructure	Heritage dwellings	Residential premises
Roller	Small remote-controlled trench roller	5	10	20
Piling	Piling rig - bored	5	5	15

Notes: Renzo Tonin & Associates project files, databases and library

Site specific buffer distances for vibration significant plant items must be measured on-site where plant and equipment are likely to operate close to or within the minimum working distance for structural damage.

Unlike noise, vibration cannot be readily 'predicted' due to many variables from site to site, for example soil type and conditions, subsurface rock, building types and foundations and actual plant on site. The data relied upon in this assessment (set out above) is taken from a database of vibration levels measured at different site. They are not specific to this project as final vibration levels are dependent on many factors including the actual plant used, its operation and the intervening geology between the activity and receiver.

7.6.2 Potential vibration impacts

Based on the proposed plant items presented, vibration generated by the built form work plant was estimated and potential vibration impacts are summarised in Table 7-14 below.

Table 7-14: Potential vibration for nearest sensitive receivers

Receiver location	Approx. distance to nearest building from works	Type of nearest sensitive building	Assessment of potential vibration impacts		
			Structural damage	Human disturbance	Vibration monitoring
NCA 1	>250m	Residential	Very low risk of structural damage from built form works.	Very low risk of adverse comment from built form works.	Vibration monitoring not required.
NCA 2	>130m	Residential	Very low risk of structural damage from built form works.	Very low risk of adverse comment from built form works.	Vibration monitoring not required.
NCA 3	Building 2.1: >110m Building 2.2: 48m Buildings 2.3 & 2.4: 76m	Residential	Very low risk of structural damage from built form works.	Low risk of adverse comment from excavation / compaction works for Building 2.2.	Vibration monitoring shall be conducted in response to complaints where required.
NCA 4	Building 2.1: >110m Building 2.2: 48m Buildings 2.3 & 2.4: 48m	Residential	Very low risk of structural damage from built form works.	Low risk of adverse comment from excavation / compaction works for Building 2.2.	Vibration monitoring shall be conducted in response to complaints where required.

Receiver location	Approx. distance to nearest building from works	Type of nearest sensitive building	Assessment of potential vibration impacts		
			Structural damage	Human disturbance	Vibration monitoring
NCA 5	>260m	Residential	Very low risk of structural damage from built form works.	Very low risk of adverse comment from built form works.	Vibration monitoring not required
NCA 6	>150m	Residential	Very low risk of structural damage from built form works.	Very low risk of adverse comment from built form works.	Vibration monitoring not required
Rail corridor	Building 2.1: 87m Building 2.2: 23m Buildings 2.3 & 2.4: 23m	Rail infrastructure	Low risk of structural damage from built form works.	N/A	Vibration monitoring is required at the commencement of built form work to establish minimum working distances.
Heritage items of former Corrimal Coke Works to be retained	Building 2.1: 49m Building 2.2: 6m Buildings 2.3 & 2.4: 58m	Heritage / buildings in poor to fair condition	High risk of structural damage to Powerhouse building and brick stack from excavation and compaction activities for Building 2.2. Medium risk to Powerhouse building and brick stack from piling activities for Building 2.2.	N/A	Vibration monitoring is required at the commencement of built form work to establish minimum working distances.

Based on the above assessment, the main risks relate to:

- Potential damage to the Powerhouse building and brick stack heritage structure within the Corrimal Coke Works site that are to be retained as these structures are location in close proximity to the Building 2.2 work area.

7.7 Vibration mitigation measures

The following vibration mitigation measures are recommended to minimise vibration impacts from built form work.

- The proper implementation of a vibration management plan is required to avoid adverse vibration disturbance to affected occupancies. Consultation with occupants and property owners is recommended and should be aimed at providing a communication path directly to the contractor.
- A management procedure is to be implemented to deal with vibration complaints. Each complaint will be investigated and where vibration levels are established as exceeding the set limits,

appropriate amelioration measures shall be put in place to mitigate future occurrences. An example of a vibration complaint management procedure is presented in APPENDIX H of this report.

- Carry out vibration testing of actual equipment on site prior to the built form work to determine acceptable buffer distances to sensitive receivers. Where built form work activities are within the acceptable buffer distances determined from site testing, additional vibration monitoring is to undertaken which signals to the contractor (by way of buzzer, flashing lights, etc.) when vibration level approach / exceed the recommended limits. Further details of the monitoring procedures are set out in Section 7.7.1.

- Where vibration is found to be excessive, management measures must be implemented to ensure vibration compliance is achieved. Management measures may include:

    - Using smaller equipment or modifying the built form work method (eg. using bored or vibratory piling preferentially to impact piling) where feasible;

    - Establishment of safe buffer zones; and

    - Time restrictions to the operation of vibration intensive plant to address human comfort.

- Notification by letter drop should be carried out for the nearest surrounding residential properties (at a minimum, NCAs 3 and 4 along Duff Parade, East Corrimal which are closest to the built form works) to address potential community concerns that perceived vibration may cause damage to property. Notification is to be provided to these receiver prior to the commencement of built form work.

7.7.1 Vibration monitoring and methodology

To minimise the potential risk of vibration generation activities causing damage to rail corridor infrastructure and heritage items within the Corrimal Coke Works site, vibration monitoring is required to verify the actual vibration levels and site-specific buffer distances.

Prior to built form work

Prior to the start of vibration intensive built form work, attended vibration measurements are to be conducted within the site to confirm the source vibration levels of the plant and attenuation of the vibration with distance. To minimise the potential for structural damage risks from the built form works, the initial vibration intensive works and measurements are to occur towards the centre of the Corrimal Coke Works Site so that they are removed from the rail infrastructure, sensitive heritage items and nearest residential dwellings.

Measurements shall be undertaken at multiple distances from the vibration generating plant while it is operating. The peak particle velocity (PPV) results are to be used to determine the source vibration

levels of the plant, create a site low for attenuation with distance and establish site-specific minimum working distances for the most vibration significant plant items.

The potential vibration impacts are to be reassessed against the site-specific minimum working distances. This may include further detailed analysis based on the frequency content of the vibration levels.

Permanent strengthening works to the heritage items within the Corrimal Coke Works site are included in a separate Development Application. Prior to vibration generating built form work, a structural engineer is to be consulted to confirm the sensitivity of the heritage items to vibration and inform the appropriate vibration limits to be adopted, as noted in Section 7.3.2.1 and 7.3.2.2.

During built form work

Adjacent to the built form work areas is the southern end of the C1 Coke Oven which is a heritage item within the Corrimal Coke Works site to be retained / conserved.

The following vibration management measures are provided to minimise vibration impact from built form work activities to the adjacent residential dwellings and heritage items:

1. Permanent strengthening works to the heritage structures at the Corrimal Coke Works site are covered in a separate Development Application. Prior to the commencement of vibration generating built form work, a structural engineer is to be consulted to confirm the sensitivity of the heritage structures to vibration impacts and determine whether vibration limits applicable to the heritage structures can then be updated in accordance with Sections 7.3.2.1 and 7.3.2.2.

2. If vibration intensive work is proposed to occur within the site specific acceptable minimum working distance, then the following would be carried out:

    a. Evaluate whether alternative construction methods, plant or equipment can be utilised for the works and re-assess potential impacts (if required).

    b. If there is any risk of exceeding the vibration objectives after all of the above options have been considered, a permanent vibration monitoring system should be installed, to warn plant operators (via flashing light, audible alarm, SMS, etc) when vibration levels are approaching the structural/cosmetic damage limits. It is recommended that for the operator alerts, that multiple alert levels are set. Typically, this would be an alert trigger level at 75% of the vibration criteria (ie. Amber alert), and an alert trigger level at 100% of the vibration criteria (ie. red alert).

        Detailed vibration monitoring procedures are outlined in APPENDIX G.

    c. A management procedure would be developed prior to the works taking place to determine the response to each trigger level. It is recommended that this includes a pause and management measures for an alert trigger level at 75% of the vibration criteria, and stop

work at an alert trigger level at 100% of the vibration criteria. Where stop work is triggered, it is recommended that the following are undertaken:

STOP WORKS PROCEDURE

i. Investigate cause of exceedance

ii. Visual inspection of the vibration sensitive building/structure/item including photos

iii. If no cosmetic damage is found, works and vibration monitoring can be resumed

iv. If cosmetic damage has been identified, repair damage and use a different construction method with lower source vibration levels.

7.8 Complaints management and community liaison

Noise and vibration levels generated by the built form work should aim to comply with the noise and vibration goals set by the relevant regulations and guidelines.

The building contractor is responsible for implementing this Construction Noise and Vibration Management Plan and ensuring that all reasonable measures are implemented, such as the provision of a Noise and Vibration Complaints Program, to minimise the generation of excessive noise and/or vibration levels.

Owners and occupants of nearby affected properties are to be provided a direct telephone line and contact person (via mail/letter drop) where any noise and vibration complaints related to the built form work activities can be recorded. Additionally, occupants are to be notified of any periods of noisy or vibration intensive built form work (such as the use of hydraulic hammers) at least 24 hours prior to their commencement.

All noise and vibration complaints shall be investigated in accordance with the Noise / Vibration Complaint Management Procedure identified in APPENDIX H of this report. Where a site investigation is required to address the complaint APPENDIX F and APPENDIX G provide detailed procedures for conducting noise and vibration monitoring.

8 Conclusion

Renzo Tonin & Associates was engaged to prepare a noise and vibration impact assessment to accompany the State Significant Development Application (SSD-83789711) for the Stage 2a built form, comprising of four residential flat buildings, of the Corrimal Coke Works site at 27 Railway Street, Corrimal.

This report assesses road / rail traffic noise intrusion into the proposed residential apartments, sets mechanical plant noise emission goals for the detailed design stage, and assess noise and vibration impacts from the construction of the Project. The report has been prepared to address the Planning Secretary's Environmental Assessment Requirements ("SEARs") and NSW EPA requirements.

8.1 Road / rail traffic impact assessment to residential development

The assessment has been undertaken in accordance with *NSW State Environment Planning Policy (Transport and Infrastructure) 2021*, the associated *Development near Rail Corridors and Busy Roads – Interim Guideline* and any other relevant vibration standards.

The findings of the study are:

- The facades of the proposed residential flat buildings will require acoustic facade treatments to meet the Transport and Infrastructure SEPP criteria. The facades that require acoustic treatment and the category of treatment required have been provided in APPENDIX E.
- Vibration impacts from the rail corridor have been found to be compliant with human comfort vibration criteria.
- Ground-borne noise of train passbys has been found to be compliant with criteria set out in the Department of Planning's *Development near Rail Corridors and Busy Roads – Interim Guideline*.
- Maximum noise level assessment of level crossing activities (signal alarms and train horns) during the night-time period reveal internal noise levels that are unlikely to impact sleep and cause awakenings to the residential receivers in the Stage 2a development.

In summary, the noise and vibration levels in the Stage 2a development of the Corrimal Coke Works site (from road and rail traffic) can be suitably mitigated using standard acoustic treatments to achieve compliance with the relevant noise criteria. As such, the Corrimal Coke Works site can be supported in relation to the Stage 2a development for residential use.

8.2 Operational noise from residential development

With respect to noise emission from mechanical plant servicing the Stage 2a residential flat buildings of the Corrimal Coke Works site, selection and location of plant have not been finalised at the SSDA stage. Based on the Protection of the Environment Operations (Noise Control) Regulation 2017, Section 6.2 of

this report establishes the mechanical plant noise emission goals which are to be achieved at detailed design stage.

8.3 Construction noise and vibration impacts

The construction of the Stage 2a residential flat buildings have been assessed with respect to:

- Potential noise impacts in accordance with the NSW *Interim Construction Noise Guideline* (ICNG, 2009);
- Potential vibration impact to the occupants of the surrounding residential dwellings in accordance with the DEC '*Assessing Vibration: a technical guideline*' (DECC, 2006); and
- Potential structural damage from vibration to surrounding residential dwellings, rail corridor infrastructure and heritage items within the site in accordance with the limits in British Standard 7385 Part 2 and German Standard DIN4150-3.

