Transport for New South Wales

Richmond Road Upgrade (M7 to Townson Road)

Contract number: 24.0000139271.1049

NV01 – Operational Traffic Noise Assessment Report (OTNAR)

Design Stage: Substantial Detailed Design

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ABBREVIATIONS / DEFINITIONS

TERM	DESCRIPTION
AREF	Addendum REF
AS/NZS	Australian and New Zealand Standard
BNI	Blacktown Native Institute
CoA	Conditions for Approval
Competent	Competent means that a person has been deemed to meet the combination of licenses, qualifications, training and instruction as defined by the Company or by legal requirements for an activity or works
Concept Design	GEA DTI JV Concept Design developed during the RFT phase
Contractor	A person or business which provides goods or services to the Company under terms specified in a contract. GEA DTI JV is the Contractor for the WUC
Correspondence	Correspondence documents refer to letters sent to or received from other entities.
Council	Blacktown Council
Design Team	Aurecon
DCD	Developed Concept Design Stage
D&C	Design and Construct
EDMS	Electronic Document Management System
Environmental documents	The documents set out in Schedule 28 of the Head Contract, which are the SWTC Appendix 4 and the Planning Approval
ER	Environmental Representative
FDD	Final Design Documentation
GEA DTI JV	Joint Venture between Gamuda Engineering Australia (GEA) and DT Infrastructure
Head Contract	Contract between Transport for New South Wales and GEA DTI JV for the Richmond Road Upgrade project.
IC	Independent Certifier
LGA	Local Government Authority (Blacktown Council)
LiDAR	Light Detection and Ranging
M7 Motorway	Westlink M7
NB	Northbound
OTNAR	Operational Traffic Noise Assessment Report
PDCS	Project Document Control System
PM	Project Manager
Principal	Transport for NSW (ABN 18 804 236 602)
Project	This Project, Richmond Road upgrade between M7 Motorway and Townson Road, Marsden Park
REF	Review of Environmental Factors
RFI	Request for Information
RFT	Request for Tender
RL	Reduced Level
RRM7	Richmond Road Upgrade (M7 to Townson Road)
SB	Southbound

TERM	DESCRIPTION
SDD	Substantial Detailed Design
Service	Any service or item of infrastructure, including water, electricity, gas, fuel, telephone, existing drainage, sewerage, railway, airport, stormwater, irrigation, street lighting, CCTV, industrial waste disposal and electronic communications service
SME	Subject Matter Expert
SUP	Shared User Path
SWTC	Scope of Works and Technical Criteria (contained in Head Contract Exhibit A)
TfNSW	Transport for NSW, The Principal
Workflow	Sequence of tasks or activities
WSO Co	Westlink M7 Operator
WUC	Works Under Contract

1 INTRODUCTION

1.1 Project description

The Richmond Road Upgrade (M7 to Townson Road) (RRM7 or the Project) is a critical infrastructure initiative designed to support the rapid growth of Sydney's North West Growth Area (NWGA). The NWGA is a planned development encompassing approximately 10,000 hectares and projected to house 250,000 people across 90,000 homes. This growth necessitates significant upgrades to the existing road network to accommodate increased traffic and freight demands.

Richmond Road serves as a vital arterial route connecting Blacktown through Marsden Park Industrial Precincts within the NWGA towards Windsor. While previous stages of the Richmond Road upgrade have been completed, further improvements are essential to address growing congestion and ensure future capacity.

The NSW Government, recognising the need for enhanced connectivity and improved traffic flow, has prioritised this project to achieve several key objectives:

- Easing congestion and improving travel times
- Enhancing traffic flow through key intersections
- Bolstering safety for all road users
- Improving connectivity between residential, commercial, and employment hubs
- Supporting pedestrian and cyclist safety through new shared paths.

These improvements will contribute to greater freight efficiency and support economic growth in the region. Key upgrades include modifications to the M7 Motorway ramp, additional lanes on Richmond Road, and intersection upgrades at various locations, including Rooty Hill Road North.