Site-specific noise and vibration levels from the civil work activities are currently unknown. Based on similar developments, noise and vibration impacts from the civil works equipment that will be used at the Corrimal Coke Works site have been predicted and presented in Sections 7.4.2 and 7.6.2.

Where the assessment has found potential exceedances of the noise objectives, site boundary hoardings have been considered to provide acoustic shielding to the surrounding residential receivers. Any remaining exceedances after the implementation of site boundary hoardings will be addressed through the noise mitigation and management measures presented in Section 7.5 to provide additional noise reduction benefits.

The assessment of vibration levels from the civil works provides recommended buffer distances for vibration compliance. The assessment found the proposed civil works to have a low risk of causing structural damage to the surrounding residential dwellings and rail infrastructure. However, buffer distances should be confirmed prior to the start of the civil works through on-site measurements of vibration.

With respect to the heritage items within the Corrimal Coke Works site that are to be retained / conserved, vibration management measures have been presented in Section 7.7.1 to aid in minimising the likelihood of structural damage from vibration impacts.

Procedures to manage complaints are also provided in Section 7.8 and APPENDIX H to ensure complaints are dealt with accordingly.

APPENDIX A Glossary of terminology

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

Adverse weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Assessment period	The period in a day over which assessments are made.
Assessment Point	A point at which noise measurements are taken or estimated.
Background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L90 noise level (see below).
Decibel [dB]	The units that sound is measured in. The following are examples of the decibel readings of common sounds in our daytime environment:

threshold of hearing	0 dB	The faintest sound we can hear
	10 dB	Human breathing
almost silent	20 dB	
	30 dB	Quiet bedroom or in a quiet national park location
generally quiet	40 dB	Library
	50 dB	Typical office space or ambience in the city at night
moderately loud	60 dB	CBD mall at lunch time
	70 dB	The sound of a car passing on the street
loud	80 dB	Loud music played at home
	90 dB	The sound of a truck passing on the street
very loud	100 dB	Indoor rock band concert
	110 dB	Operating a chainsaw or jackhammer
extremely loud	120 dB	Jet plane take-off at 100m away
threshold of pain	130 dB	
	140 dB	Military jet take-off at 25m away

dB(A)	A-weighted decibels. The A- weighting noise filter simulates the response of the human ear at relatively low levels, where the ear is not as effective in hearing low frequency sounds as it is in hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter.
dB(C)	C-weighted decibels. The C-weighting noise filter simulates the response of the human ear at relatively high levels, where the human ear is nearly equally effective at hearing from mid-low frequency (63Hz) to mid-high frequency (4kHz), but is less effective outside these frequencies.

Frequency	Frequency is synonymous to pitch. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
Impulsive noise	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent noise	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.
L_{Max}	The maximum sound pressure level measured over a given period.
L_{Min}	The minimum sound pressure level measured over a given period.
L_1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L_{10}	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L_{90}	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
L_{eq}	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.
Reflection	Sound wave changed in direction of propagation due to a solid object obscuring its path.
SEL	Sound Exposure Level (SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any period of time and can be used for predicting noise at various locations.
Sound	A fluctuation of air pressure which is propagated as a wave through air.
Sound absorption	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound level meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound pressure level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound power level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
Tonal noise	Containing a prominent frequency and characterised by a definite pitch.

APPENDIX B Long-term noise monitoring methodology

B.1 Noise monitoring equipment

A long-term unattended noise monitor consists of a sound level meter housed inside a weather resistant enclosure. Noise levels are monitored continuously with statistical data stored in memory for every 15-minute period.

Long term noise monitoring was conducted using the following instrumentation:

Description	Type	Octave band data	Logger location(s)
RTA05-008 (NTi Audio XL2)	Type 1	1/3	60 Duff Parade, East Corrimal (Location N1)
RTA07-008 (NTi Audio XL2)	Type 1	1/3	33 Railway Street, Corrimal (Location N2)
RTA07-009 (NTi Audio XL2)	Type 1	1/3	12 Carr Street, Towradgi (Location N3)
RTA07-032 (NTi Audio XL2)	Type 1	1/3	Eastern boundary of Stage 1 development (Location N4)

Notes: All meters comply with AS IEC 61672.1 2004 "Electroacoustics - Sound Level Meters" and designated either Type 1 or Type 2 as per table, and are suitable for field use.

The equipment was calibrated prior and subsequent to the measurement period using a Bruel & Kjaer Type 4231 calibrator. No significant drift in calibration was observed.

B.2 Meteorology during monitoring

Measurements affected by extraneous noise, wind (greater than 5m/s) or rain were excluded from the recorded data in accordance with the NSW NPfI. Determination of extraneous meteorological conditions was based on data provided by the Bureau of Meteorology (BOM), for a location considered representative of the noise monitoring location(s). However, the data was adjusted to account for the height difference between the BOM weather station, where wind speed and direction is recorded at a height of 10m above ground level, and the microphone location, which is typically 1.5m above ground level (and less than 3m). The correction factor applied to the data is based on Table C.1 of ISO 4354:2009 '*Wind actions on structures*'.

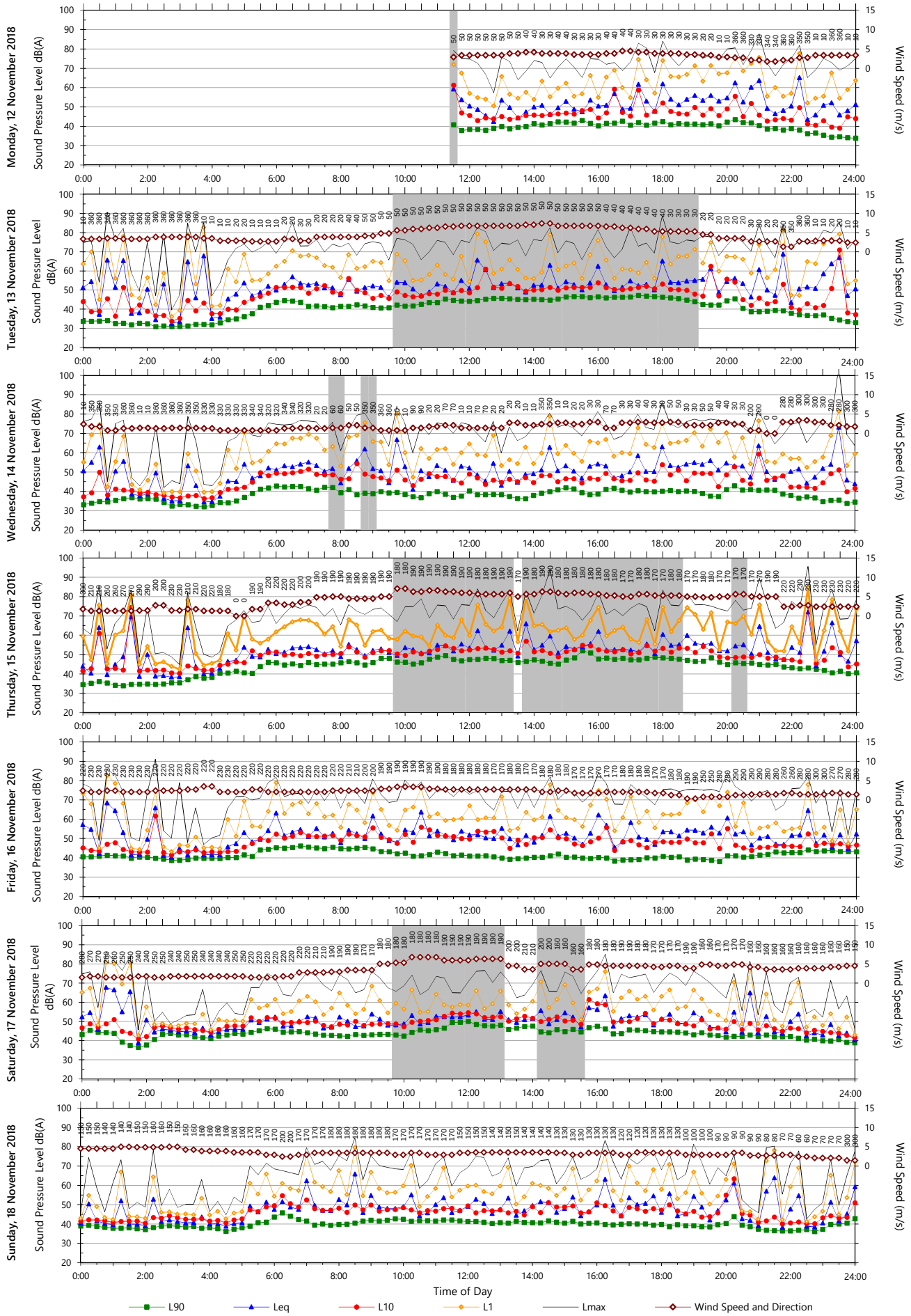
B.3 Noise vs time graphs

Noise almost always varies with time. Noise environments can be described using various descriptors to show how a noise ranges about a level. In this report, noise values measured or referred to include the L_{10}, L_{90}, and L_{eq} levels. The statistical descriptors L_{10} and L_{90} measure the noise level exceeded for 10% and 90% of the sample measurement time. The L_{eq} level is the equivalent continuous noise level or the level averaged on an equal energy basis. Measurement sample periods are usually ten to fifteen minutes. The Noise -vs- Time graphs representing measured noise levels, as presented in this report, illustrate these concepts for the broadband dB(A) results.

APPENDIX C Long-term noise monitoring results

Unattended Monitoring Results

Location: 60 Duff Parade, East Corrimal

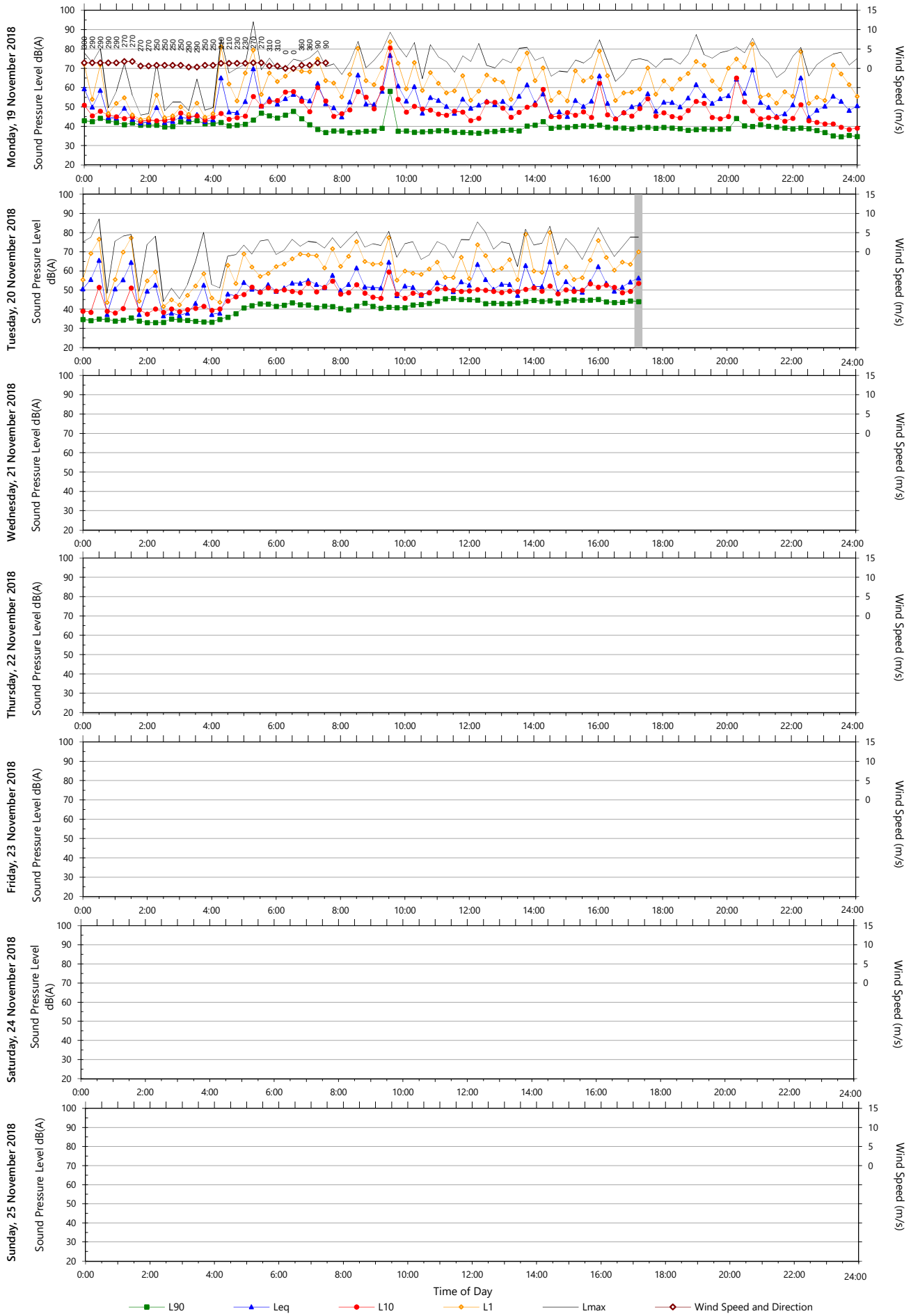


Data File: 2018-11-12_SLM_000_123_Rpt_Report.txt

Template: QTE-26 (rev 22) Logger Graphs Program

Unattended Monitoring Results

Location: 60 Duff Parade, East Corrimal

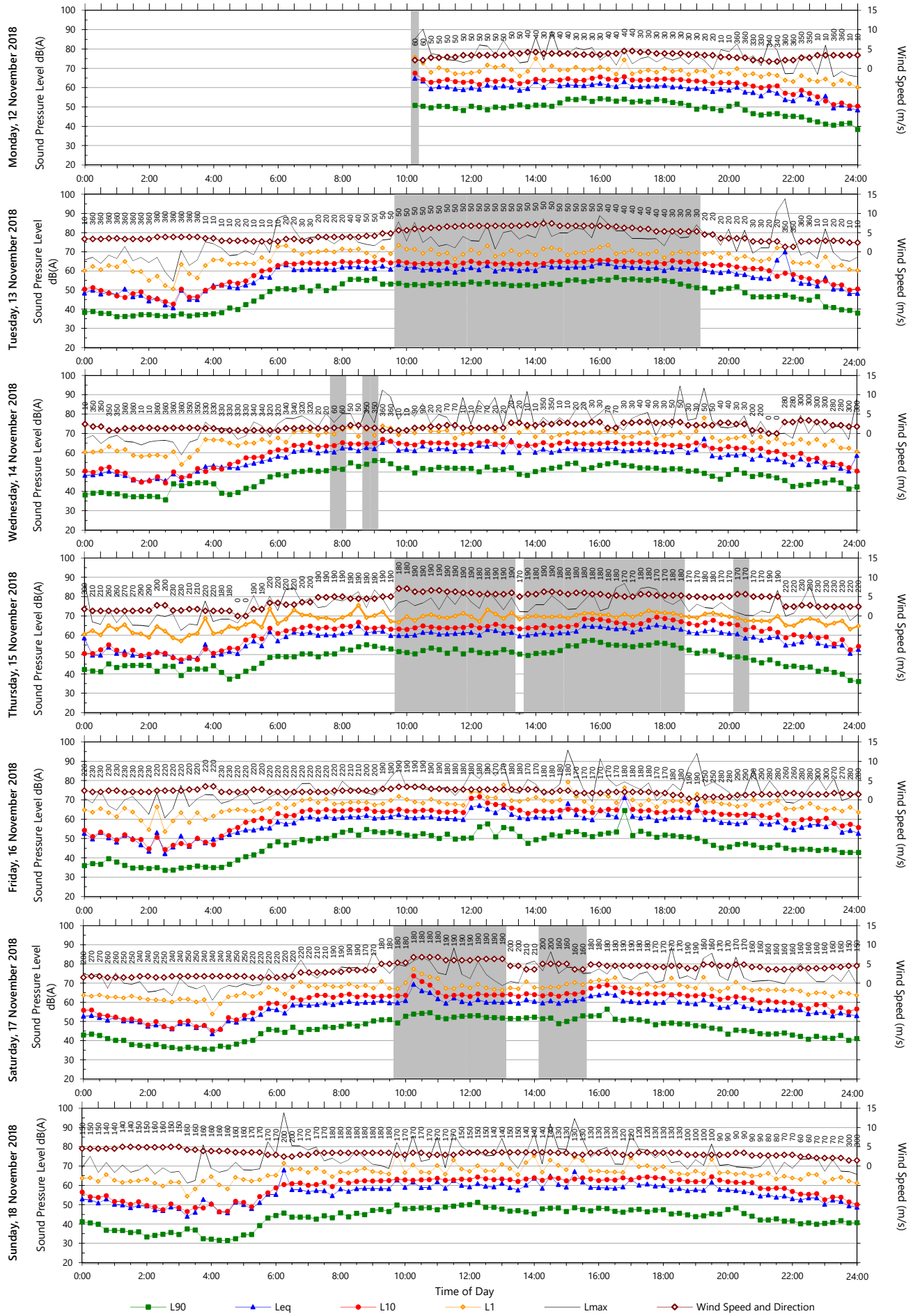


Data File: 2018-11-12_SLM_000_123_Rpt_Report.txt

Template: QTE-26 (rev 22) Logger Graphs Program

Unattended Monitoring Results

Location: 33 Railway Street, Corrimal

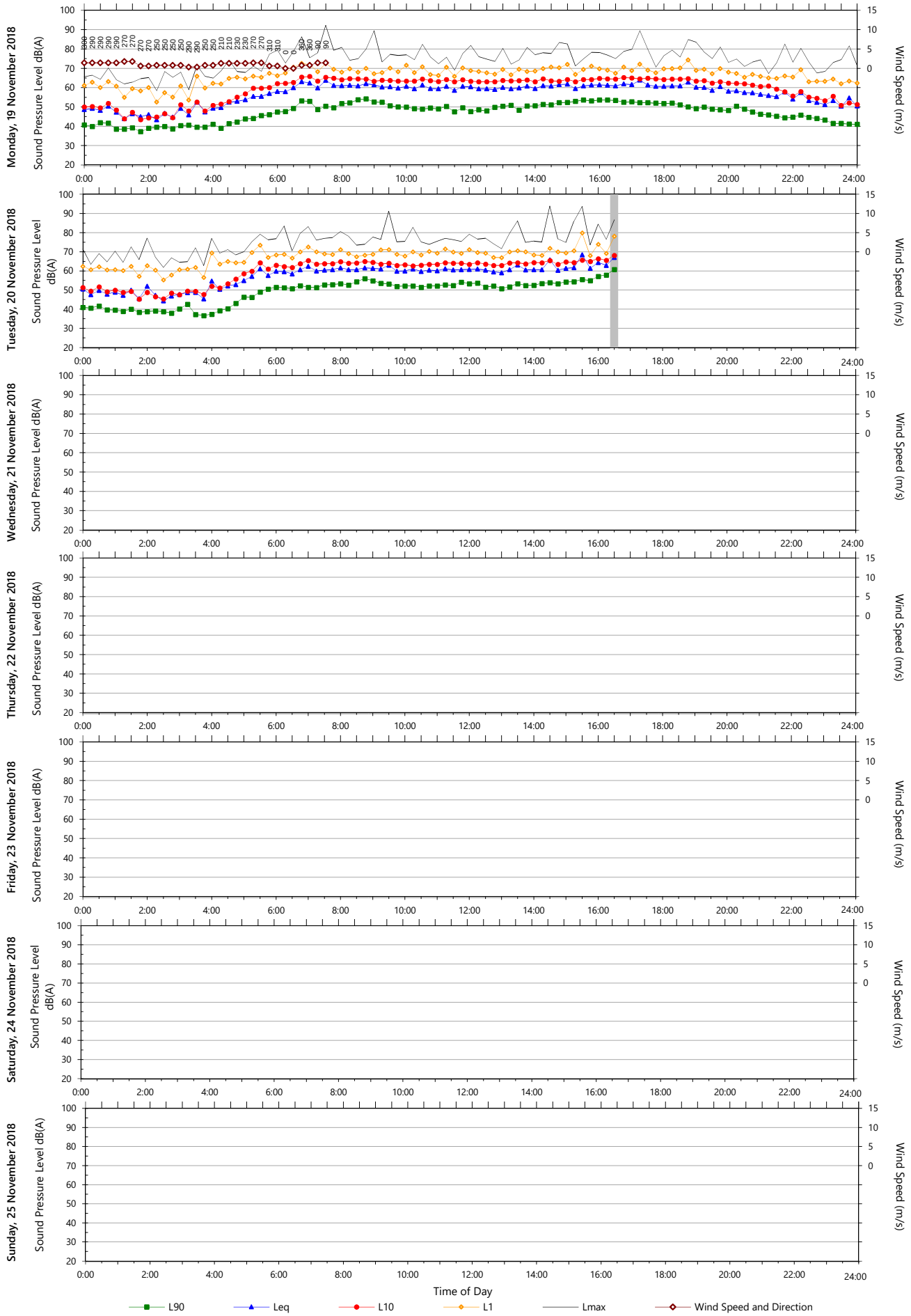


Data File: 2018-11-12_SLM_000_123_Rpt_Report.txt

Template: QTE-26 (rev 22) Logger Graphs Program

Unattended Monitoring Results

Location: 33 Railway Street, Corrimal

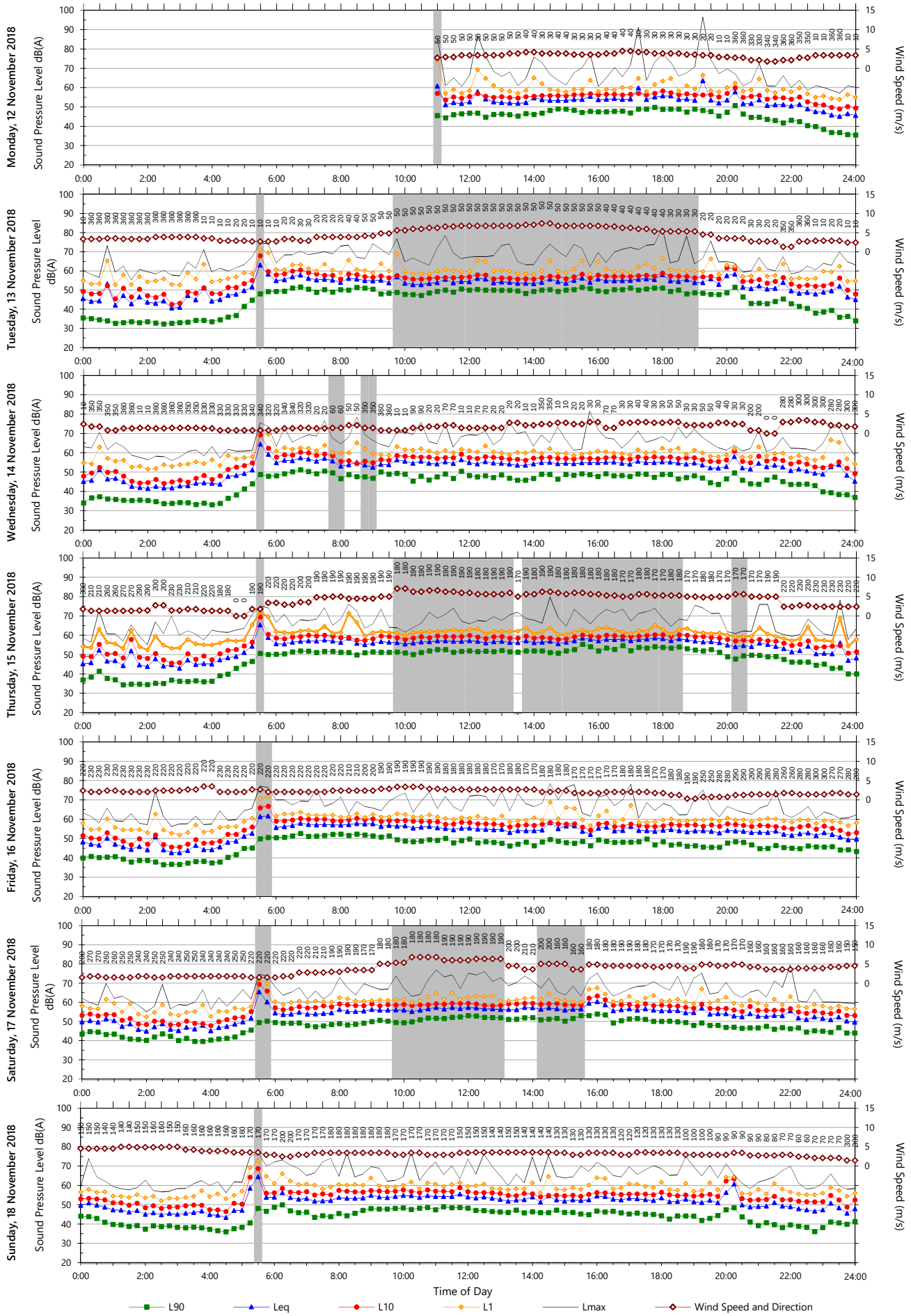


Data File: 2018-11-12_SLM_000_123_Rpt_Report.txt

Template: QTE-26 (rev 22) Logger Graphs Program

Unattended Monitoring Results

Location: 12 Carr Street, Corrimal

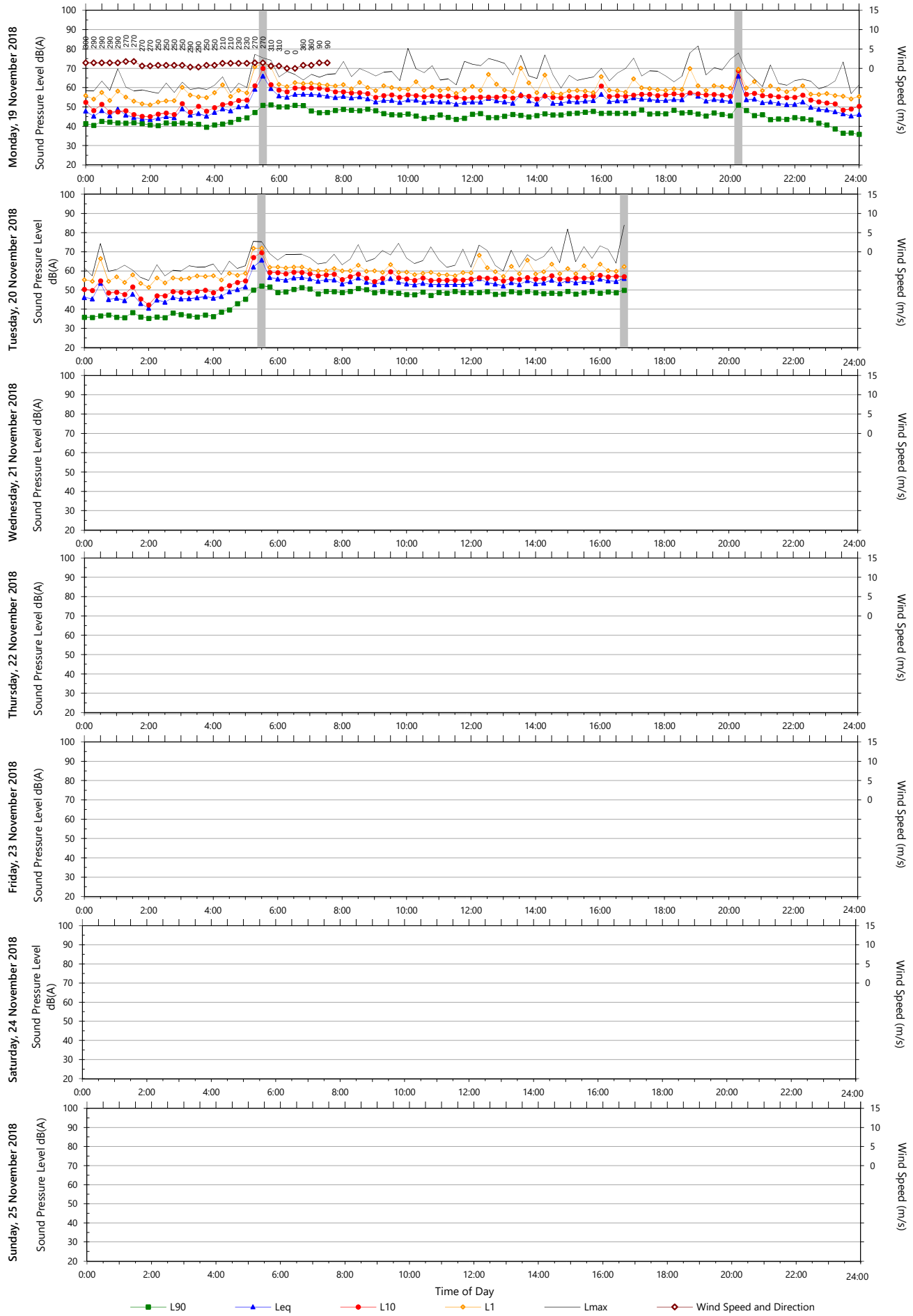


Data File: 2018-11-12_SLM_000_123_Rpt_Report.txt

Template: QTE-26 (rev 22) Logger Graphs Program

Unattended Monitoring Results

Location: 12 Carr Street, Corrimal

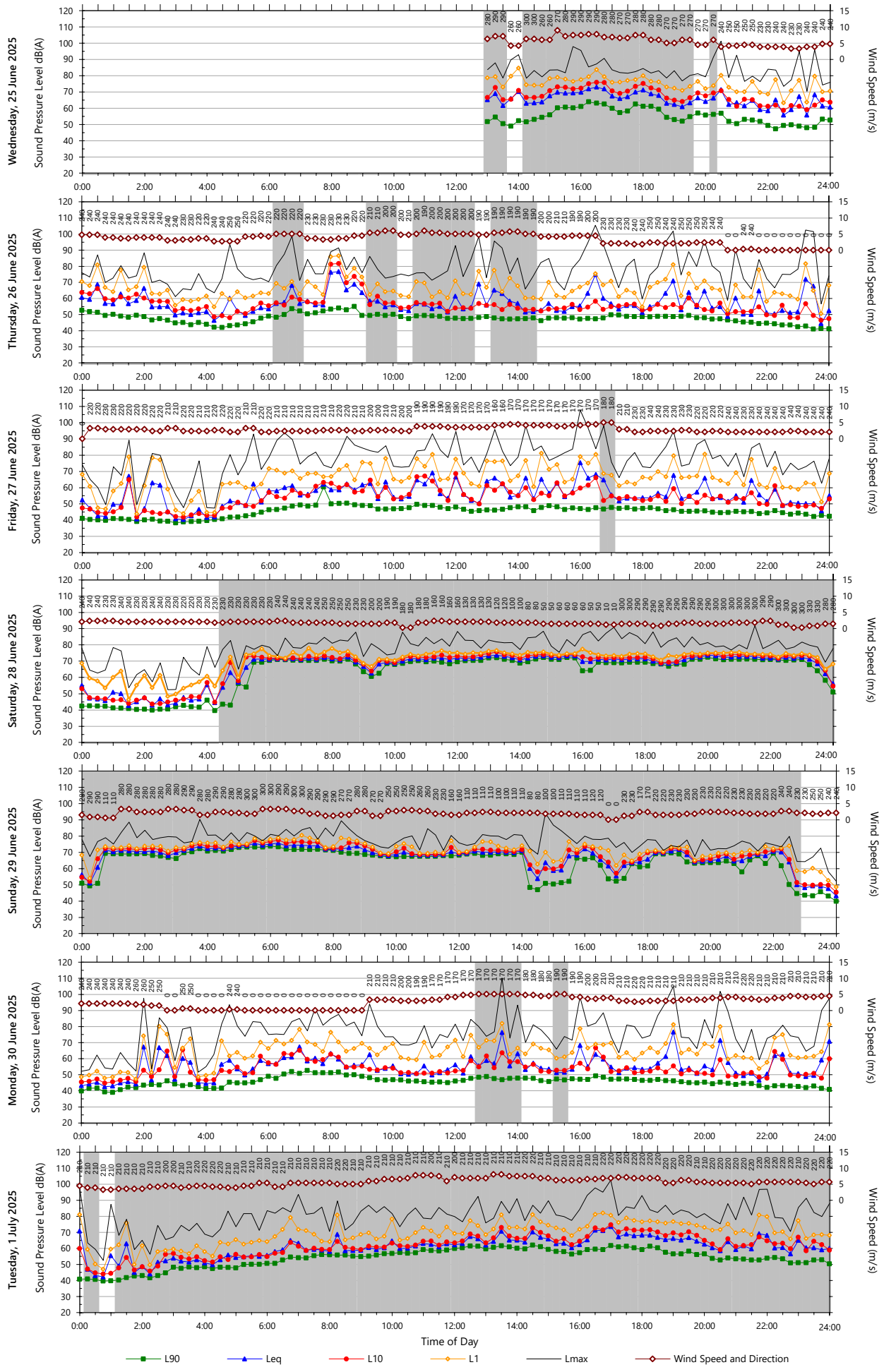


Data File: 2018-11-12_SLM_000_123_Rpt_Report.txt

Template: QTE-26 (rev 22) Logger Graphs Program

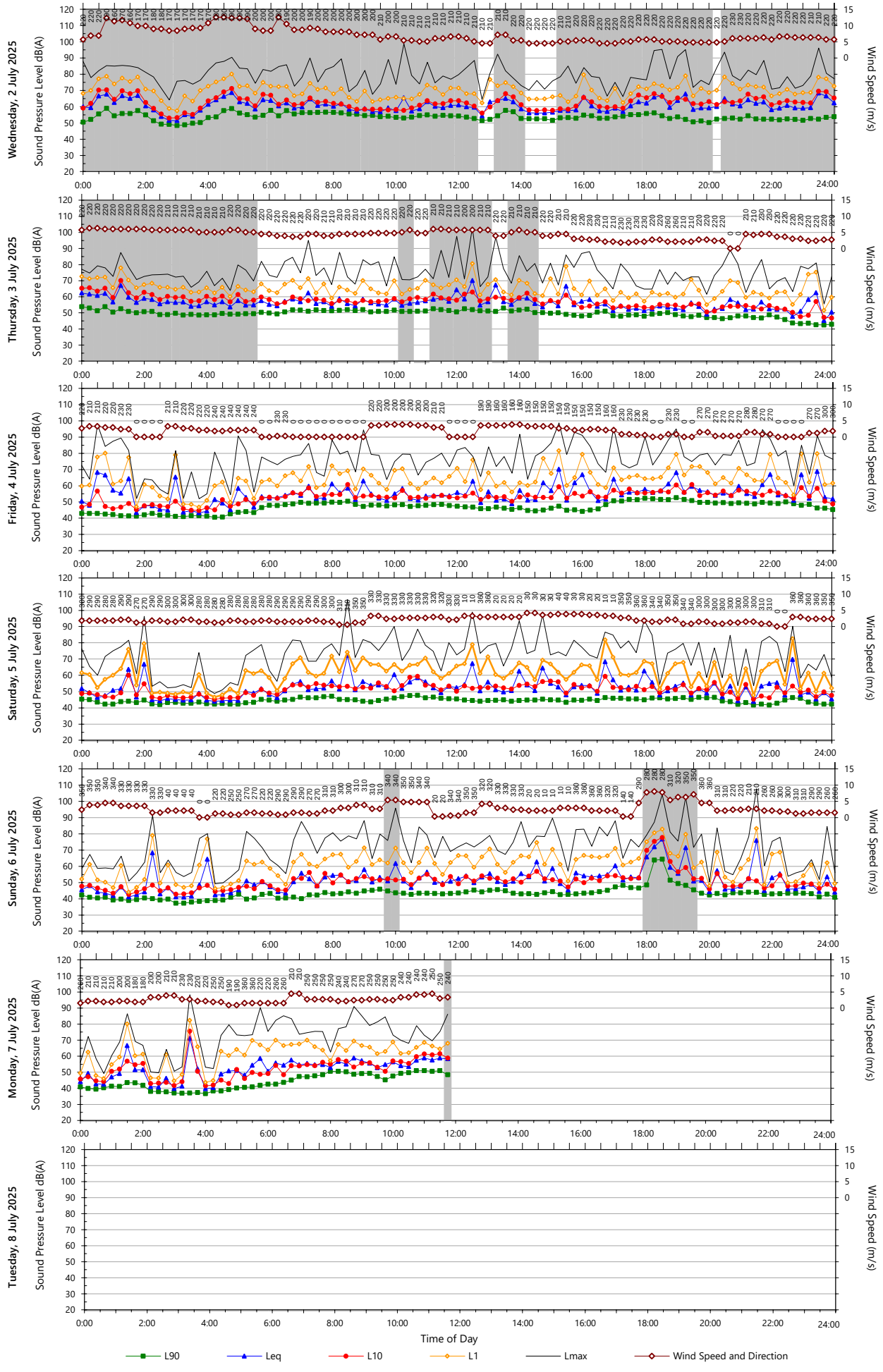
Unattended Monitoring Results

Location: Corrimal Coke Works site - Eastern boundary



Data File: 2025-06-25_SLM_000_123_Rpt_Report.txt

Template: QTE-26 Logger Graphs Program (r47)



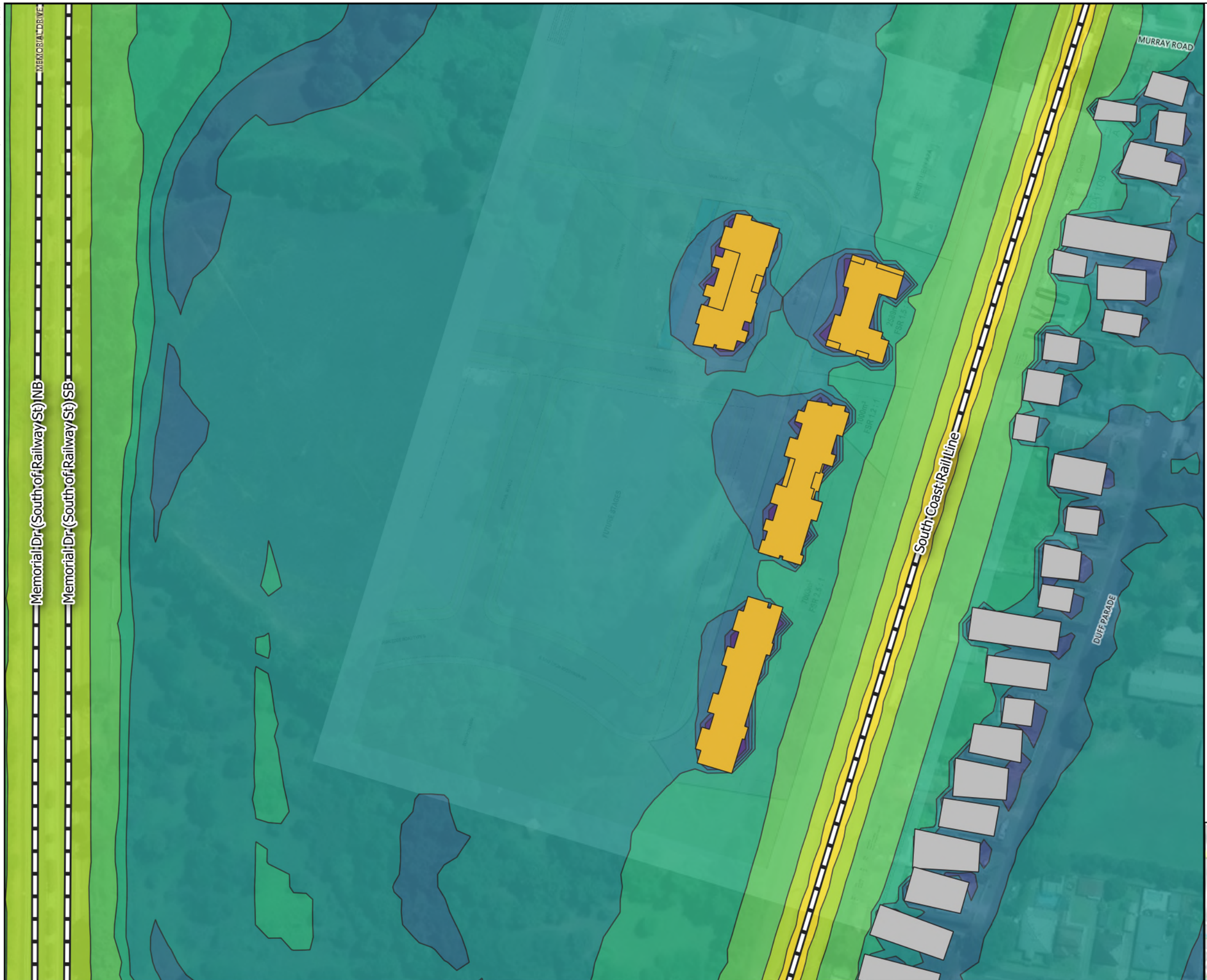
Data File: 2025-06-25_SLM_000_123_Rpt_Report.txt

Template: QTE-26 Logger Graphs Program (r47)

APPENDIX D Noise modelling contour map

Plot Date: 20/10/25 - 16:16 Layout: Gen Appendix Template noise contours