The project is divided into two separable portions:

- Portion 1 (Northern Section): This section extends from just north of the Townson Road junction to south of the intersection with Alderton and Langford Drives. It includes widening Richmond Road from four to six lanes. Construction will commence in October 2025 and will be complete by December 2026
- Portion 2 (Southern Section): This section will focus on the construction of a flyover exit ramp from the M7 which crosses over Rooty Hill Road North, the construction of a new road/ pedestrian and bikeway bridge over Bells Creek and the widening of Richmond Road from four to six lanes. It will incorporate additional turning lanes at the Rooty Hill Road junction and will join the southern point of Portion 1. Construction is expected to begin mid-2026 and will be complete before the end of 2028.

In February 2025 TfNSW released a RFT for the Design and Construction of the Project. Gamuda Engineering Australia DT Infrastructure Joint Venture (GEA DTI JV) and Aurecon were the successful parties, and TfNSW executed the contract with GEA DTI JV on 23 October 2025.

An overview of the Project is provided in **Figure 1**.

Figure 1 Project site overview

The Project comprises approximately 2.2 km of Main Carriageway between M7 Motorway and Towson Road in Marsden Park. The cross section consists of a six lane carriageway with three lanes in each direction excluding any auxiliary lanes.

The key features of the project include the following:

- Upgrade of Richmond Road between the M7 Motorway and Townson Road to six lanes (three lanes in each direction). This would include:
  - Road widening between the M7 Motorway and the Alderton Drive / Langford Drive intersection including a new bridge structure over Bells Creek
  - Widening into the median from the Alderton Drive / Langford Drive intersection to about 250 metres north of the Hollinsworth Road / Townson Road intersection
- Building a new flyover bridge from the M7 Motorway Rooty Hill Road North exit ramp to Richmond Road northbound to allow road users to bypass two sets of traffic lights, reducing congestion and queuing onto the motorway allowing uninterrupted flow of traffic
- Upgrades to the intersection of Richmond Road, Hollinsworth Road and Townson Road including:
  - Additional northbound through lane along Richmond Road (providing three through lanes towards Richmond)
  - Additional dedicated right turn lane from Richmond Road southbound onto Hollinsworth Road
  - New left turn slip lane from Hollinsworth Road onto Richmond Road including a pedestrian island and crossing
  - Staged pedestrian crossings across Richmond Road on the north and south sides of the intersection, with a pedestrian refuge in the median.
- Upgrades to the intersection of Richmond Road, Langford Drive and Alderton Drive including:
  - Additional northbound and southbound through lanes along Richmond Road (providing three through lanes in both directions)
  - Staged pedestrian crossings across Richmond Road on the north and south sides of the intersection, with a pedestrian refuge in the median.
- Upgrades to the intersection of Richmond Road, Rooty Hill Road North and the M7 Motorway ramps including:
  - Two dedicated lanes on Richmond Road heading onto the M7 Motorway (southbound entry ramp)
  - Two dedicated southbound through lanes on Richmond Road (towards Blacktown)
  - Additional right turn lane from Richmond Road southbound onto Rooty Hill Road North (providing two dedicated right turn lanes onto Rooty Hill Road North)
  - Relocation of the existing pedestrian crossing on Richmond Road approximately 160 metres south. This would be a new staged pedestrian crossing across Richmond Road, with a pedestrian refuge in the median at the intersection of Richmond Road and the M7 Motorway southbound entry ramp.
- Building a new concrete bridge structure over Bells Creek for the northbound carriageway. This would include:
  - Three northbound travel lanes
  - A shared pedestrian and bike path on the western side, which replaces the existing boardwalk bridge next to the northbound Richmond Road carriageway
- Upgrade works on the existing Bells Creek Bridge which becomes the southbound carriageway of Richmond Road

- Shifting the existing pedestrian and bike path on the western side of Richmond Road to be further west
- Continuing to improve public transport by maintaining the dedicated bus lanes at the intersections.
- Drainage and water quality structures including:
  - Adjustments to the pits and pipes of the existing stormwater network
  - New water quality basin on the east side of Richmond Road
  - Open flooding channel on the eastern side of Richmond Road roughly between the M7 Motorway northbound on-ramp and Bells Creek for flood mitigation purposes.
- Roadside furniture including safety barriers, signage, line marking, lighting and fencing.
- Earthwork cutting, embankments and retaining walls to accommodate the widened road alignment, flyover bridge and open flooding channel.
- Modified formal access to properties along the upgraded sections of Richmond Road.
- Property acquisition including full acquisition of one property and partial acquisition of two properties.
- Rehabilitation of disturbed areas and landscaping.
- Establishment and use of three temporary ancillary facilities during construction.