GIS File: R:\AssocSydProjects\TK551-TK600\TK577 mg Corrimal Cokeworks\Task 14 - Stage 2 SSDA\5 Calcs\TK577-14.05 QGIS (r0).qgz



LEGEND

Noise contours

- <35
- 35-40
- 40-45
- 45-50
- 50-55
- 55-60
- 60-65
- 65-70
- >70

- Stage 2a residential flat buildings
- Neighbouring properties

REV	BY	DATE	DESCRIPTION	APPROVED
r0	CC	20/10/25	Prepare figures	MG

A3 Original

Co-ordinate System: GDA94 / MGA zone 56

0 19 38 57 76 95 114 m

At A3 1:1,500

FULL SIZE A3

NOTE: Do not scale from this drawing.

N

CLIENT

LEGACY PROPERTY

ACOUSTIC CONSULTANT

RENZO TONIN & ASSOCIATES
inspired to achieve
Ph (02) 8218 0500 Fax (02) 8218 0501

CORRIMAL COKE WORKS SITE
STAGE 2A RESIDENTIAL FLAT BUILDINGS

Road and rail noise contours @ 1.5m above ground level
LAeq,9hour (night-time)

APPENDIX E Building treatment recommendations

Some of the future apartments in the proposed Stage 2a residential development will require facade treatment to achieve suitable internal noise levels. The facade treatment recommendations are shown on the following attached figures.

Table C-1 details the facade treatment categories and recommended constructions. The façade recommendations assume room volumes and areas as per Table B1 of the Interim Guideline.

Plot Date: 18/10/25 - 20:43 Layout: Gen Appendix Template

GIS File: R:\AssocSydProjects\TK551-TK600\TK577 mg Corrimal Cokeworks\Task 14 - Stage 2 SSDA\5 Calcs\TK577-14.05 QGIS (r0).qgz

LEGEND

Facade treatment categories

- No treatment
- Category 1
- Category 2
- Category 3
- Category 4

Stage 2a residential flat buildings

REV	BY	DATE	DESCRIPTION	APPROVER
r0	CC	20/10/25	Prepare figures	MG

A3 Original

Co-ordinate System: GDA94 / MGA zone 56

0 10 20 30 40 50 60 m

At A3 1:1,000

FULL SIZE A3

NOTE: Do not scale from this drawing.

N

CLIENT

LEGACY PROPERTY

ACOUSTIC CONSULTANT

RENZO TONIN & ASSOCIATES

inspired to achieve

Ph (02) 8218 0500 Fax (02) 8218 0501

CORRIMAL COKE WORKS SITE

STAGE 2A RESIDENTIAL FLAT BUILDINGS

Ground Level treatment categories

Plot Date: 18/10/25 - 20:49 Layout: Gen Appendix Template L1

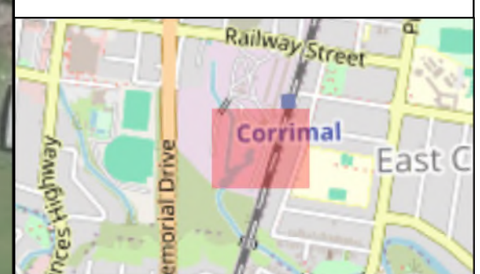
GIS File: R:\AssocSydProjects\TK551-TK600\TK577 mg Corrimal Cokeworks\Task 14 - Stage 2 SSDA\5 Calcs\TK577-14.05 QGIS (r0).qgz

LEGEND

Facade treatment categories

- No treatment
- Category 1
- Category 2
- Category 3
- Category 4

Stage 2a residential flat buildings



REV	BY	DATE	DESCRIPTION	APPROVER
..	..	..	..	..
..	..	..	..	..
..	..	..	..	..
..	..	..	..	..
..	..	..	..	..
..	..	..	..	..
r0	CC	20/10/25	Prepare figures	MG

A3 Original

Co-ordinate System: GDA94 / MGA zone 56

0 10 20 30 40 50 60 m

At A3 1:1,000

FULL SIZE A3

NOTE: Do not scale from this drawing.

N

CLIENT

LEGACY PROPERTY

ACOUSTIC CONSULTANT

RENZO TONIN & ASSOCIATES
inspired to achieve
Ph (02) 8218 0500 Fax (02) 8218 0501

CORRIMAL COKE WORKS SITE
STAGE 2A RESIDENTIAL FLAT BUILDINGS

Level 1 treatment categories

Plot Date: 18/10/25 - 20:52 Layout: Gen Appendix Template L2

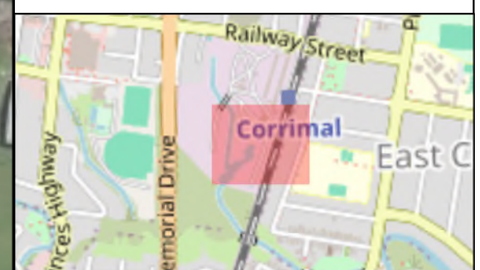
GIS File: R:\AssocSydProjects\TK551-TK600\TK577 mg Corrimal Cokeworks\Task 14 - Stage 2 SSDA\5 Calcs\TK577-14.05 QGIS (r0).qgz

LEGEND

Facade treatment categories

- No treatment
- Category 1
- Category 2
- Category 3
- Category 4

Stage 2a residential flat buildings



90 m
60
30
0

REV	BY	DATE	DESCRIPTION	APPROVER
r0	CC	20/10/25	Prepare figures	MG

A3 Original

Co-ordinate System: GDA94 / MGA zone 56

0 10 20 30 40 50 60 m

At A3 1:1,000

FULL SIZE A3

NOTE: Do not scale from this drawing.