The project alignment generally runs from south to north and consequently the carriageways are identified as northbound and southbound carriageways. For consistency across the Project, a convention has been adopted to name features on the nearside shoulder of the northbound carriageway as being on the western side of the alignment. Similarly, features on the nearside shoulder of the southbound carriageway are referred to as being on the eastern side of the alignment.

1.2 Purpose of this report

The Scope of Works and Technical Criteria (SWTC) Appendix D1 – Additional Environmental requirements and the REF Determination require the preparation of a Detail Design Operational Traffic Noise Assessment Report (OTNAR), where there is likely to be material change to predicted operational noise levels as a result of the changes to design or modelling parameters.

The OTNAR includes:

- Confirmation of the noise goals for the surrounding noise sensitive receivers
- Description of the assessment methodology, including inputs to and validation of the noise model
- Confirmation of the operational noise predictions and impacts from the final design of the project
- Review of the feasible and reasonable noise mitigation measures identified in the REF, along with identification of any additional noise mitigation measures, where relevant.

1.3 Assessment Requirements

1.3.1 SWTC Assessment Requirements

As summarised in **Section 1.2**, the SWTC Appendix D1 details the below requirements:

4.5 Operational Noise and Vibration

a) The contractor must complete an operational noise assessment of the Design Documentation in accordance with, and to satisfy the requirements of the Road Noise Policy (RNP), TfNSW Road Noise Criteria Guideline (RNCG) and TfNSW Road Noise Mitigation Guideline (RNMG).

d) The contractor must prepare a Detailed Design Operational Traffic Noise Assessment Report where there is likely to be material change to predicted operational noise levels as a result of the changes to design or modelling parameters.

e) *The OTNAR must be prepared in accordance with operation traffic noise assessment requirements of TfNSW Noise and Vibration Assessment procedure (for road traffic and construction), TfNSW Road Noise Model Validation Guideline, TfNSW Road Noise Criteria Guideline and TfNSW Road Nosie Mitigation Guideline, inclusive of an assessment of barrier height in accordance with TfNSW Road Noise Mitigation Guideline.*

f) *The contractor is to fully design and specify all the noise attenuation measures required for the Project (such as noise walls, noise mounds, architectural treatments, pavement treatments). This is to include design and specification of the architectural and structural features of any noise wall or mounds.*

g) *Where noise mounds are specified, the design must include heights, lengths, cross-sectional detail, material requirements, drainage and landscaping requirements. The design is also the ensure the stability of the mounds.*

7 Noise Mitigation

7.1 General

a) *The contractor must implement and install all the at-property construction noise mitigation treatments required by the Environmental Documents except those identified in Table D.1-1 of Appendix D.1.*

1.3.2 REF Determination Requirements

The REF determination report details the environmental mitigation measures applicable to the project. The relevant mitigation measures to the operational noise assessment are summarised below:

NAH4 *Consultation would continue with DSMG throughout detailed design and construction, under the working group agreement. DSMG input would be sought on:*

Management of noise impacts from the proposal both during construction and operation, and opportunities to enable future use of the Blacktown Native Institution (BNI) site for cultural use

NV10 *Undertake an assessment to identify feasible and reasonable mitigation measured for properties where operational noise is predicted to exceed relevant criteria.*

1.4 Terminology

The assessment uses specific acoustic terminology, and an explanation of common terms is included in **Appendix A.**

2 Existing Environment

Receivers potentially sensitive to noise and vibration have been categorised as residential dwellings, commercial/industrial buildings, or 'other sensitive' land uses which include places of worship, educational facilities and child care centres. Receiver types and locations within the project area are shown in **Figure 2**.

The 'other sensitive' non-residential receivers identified in the study area are shown in **Table 1**.