N

CLIENT

LEGACY PROPERTY

ACOUSTIC CONSULTANT

RENZO TONIN & ASSOCIATES
inspired to achieve
Ph (02) 8218 0500 Fax (02) 8218 0501

CORRIMAL COKE WORKS SITE
STAGE 2A RESIDENTIAL FLAT BUILDINGS

Level 2 treatment categories

Plot Date: 18/10/25 - 20:54 Layout: Gen Appendix Template L3

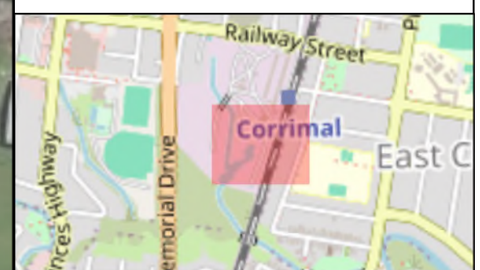
GIS File: R:\AssocSydProjects\TK551-TK600\TK577 mg Corrimal Cokeworks\Task 14 - Stage 2 SSDA\5 Calcs\TK577-14.05 GGIS (r0).ggz

LEGEND

Facade treatment categories

- No treatment
- Category 1
- Category 2
- Category 3
- Category 4

Stage 2a residential flat buildings



90 m
60
30
0

REV	BY	DATE	DESCRIPTION	APPROVER
..	..	..	..	..
..	..	..	..	..
..	..	..	..	..
..	..	..	..	..
..	..	..	..	..
..	..	..	..	..
r0	CC	20/10/25	Prepare figures	MG

A3 Original

Co-ordinate System: GDA94 / MGA zone 56

0 10 20 30 40 50 60 m

At A3 1:1,000

FULL SIZE A3

NOTE: Do not scale from this drawing.

N

CLIENT

LEGACY PROPERTY

ACOUSTIC CONSULTANT

RENZO TONIN & ASSOCIATES
inspired to achieve
Ph (02) 8218 0500 Fax (02) 8218 0501

CORRIMAL COKE WORKS SITE
STAGE 2A RESIDENTIAL FLAT BUILDINGS

Level 3 treatment categories

Plot Date: 18/10/25 - 20:56 Layout: Gen Appendix Template L4

GIS File: R:\AssocSydProjects\TK551-TK600\TK577 mg Corrimal Cokeworks\Task 14 - Stage 2 SSDA\5 Calcs\TK577-14.05 QGIS (r0).qgz

LEGEND

Facade treatment categories

- No treatment
- Category 1
- Category 2
- Category 3
- Category 4

Stage 2a residential flat buildings

REV	BY	DATE	DESCRIPTION	APPROVER
r0	CC	20/10/25	Prepare figures	MG

A3 Original

Co-ordinate System: GDA94 / MGA zone 56

0 10 20 30 40 50 60 m

At A3 1:1,000

FULL SIZE A3

NOTE: Do not scale from this drawing.

N

CLIENT

LEGACY PROPERTY

ACOUSTIC CONSULTANT

RENZO TONIN & ASSOCIATES
inspired to achieve
Ph (02) 8218 0500 Fax (02) 8218 0501

CORRIMAL COKE WORKS SITE
STAGE 2A RESIDENTIAL FLAT BUILDINGS

Level 4 treatment categories

Plot Date: 18/10/25 - 20:58 Layout: Gen Appendix Template L5

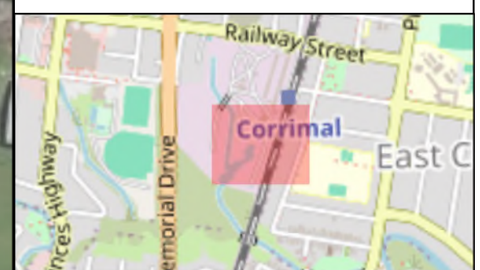
GIS File: R:\AssocSydProjects\TK551-TK600\TK577 mg Corrimal Cokeworks\Task 14 - Stage 2 SSDA\5 Calcs\TK577-14.05 QGIS (r0).qgz

LEGEND

Facade treatment categories

- No treatment
- Category 1
- Category 2
- Category 3
- Category 4

Stage 2a residential flat buildings



90 m
60
30
0

REV	BY	DATE	DESCRIPTION	APPROVER
r0	CC	20/10/25	Prepare figures	MG

A3 Original

Co-ordinate System: GDA94 / MGA zone 56

0 10 20 30 40 50 60 m

At A3 1:1,000

FULL SIZE A3

NOTE: Do not scale from this drawing.

N

CLIENT

LEGACY PROPERTY

ACOUSTIC CONSULTANT

RENZO TONIN & ASSOCIATES
inspired to achieve
Ph (02) 8218 0500 Fax (02) 8218 0501

CORRIMAL COKE WORKS SITE
STAGE 2A RESIDENTIAL FLAT BUILDINGS

Level 5 treatment categories

Table C-1: Acoustic treatment category details

Category No.	Building Element	Required Acoustic Rating of Building Element, Rw	Construction Recommendation		
1	Windows / Sliding Doors	24+	Openable with minimum 4mm monolithic glass and standard weather seals		
	Facade	38+	Cladding Construction: 9mm fibre cement sheeting or weatherboards or plank cladding externally, 90mm timber stud, R2 insulation batts in wall cavity, 10mm standard plasterboard internally.	Brick Veneer Construction: 110mm brick, 90mm timber stud, minimum 40mm clearance between masonry and stud frame, R2 insulation batts in wall cavity, 10mm standard plasterboard internally.	Cavity Brick Construction: 2 leaves of 110mm brickwork separated by 50mm gap.
	Roof	40+	Pitched concrete or terracotta tile or metal sheet roof, 10mm plasterboard ceiling fixed to ceiling joists, bulk insulation in roof cavity.		
	Door	28+	35mm solid core timber door fitted with full perimeter acoustic seals		
2	Windows / Sliding Doors	27+	Openable with minimum 6mm monolithic glass and full perimeter acoustic seals		
	Facade	45+	Cladding Construction: 9mm fibre cement sheeting or weatherboards or plank cladding externally, 90mm timber stud, R2 insulation batts in wall cavity, 10mm standard plasterboard internally.	Brick Veneer Construction: 110mm brick, 90mm timber stud, minimum 40mm clearance between masonry and stud frame, R2 insulation batts in wall cavity, 10mm standard plasterboard internally.	Cavity Brick Construction: 2 leaves of 110mm brickwork separated by 50mm gap.
	Roof	43+	Pitched concrete or terracotta tile or metal sheet roof, 10mm plasterboard ceiling fixed to ceiling joists, bulk insulation in roof cavity.		
	Door	30+	40mm solid core timber door fitted with full perimeter acoustic seals		
3	Windows / Sliding Doors	32+	Openable with minimum 6.38mm laminated glass and full perimeter acoustic seals		
	Facade	52+	Brick Veneer Construction: 110mm brick, 90mm timber stud, minimum 40mm clearance between masonry and stud frame, R2 insulation batts in wall cavity, 10mm standard plasterboard internally.		Cavity Brick Construction: 2 leaves of 110mm brickwork separated by 50mm gap.
	Roof	48+	Pitched concrete or terracotta tile or sheet metal roof, 1 layer of 13mm sound-rated plasterboard fixed to ceiling joists, bulk insulation in roof cavity.		
	Door	33+	45mm solid core timber door fitted with full perimeter acoustic seals		
4	Windows / Sliding Doors	35+	Openable with minimum 10.38mm laminated glass and full perimeter acoustic seals		

Category No.	Building Element	Required Acoustic Rating of Building Element, Rw	Construction Recommendation	
	Facade	55+	Brick Veneer Construction: 110mm brick, 90mm timber stud, minimum 40mm clearance between masonry and stud frame, R2 insulation batts in wall cavity, 10mm standard plasterboard internally.	Cavity Brick Construction: 2 leaves of 110mm brickwork separated by 50mm gap.
	Roof	52+	Pitched concrete or terracotta tile or sheet metal, 2 layers of 13mm sound-rated plasterboard fixed to ceiling joists, bulk insulation in roof cavity.	
	Door	33+	45mm solid core timber door fitted with full perimeter acoustic seals	

Notes:

- Where a room has different category recommendations on two or more facades, the roof recommendation for the highest category applies.
- Any wall, roof or ceiling penetrations shall be acoustically sealed so as not to reduce the acoustic performance of the element.
- The acoustic performance of glazed doors should be in accordance with the window glazing requirement of the applicable category.
- Development Near Rail Corridors and Busy Roads – Interim Guideline recommends solid core timber doors of 45mm thickness for treatment categories 3 and 4. To align with current industry construction methods, solid core door recommendations have been limited to no more than 40mm thickness.

The required acoustic rating is for the entire system. For example, for windows this includes the glass, frame and seals including the perimeter seal at the wall junction.

By way of explanation, the Sound Insulation Rating Rw is a measure of the noise reduction property of the glazing assembly, a higher rating implying a higher sound reduction performance.

Note that the Rw rating of systems measured as built on site (R'w Field Test) may be up to 5 points lower than the laboratory result.

The client is advised not to commence detailing or otherwise commit to systems which have not been tested in an approved laboratory or for which an opinion only is available. Testing of systems and assemblies is a component of the quality control of the design process and should be viewed as a priority because there is no guarantee the forecast results will be achieved. No responsibility is taken for use of or reliance upon untested systems, estimates or opinions. The advice provided here is in respect of acoustics only.

The advice provided here is in respect of acoustics only. Supplementary professional advice may need to be sought in respect of fire ratings, structural design, buildability, fitness for purpose and the like.

NOTES FOR GLAZING CONSTRUCTIONS:

All openable glass windows and doors shall incorporate full perimeter acoustic seals equivalent to Q-Lon, which enable the Rw rating performance of the glazing to not be reduced.

The above glazing thicknesses should be considered the minimum thicknesses to achieve acoustical ratings. Greater glazing thicknesses may be required for structural loading, wind loading etc.

GENERAL

The sealing of all gaps in acoustic rated glazing assemblies and facades is critical in a sound rated construction. Use only sealer approved by the acoustic consultant.

Check design of all junction details with acoustic consultant prior to construction.

Check the necessity for HOLD POINTS with the acoustic consultant to ensure that all building details have been correctly interpreted and constructed.

The information provided in this table is subject to modification and review without notice.

The advice provided here is in respect of acoustics only. Supplementary professional advice may need to be sought in respect of fire ratings, structural design, buildability, fitness for purpose and the like.

APPENDIX F Specification for construction noise monitoring

F.1 Scope

This document specifies methods for undertaking noise monitoring during the construction phase of the project.

F.2 Referenced standards and guidelines

- Australian Standard AS IEC 61672.1 2004 '*Electroacoustics - Sound Level Meters - Specifications*'
- Australian Standard AS 1259.2-1990 '*Acoustics - Sound Level Meters*'
- Australian Standard AS 1055-1997 '*Acoustics - Description and Measurement of Environmental Noise*'
- NSW '*Interim Construction Noise Guideline*' (Department of Environment and Climate Change 2009)
- NSW '*Noise Policy for Industry*' (Environment Protection Authority 2017)

F.3 Testing procedures

The following procedures are to be followed by personnel suitably qualified and experienced in undertaking acoustic measurements.