Table 1 'Other Sensitive' Receivers (Non-Residential)

NCA	NAME	ADDRESS	TYPE
NCA01	Bait-ul Huda Mosque	45 Hollinsworth Road, Marsden Park NSW 2765	Place of Worship
NCA03	Prepare Early Education Centre Greenway Village	1 Woodburn Street, Colebee NSW 2761	Child Care Centre
NCA07	Busy Bees Long Daycare Centre	674 Richmond Road, Glendenning NSW 2761	Childcare Centre
NCA07	St Francis of Assisi Catholic Primary School	1 Stone Street, Glendenning NSW 2761	School

Figure 2 Receiver and Noise monitoring Locations

2.1 Existing Noise Survey and Monitoring Locations

Unattended noise monitoring was completed in the study area during 2024 as part of the REF assessment(refer to Richmond Road Upgrade between M7 Motorway and Townson Road, Marsden Park – Noise and Vibration Assessment dated November 2024). The noise monitoring equipment continuously measured existing noise levels in 15-minute periods during the daytime, evening and night-time. This data has been used in this OTNAR to validate the operational road noise model (see **Section 4.3**).

The noise monitoring locations used for validation are shown in **Figure 2** and the measured existing noise levels are summarised in **Table 2**.

Table 2 Summary of Unattended Noise Monitoring Results

ID	ADDRESS	MEASURED NOISE LEVEL (DBA)	
		AVERAGE NOISE (L_{AEQ})[1]	
		DAY	NIGHT
L01	Langford Park	68	66
L02	Westlink M7	65	62
L03	45 Hollinsworth Road	67	65
L05	Rooty Hill Road North	62	59
L07	6 Shipton Place	69	65
L09	20 Alderton Drive	63	58

Note 1: Operational road noise is assessed during the daytime which is 7 am to 10 pm and the night-time which is 10 pm to 7 am. See the NSW EPA Road Noise Policy.

3 Operational Noise Criteria

3.1 Noise Guidelines

The guidelines used to assess the potential operational road traffic noise impacts from the project are listed in **Table 3**. The guidelines aim to protect the community and environment from excessive noise and vibration impacts from the long-term operation of projects.

Table 3 Operational Road Traffic Noise and Vibration Guidelines

GUIDELINE/POLICY NAME	WHEN GUIDELINE IS USED
Road Noise Policy **(RNP) (DECCW, 2011)**	Operational road traffic noise assessment
Road Noise Criteria Guideline **(RNCG) (Transport for NSW 2025)**	Defines TfNSW's interpretation of the RNP and details how criteria are applied to sensitive receivers
Road Noise Mitigation Guideline **(RNMG) (Transport for NSW, 2025)**	Details how additional mitigation measures are to be applied to road infrastructure projects
Road Noise Model Validation Guideline **(Transport for NSW, 2026)**	Contains procedures for validating operational road traffic noise models and standard input parameters
Noise and vibration assessment procedure (road infrastructure projects) ***(Transport for NSW, 2024)***	Defines how to complete operational road traffic noise and vibration assessments
AS2107:2016 Acoustics – Recommended design sound levels and reverberation times for building interiors	Provides recommended design sound levels for internal areas of occupied spaces.
At-Receiver Noise Treatment Guideline **(Roads and Maritime, 2023)**	Provides an overview and discussion of feasible and reasonable at-receiver noise mitigation measures

3.1.1 Airborne Noise – Road Noise Policy and Noise Criteria Guideline

The *NSW Road Noise Policy* (RNP) is used to assess and manage potential airborne noise impact from new and redeveloped road projects.

This assessment is undertaken with guidance from the *Road Noise Criteria Guideline* (RNCG) which is Transport for NSW's interpretation of the RNP and provides a consistent approach to identifying road noise criteria for infrastructure projects.

The RNP and RNCG provide non-mandatory criteria for residential and 'other sensitive' land uses. Where a project results in road traffic noise levels which are predicted to be above the criteria, the project should investigate feasible and reasonable noise mitigation measures to minimise the impacts.

The RNP and RNCG use the following terms to describe and assess the impacts from road projects:

- '**No Build**' – the assessment scenario used to predict noise levels if the project were not to go ahead
- '**Build**' – the assessment scenario used to predict noise levels with the project.

The difference between the 'Build' and the 'No Build' noise levels is used to determine the impact of the project.

3.1.1.1 Residential Receivers

A road is 'redeveloped' where work is in an existing road corridor and the existing road is not substantially realigned. A road is 'new' when a project proposes road construction in an undeveloped corridor.

Richmond Road and the overpass are considered a 'redeveloped' road. The relevant noise criteria for residential receivers affected by traffic noise are shown in **Table 4**.

Table 4 RNCG Criteria for Residential Receivers

ROAD CATEGORY	TYPE OF PROJECT/LAND USE	ASSESSMENT CRITERIA (DBA)	
		DAYTIME (7 AM – 10 PM)	NIGHT-TIME (10 PM – 7 AM)
Freeway/ arterial/ sub-arterial roads	2. Existing residences affected by noise from redevelopment of existing freeway/arterial/sub-arterial roads	LAeq(15 hour) 60 (external)	LAeq(9 hour) 55 (external)
	3. Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments		
	6. Existing residences affected by increases in traffic noise of 12 dB or more from redevelopment of existing freeway/arterial/sub-arterial roads[2]	Between LAeq(15hour) 42-60 (external)	Between LAeq(9hour) 42-55 (external)
Local Roads	7. Existing residences affected by noise from new local road corridors	LAeq(1hour) 55 (external)	LAeq(1hour) 50 (external)
	8. Existing residences affected by noise from redevelopment of existing local roads		
	9. Existing residences affected by additional traffic on existing local roads generated by land use developments		

Note 1: The criteria are assigned to the entire residence and depend on the proportion of noise coming from new and redeveloped roads.

Note 2: The relative increase criterion at each facade is determined from the existing traffic noise level plus 12 dB.

The criteria are lower for the night-time due to the greater sensitivity of communities to noise impacts during this period.

The RNP and RNCG require noise to be assessed at project opening and for a future design year, which is typically ten years after opening. For this project, the at-opening year is 2028 and the future design year is 2038.

3.1.1.2 'Other Sensitive' Land Uses

Several 'other sensitive' non-residential land uses have been identified in the study area. The noise criteria for these receivers are shown in **Table 5**. The RNCG does not consider commercial and industrial receivers as being sensitive to operational airborne road traffic noise impacts.

Table 5 RNCG Criteria for Other Sensitive Receivers

EXISTING SENSITIVE LAND USE	ASSESSMENT CRITERIA (DB)		ADDITIONAL CONSIDERATIONS
	DAYTIME (7 AM – 10 PM)	NIGHT-TIME (10 PM – 7 AM)	
1. School classrooms	LAeq(1 hour) 40 (internal)[1]	-	In the case of buildings used for education or health care, noise level criteria for spaces other than classrooms and wards may be obtained by interpolation from the 'maximum' levels shown in Australian Standard 2107:2000 (Standards Australia 2000). The buildings within the Western Sydney Local Health Precinct have been classified as Health Care Services which as defined in AS 2107 have a maximum internal noise level of 45dBA – 50dBA LAeq (1 hour).
2. Hospital wards	LAeq(1 hour) 35 (internal)[1]	LAeq(1 hour) 35 (internal) [1]	

EXISTING SENSITIVE LAND USE	ASSESSMENT CRITERIA (DB)		ADDITIONAL CONSIDERATIONS
	DAYTIME (7 AM – 10 PM)	NIGHT-TIME (10 PM – 7 AM)	
3. Places of worship	LAeq(1 hour) 40 (internal)[1]	LAeq(1 hour) 40 (internal)[1]	The criteria are internal, ie the inside of a church. Areas outside the place of worship, such as a churchyard or cemetery, may also be a place of worship. Therefore, in determining appropriate criteria for such external areas, it should be established what is in these areas that may be affected by road traffic noise.
4. Open space (active use	LAeq(15 hour) 60 (external)	-	Active recreation is characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion.
5. Open space (passive use)	LAeq(15 hour) 55 (external)	-	Passive recreation is characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion (eg playing chess, reading).
6. Child care facilities	Sleeping rooms LAeq(1 hour) 35 (internal)[1] Indoor play areas LAeq(1 hour) 40 (internal)[1] Outdoor play areas LAeq(1 hour) 55 (internal)	-	Multipurpose spaces (eg shared indoor play/sleeping rooms) should meet the lower of the respective criteria. Measurements for sleeping rooms should be taken during designated sleeping times for the facility, or if these are not known, during the highest hourly traffic noise level during the opening hours of the facility.
7. Aged care facilities	-	-	The criteria for residential land uses should be applied to these facilities.

Note 1: The criteria are specified as an internal noise level for this receiver category. As the noise model predicts external noise levels, it has been conservatively assumed that all schools and places of worship have openable windows and external noise levels are 10 dB higher than the corresponding internal level, which is representative of windows being partially open to provide ventilation.