All noise monitoring equipment used must be at least Type 2 instruments as described in AS 1259.2-1990 and calibrated to standards that are traceable to Australian Physical Standards held by the National Measurement Laboratory (CSIRO Division of Applied Physics). The calibration of the monitoring equipment shall also be checked in the field before and after the noise measurement period, and in the case of long-term noise monitoring, calibration levels shall be checked at minimum weekly intervals.

Long-term noise monitoring equipment or Noise Loggers, consist of sound level meters housed in weather resistant enclosures. The operator may retrieve the data at the conclusion of each monitoring period in person or remotely if the logger is fitted with mobile communications.

All environmental noise measurements shall be taken with the following meter settings:

- Time constant: FAST (ie 125 milliseconds)
- Frequency weightings: A-weighting
- Sample period: 15 minutes

All outdoor noise measurements shall be undertaken with a windscreen over the microphone. Windscreens reduce wind noise at the microphones.

Measurements of noise should be disregarded when it is raining and/or the wind speed is greater than 5m/s (18km/h).

F.4 Long-term (unattended) monitoring

Noise monitoring shall be undertaken in accordance with the environmental noise measurement requirements stipulated in the reference standards and documents listed above.

Noise monitoring equipment shall be placed at positions which have unobstructed views of general site activities, while acoustically shielded as much as possible from non-construction site noise (eg. road traffic, rail noise and other surrounding noise).

Noise levels are to be recorded at a minimum rate of 10 samples per second. Every 15 minutes, the data is to be processed statistically and stored in memory. The minimum range of noise metrics to be stored in memory for later retrieval is the following A-weighted noise levels: L_{min}, L_{90}, L_{eq}, L_{10}, L_1 and L_{max}.

Where the noise monitors are placed within 3.5 metres of building facades, walls or cliffs, then a reflection correction of up to -2.5dB(A) shall be applied to remove the effect of increased noise due to sound reflections from such structures.

Meteorological conditions including wind velocity, wind direction and rainfall shall be monitored over the entire noise monitoring period, either on site or recorded from the nearest weather station to the project site.

F.5 Short-term (attended) monitoring

Where noise complaints or requests from relevant authorities are received, attended short-term noise monitoring shall also be conducted at the requested outdoor location (unless the issue is related to regenerated noise from tunnelling and driveage works) and at any other relevant noise receiver location with closest proximity to the construction activities.

Short-term noise monitoring shall be used to supplement long-term noise monitoring undertaken at nearby locations, and to establish whether noise levels measured by the long-term noise monitors are determined by construction activities carried out on site.

All attended short-term noise monitoring shall be recorded over 15 minute sample intervals. Noise levels are to be recorded at a minimum rate of 10 samples per second. Every 15 minutes, the data is to be processed statistically and stored in memory. The minimum range of noise metrics to be stored in memory and reported is the following A-weighted noise levels: L_{min}, L_{90}, L_{eq}, L_{10}, L_1 and L_{max}.

In addition to measuring and reporting overall A-weighted noise levels, statistical L_{90}, L_{eq}, L_{10} noise levels shall be measured and reported in third-octave band frequencies from 31.5Hz to 8kHz.

Where the noise monitors are placed within 3.5 metres of building facades, walls or cliffs, then a reflection correction of up to -2.5dB(A) shall be applied to remove the effect of increased noise due to sound reflections from such structures.

Outdoor noise monitoring is to be undertaken with the microphone at a height of 1.2 – 1.5m from the ground, unless noise measurements are taken from a balcony or veranda, in which case the same microphone height shall apply off the floor.

Noise measurements inside buildings should be at least 1m from the walls or other major reflecting surfaces, 1.2 m to 1.5m above the floor, and 1.5m from windows.

Noise monitoring shall be undertaken in accordance with the environmental noise measurement requirements stipulated in the reference standards and documents listed above.

The following information shall be recorded:

- Date and time of measurements;
- Type and model number of instrumentation;
- Results of field calibration checks before and after measurements;
- Description of the time aspects of each measurement (ie sample times, measurement time intervals and time of day);
- Sketch map of area;
- Measurement location details and number of measurements at each location;
- Weather conditions during measurements, including wind velocity, wind direction, temperature, relative humidity and cloud cover
- Operation and load conditions of the noise sources under investigation
- Any adjustment made for presence or absence of nearby reflecting surfaces; and
- Noise due to other sources (eg traffic, aircraft, trains, dogs barking, insects etc).

APPENDIX G Construction vibration monitoring specification

G.1 Scope

This document specifies methods for undertaking vibration monitoring during the construction phase of the project. Vibration monitoring during construction activities may be carried out for the following reasons:

- To confirm acceptability of construction techniques, or confirm compliance with limits for structural or cosmetic damage of buildings; or
- To assess compliance with vibration limits for human exposure to vibration.

Monitoring may be carried out in response to specific conditions of approval or complaint. However, the recommended work practice is to conduct proactive monitoring and establish procedures that provide greater assurance of compliance with relevant policy guidelines and Standards throughout all phases of the project works.

G.1.1 Requirements for vibration monitoring

Vibration monitoring is to be carried out at the following times in accordance with this Impact Assessment:

- At the commencement of operation of each piece of plant equipment or site activity which has the potential to generate significant vibration levels. The objective of this monitoring is to refine the indicative working distances for vibration generating equipment and provide site-specific minimum working distances. Refer to procedure below for establishment Vibration Minimum Working Distances.
- Where vibration complaints or requests from relevant authorities, at the requested location and at any other relevant vibration receiver location with closest proximity to the construction activities. This may be carried out with short-term or long-term monitoring methods.

Vibration amplitude may be measured as displacement, velocity, or acceleration.

- **Displacement** (x) measurement is the distance or amplitude displaced from a resting position. The SI unit for distance is the meter (m), although common industrial standards (including the TfNSW vibration limits) include mm.
- **Velocity** ($v=\Delta x/\Delta t$) is the rate of change of displacement with respect to change in time. The SI unit for velocity is meters per second (m/s), although common industrial standards (including the TfNSW vibration limits) include mm/s. The Peak Particle Velocity (PPV) is the greatest instantaneous particle velocity during a given time interval. If measurements are made in 3-axis (x, y, and z) then the resultant PPV is the vector sum (i.e. the square root of the summed squares of the maximum velocities) regardless of when in the time history those occur.

- **Acceleration** ($a=\Delta v/\Delta t$) is the rate of change of velocity with respect to change in time. The SI unit for acceleration is meters per second squared (m/s^2).

G.2 Referenced standards and guidelines

- AS 2775-2004 *Mechanical vibration and shock – Mechanical mounting of accelerometers*
- AS 2670.2-1990 *Evaluation of human exposure to whole body vibration*
- BS 6472-1992 *Guide to evaluation of human exposure to vibration in buildings (1 Hz to 80 Hz)*
- BS 6841–1987 *Guide to measurement and evaluation of human exposure to whole-body mechanical vibration and repeated shock*
- BS 7482–1991 Parts 1 and 3: *Instrumentation for the measurement of vibration exposure of human beings*
- BS 7385:1 *Evaluation and Measurement for Vibration in Buildings – Part 1: Guide for measurement of vibrations and evaluation of their effects on buildings*
- BS 7385:2 *Evaluation and Measurement for Vibration in Buildings – Part 2: Guide to Damage Levels from Ground borne Vibration*
- DIN 4150-1999 Part 3 *Structural vibration – Effects of vibration on structures*
- ISO 4866 *Mechanical Vibration & Shock – Vibration of Buildings – Guidelines for the Management of the Vibrations and Evaluation of their Effects on Buildings*
- NSW DEC (EPA) 2006 *Assessing Vibration: A technical guide*

Vibration monitoring shall be undertaken in accordance with the vibration measurement requirements stipulated in the reference Standards and guidelines listed above; however, the following notes of importance are included herein.

G.3 Vibration minimum working distances

Minimum working distances are to be established for each vibration generating item of equipment, as identified in this Plan, to provide a site-specific minimum working distances.

The testing regime should commence at a suitable time to allow sufficient time to amend construction techniques as necessary, without affecting the overall construction program.

Minimum working distances are to be established using identical equipment or simulated practices at a location removed from the sensitive structure or receiver.

Sufficient measurements are to be carried out in accordance with the relevant Standards to confirm the minimum working distances and confirm the acceptable work practices that are likely to be compliant given the proximity of actual works to sensitive receivers and structures.

Consultation between consultants, engineers and the construction team may be required where revision to work practices is required.

G.3.1 Personnel and equipment

The following procedures are to be followed by personnel suitably qualified and experienced in undertaking vibration measurements.

All vibration monitoring equipment used must be checked for accuracy (to manufacturer's specification) at least every two years against a reference vibration transducer that is calibrated at least every three years [ref: NATA General Accreditation Guidance - General Equipment - Calibration and Checks, General Equipment Table (January 2018)].

Vibration monitors consist of a computer unit connected by cable to a tri-axial vibration transducer which senses vertical, axial and horizontal vibration, or three separate uni-axial vibration transducers positioned in the vertical, axial and horizontal axes. The parameters to be measured differ dependent upon the relevant Standards but may include:

Assessment type	Type of vibration	Relevant standard/guideline	Measurement parameters
Human comfort	Continuous and impulsive	DECC guideline BS 6472-1992	RMS acceleration, 1-80Hz. 1/3 octave weighted as defined in BS6841-1987
	Intermittent vibration	DECC guideline BS 6472-1992	RMS acceleration, 1-80Hz Vibration Dose Values (VDVs) in accordance with BS6472-1992
Structural damage	Non-blasting	DIN 4150-1999 Part 3	Peak-particle velocity (PPV), 1-100Hz
	Non-blasting	BS 7385 Part 2	Peak-particle velocity (PPV), 4-250Hz
Structural damage – sensitive structures	Non-blasting	DIN 4150-1999 Part 3	Peak-particle velocity (PPV), 1-100Hz

Short-term vibration monitors should allow real-time analysis of vibration levels to assist assessment and feedback on the subject operations and procedures.

G.3.2 Monitoring procedure

Vibration monitoring equipment should be installed in accordance with the following guidance:

- At a location equivalent to the site and ground conditions at the sensitive receiver location. The working distances should not be established via immediate measurement and activities near the sensitive structure.
- The surface should be solid and rigid in order to best represent the vibration levels entering the building/structure under investigation.
- The vibration sensor or transducer should not be mounted on loose gravel or other unstable surfaces.

- The vibration geophone or transducer(s) should be directly mounted to the vibrating surface using bees wax, double sided adhesive tape, or magnetically fixed to a mounting plate fastened to the vibrating surface.
- Where a suitable mounting surface is unavailable, a metal stake (at least 300mm in length) with a mounting plate should be driven into solid ground adjacent to the building of interest. The vibration sensor or transducer shall be fixed on top of the mounting plate.

The following information shall be recorded:

- Date and time of measurements;
- Type and model number of instrumentation;
- Description of the time aspects of each measurement (i.e. sample times, measurement time intervals and time of day);
- Sketch map of area;
- Measurement location details (including distance from vibrating source) and number of measurements at each location;
- Operation and load conditions of the vibrating plant under investigation and distance from the measurement location; and
- Possible vibration influences from other sources (e.g. other mechanical plant, traffic, railway).

G.4 Long-term (unattended) monitoring

Long-term unattended vibration monitoring shall be undertaken continuously whilst the vibrating plant is operational within the pre-determined 'minimum working distances' from potentially affected buildings or sensitive structures. Long-term unattended vibration monitoring is generally carried out for the assessment of structural or cosmetic damage rather than human exposure.

G.4.1 Personnel and equipment

The following procedures are to be followed by personnel suitably qualified and experienced in undertaking vibration measurements.

All vibration monitoring equipment used must be checked for accuracy (to manufacturer's specification) at least every two years against a reference vibration transducer that is calibrated at least every three years [ref: NATA General Accreditation Guidance - General Equipment - Calibration and Checks, General Equipment Table (January 2018)].