3.1.1.3 Blacktown Native Institution (BNI) Area

Mitigation Measure NAH4 detailed in the Determination Report for the project and summarised in **Section 1.3.2**, requires consultation with DSMG throughout detailed design regarding the management of noise impacts from the project during operation.

For consultation purposes, the BNI area shown in **Figure 2** is identified as a passive recreational area and has been assessed against the corresponding criteria outlined in **Table 5** to support ongoing consultation.

3.1.2 Potential Road Traffic Noise Impacts on the Surrounding Road Network

Where a project results in traffic redistribution, noise impacts can occur on the surrounding road network due to vehicles using different routes after the project is complete. The RNCG criteria (see **Table 4**) are therefore to be applied to the surrounding road network (within the study area) where a road project generates an increase in road traffic noise of more than 2.0 dB.

3.2 Noise Mitigation

The *Road Noise Mitigation Guideline* (RNMG) provides guidance in managing and controlling road traffic noise and describes the principles to be applied when reviewing noise mitigation. The RNMG recognises that the RNCG criteria are not always practicable and that it is not always feasible or reasonable to expect that they are achieved.

As projects progress through the early design stages, various road design features are evaluated to assist with minimising road traffic noise. The RNMG defines these 'integrated noise reduction measures' as including:

- Adjustments to vertical and horizontal alignments
- Road gradient modifications
- Traffic management
- Cost effective use of won project spoil to provide landscape mounds where there is suitable site footprint.

Following use of the above measures, site specific 'additional noise mitigation measures' are then required to be investigated for receivers which have residual exceedances of the criteria. When evaluating if a receiver qualifies for consideration of 'additional noise mitigation measures' the RNMG considers how far above the criterion the noise level is and also how much a project increases noise levels. These considerations provide a feasible and reasonable approach to identifying qualifying receivers.

The RNMG provides three triggers where a receiver may qualify for consideration of 'additional noise mitigation' (beyond the use of 'integrated noise reduction measures'). These are:

- **Trigger 1** – the predicted 'Build' noise level exceeds the RNCG controlling criterion and the noise level increase due to the project (ie the noise predictions for the 'Build' minus the 'No Build') is greater than 2.0 dB
- **Trigger 2** – the predicted 'Build' noise level is 5 dB or more above the RNCG controlling criterion (ie exceeds the cumulative limit) and the receiver is significantly influenced by project road noise, regardless of the incremental impact of the project
- **Trigger 3** – the noise level contribution from the road project is acute (daytime $L_{Aeq(15hour)}$ 65 dBA or higher, or night-time $L_{Aeq(9hour)}$ 60 dBA or higher) even if noise levels are controlled by a non-project road.

The eligibility of receivers for consideration of 'additional noise mitigation' is determined before the benefit of low noise pavement and noise barriers are included. The requirement for the project is to provide feasible and reasonable additional mitigation to eligible receivers with the aim of meeting the RNCG controlling criterion.

For receivers that qualify for consideration of 'additional noise mitigation', potential noise mitigation measures are to be considered in the following order of preference:

- At-source mitigation:
    1. Quieter road pavement surfaces
- In-corridor mitigation:
    2. Noise mounds
    3. Noise barriers
- At-receiver mitigation:
    4. At-property treatments.

3.3 Maximum Noise Levels

Maximum noise levels near roads are generally controlled by noise from trucks. Where roads are located close to residential receivers there is potential for sleep disturbance impacts from maximum noise level events.

The RNP and RNCG both state that while a maximum noise level assessment is required to be undertaken for new and redeveloped road infrastructure projects, it should only be used as a tool to help prioritise and rank mitigation strategies and should not be applied as a decisive criterion.

The purpose of a maximum noise level assessment is to determine where maximum noise levels are likely to change as a result of a project.

The maximum noise level assessment includes an evaluation of the number and distribution of night-time events in accordance with the RNCG. A maximum noise level event is defined as being any pass-by where:

- The maximum noise level of the event is greater than 65 dBA L_{AFmax}

  and

- The $L_{AFmax} – L_{Aeq(1hour)}$ is greater than or equal to 15 dB.

Existing maximum noise levels were monitored in the study area during the unattended noise monitoring survey as part of the REF and the results presented in the report are in **Section 6.4**.