Vibration monitors consist of a computer unit connected by cable to a tri-axial vibration transducer which senses vertical, axial and horizontal vibration, or three separate uni-axial vibration transducers positioned in the vertical, axial and horizontal axes.

Long-term monitoring for the management of structural and cosmetic damage should include the following:

- Vibration levels are to be monitored continuously with the following parameters being stored at a maximum interval period of 5 minutes:
    - Peak-particle velocity (PPV) between 1 Hz and 100 Hz for each direction of the tri-axial geophone (or transducers) and vector-sum peak-particle velocity [DIN4150.3];
    - Peak-particle velocity (PPV) between 4 Hz and 250 Hz for each direction of the tri-axial geophone (or transducers) and vector-sum peak-particle velocity [BS 7385.2].
- Vibration levels are to be stored at the pre-defined intervals in the logger memory for record, data analysis or post-processing. Data may be retrieved at the conclusion of each monitoring period either by operator download or remotely via a telephone modem if the logger is fitted with a remote communications option.
- Monitors should be fitted with an audible, visual, SMS or email alert system, triggered to provide warning when the measured level of vibration approaches or exceeds the limits defined by the relevant Standard.
- Where the trigger limits are exceeded, a detailed waveform recording should be stored including a detailed frequency spectrum for assessment against the frequency limit curve.

G.4.2 Monitoring location and mounting

Vibration monitoring equipment should be installed in accordance with the following guidance:

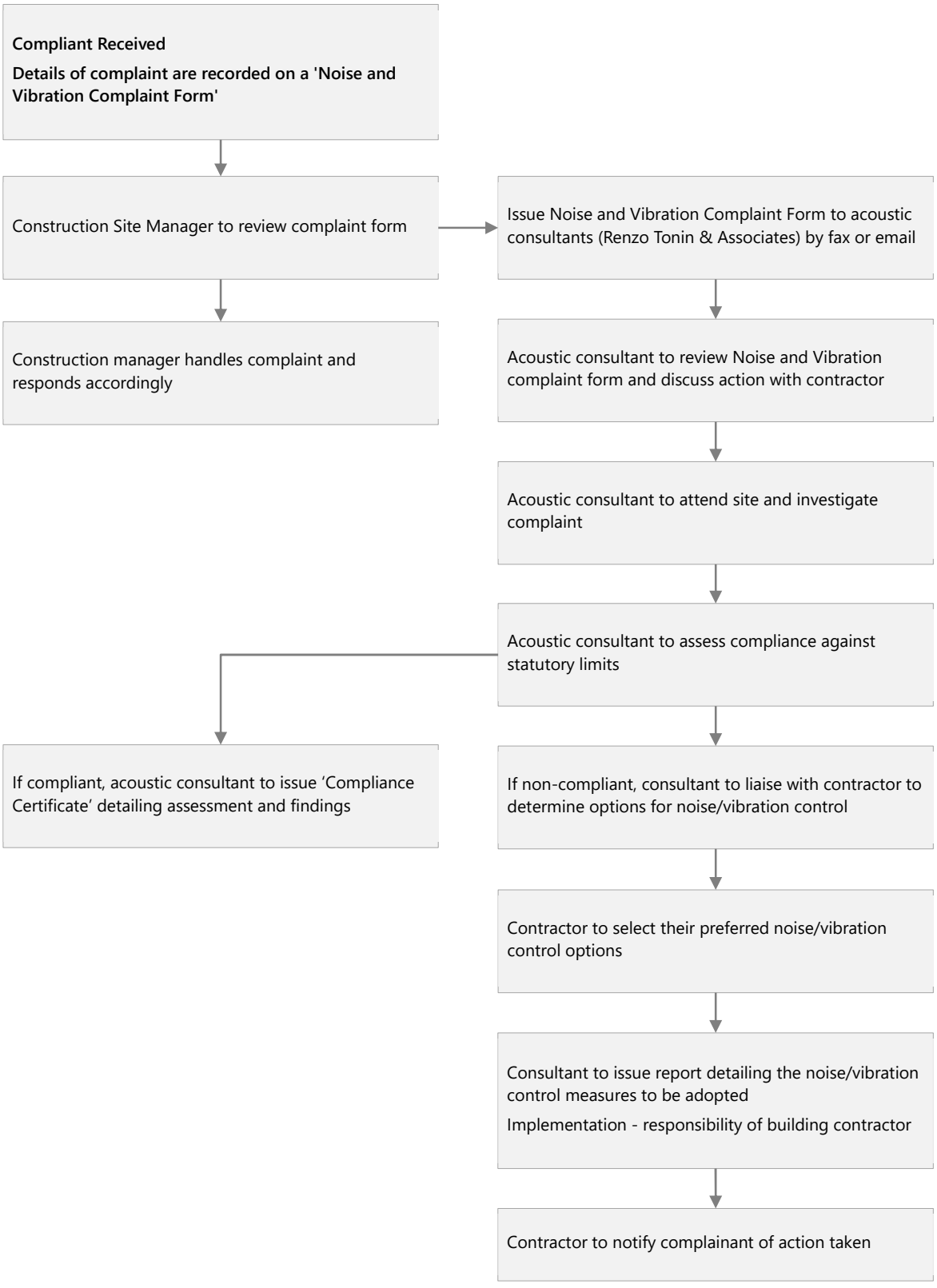
- Equipment should be positioned at the footings or foundations of the building of interest, closest to the vibrating plant.
- The mounting surface should be solid and rigid in order to best represent the vibration levels entering the structure of the building under investigation.
- The vibration geophone or transducer(s) should not be mounted on loose tiles, loose gravel or other unstable surfaces.
- The vibration geophone or transducer(s) should be directly mounted to the vibrating surface using bees wax, double sided adhesive tape, or magnetically fixed to a mounting plate fastened to the vibrating surface.
- Where a suitable mounting surface is unavailable, a metal stake (at least 300mm in length) with a mounting plate should be driven into solid ground adjacent to the building of interest. The vibration sensor or transducer shall be fixed to the mounting plate.

G.5 Vibration measurements in response to complaints

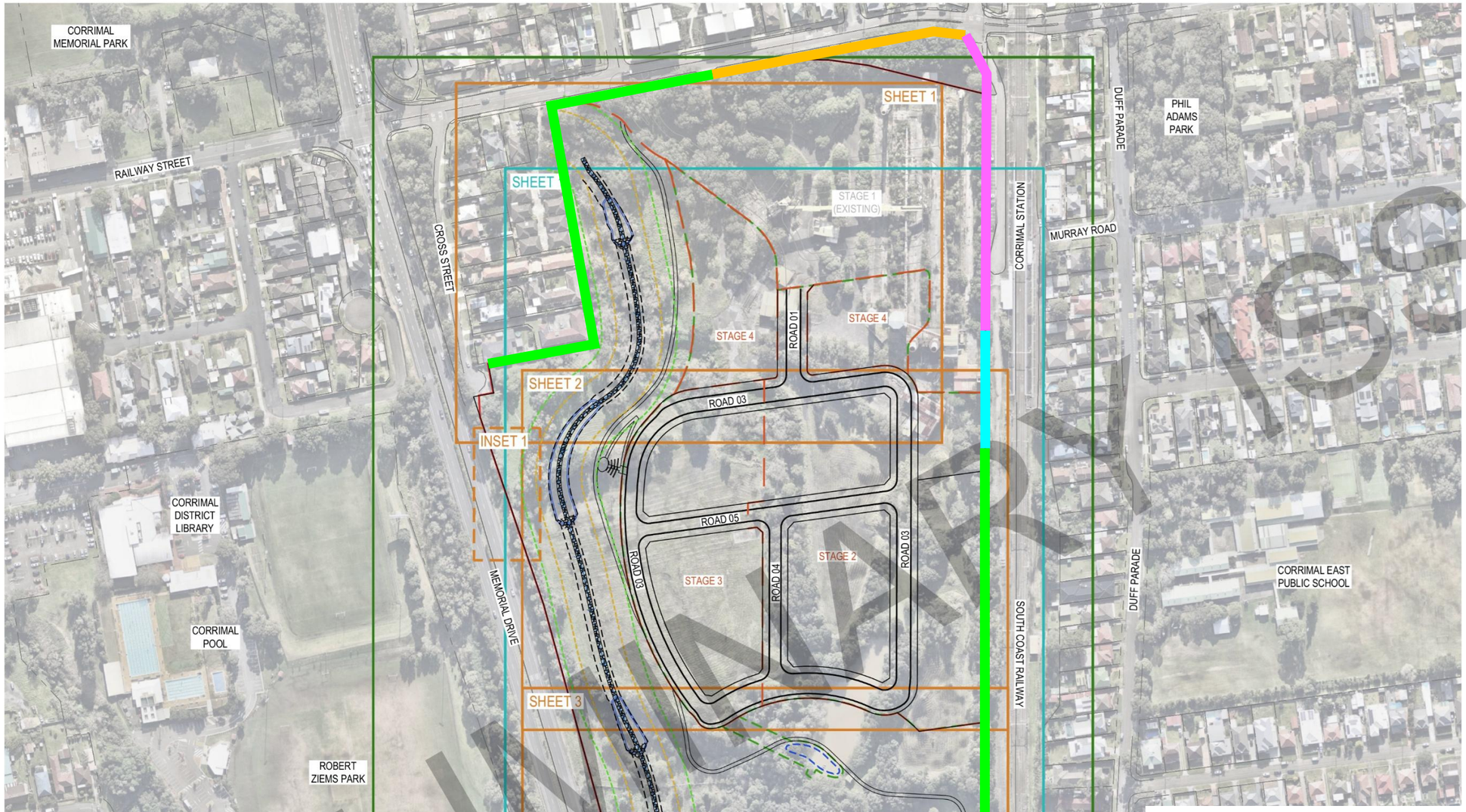
Proactive vibration monitoring and establishment of procedures that comply with the policy guidelines and Standards is the recommended work practice to reduce the risk of complaint regarding vibration from the site.

There may however be cases where specific monitoring is required to investigate a complaint or issue identified during the project works. Vibration monitoring may be carried out using either short-term or long-term methodologies depending on the nature of the complaint. Short-term attended manned procedures would generally be carried out when measurements are required inside a property or where immediate action and detailed observations are required to be made at the time of measurements. Short-term monitoring would generally follow the procedures outlined for the establishment of Minimum Working Distances. Long-term monitoring would be carried out as described in Section D.4 above.

APPENDIX H Noise/vibration complaint management procedure



APPENDIX I Proposed hoarding/temporary barrier locations



Legend

- Location of 2.0m high hoardings/temporary acoustic barriers proposed for previous bulk earthwork stages
- Location of 2.4m high hoardings erected for previous demolition stage
- Existing Colorbond fence (approx. 2.5m high)
- Existing Colorbond fence (approx. 1.8m high)

REV	DATE	DESCRIPTION	AMD BY	APP BY
1	19.06.25	FOR INFORMATION	SCM	SS

0 15 30 45 60 75m
SCALE 1:1500 AT ORIGINAL SIZE

LEGACYPROPERTY

MAKER ENG SURVEY DESIGN DELIVER

DRAWN: J.BADI	DESIGNED: C.WIEWIORA
DRAFT CHECK: S.McINNES	DESIGN CHECK: A.GOLLAN
APPROVED: S.SAIYANMONTAKUL	

CORRIMAL COKE WORKS
STAGE 2-4 RESIDENTIAL SUBDIVISION
KEY PLAN

DRAWING NUMBER	SHEET No.	ORIG. SIZE	REVISION
MKR00452-11-C0040		A1	1

Supachock Saiyanmontakul, 27/6/2025 10:21 AM

C:\12d\SIdata\12DSYNERGY\MKR00452 Corrimal Coke Works_TZ\02 Design\Drawings\11 DA\MKR00452-11-C0040.dwg