4 Methodology

4.1 Noise Model

A noise model of the study area has been used to predict noise levels from the operation of the project to the surrounding receivers. The model uses Calculation of Road Traffic Noise (CoRTN) (UK Department of Transport, 1988) algorithms NSW Adaptation in SoundPLAN v8.2 software.

Local terrain, receiver buildings and structures were digitised in the noise model to develop a three-dimensional representation of the project and surrounding areas.

The '**No Build'** scenarios use 1 m contours from Lidar and survey provided.

The '**Build**' scenarios use the SDD design of the project provided which includes all new changes to existing ground levels. It also includes the reference design for Portion 1.

4.1.1 Project and Non-Project Roads

Roads where design or engineering changes are proposed as part of the project are considered as 'project' roads. Existing roads with no upgrades or work occurring are considered 'non-project'.

All major roads in the study area have been modelled together with major roads on the surrounding road network to determine the contributions from 'project' and 'non-project' roads at individual receivers, as required by the RNCG. Project and non-project roads are shown in **Appendix B**.

4.2 Design Inputs

Table 6 Summary of Noise Model inputs and Parameters

INPUT PARAMETER	SOURCE OF DATA
Noise assessment algorithm	Calculation of Road Traffic Noise (CoRTN) (UK Department of Transport, 1988) algorithms NSW Adaptation in SoundPLAN V8.2 software consistent with the REF.
Ground topography	The detailed design noise model includes an updated high resolution 'digital ground model' which is an accurate 3D representation of the terrain in the study area. The ground model was constructed from a combination of surveyed road corridor data, LIDAR point cloud data and most recently available 1 m contours. The ground model has been updated to include the SDD design provided for the Build Scenario.
Buildings, receiver locations and floors	Buildings can provide screening to more distant locations in the study area. The buildings in the noise model have been updated based on the most recent information available and were generated from a third-party database, digitised based on satellite imagery and a combination of automated and manual processing to identify building attributes. The buildings have been checked and updated where appropriate to be suitable for noise modelling. The model predicts noise at 1 m from every facade of every identified receiver in the assessment area using the following heights: Ground floor – 1.5 m First floor – 4.5 m Floor height – 3 m.
Noise barriers	All existing noise barriers in the study area were updated and taken from design documentation for the M7 and were fitted to the DGM in lieu of available survey information. Some noise barriers were obtained from survey information where available.
Study area	The assessment area extends a minimum of 600 m from the centre line of the outermost traffic lane on each side of the project roads, as required by the RNP/RNCG.
Assessment timeframes	The project is assessed 'at-opening' in 2028 and in the 'future design' year in 2038.

INPUT PARAMETER	SOURCE OF DATA
Traffic volumes	Existing traffic volumes were measured at the same time as the noise monitoring survey as detailed in the REF Report. This data was used to model the existing situation and validate the operational noise model. The predicted traffic volumes for the 2028 and 2038 assessment used in the assessment were taken from traffic volumes detailed in the REF. Due in insufficient information, TfNSW team advised GEDT to utilise the REF volumes with an adjustment to increase the traffic along the new flyover to 95% of the volume using the exit from the M7 only. All other sections remain as per the REF and REF Noise Model provided.
Vehicle speed	Existing vehicle speeds were measured during the noise monitoring survey as detailed in the REF report and used to validate the noise model. Speeds for the M7 and M7 Ramps were modelled at the posted speeds as per the REF as actual speeds are unknown.
Source heights and source correction	Vehicles generally emit road traffic noise at four source heights. These are represented in the noise model, as required by the Road Noise Model Validation Guideline, by the following: Cars (at 0.5 m height with a source correction of 0.0 dB) Truck tyres (at 0.5 m height with a source contribution of 25% (-6.0 dB)) Truck engines (at 1.5 m height with a source contribution of 60% (-2.2 dB)) Truck exhausts (at 3.6 m height with a source contribution of 15% (-8.2 dB)).
Road pavement surface corrections	The road pavement surfaces used in the modelling are detailed below. The road pavement surfaces are generally consistent with the REF, however the ramps have been updated to be OGA as per information provided. These are also shown in **Appendix B**. M7 Motorway: Open Grade Asphalt (OGA) M7 Motorway ramps: Open Grade Asphalt (OGA) and Dense Grade Asphalt (DGA) All other roads: Dense Grade Asphalt (DGA) The correction factors used in the modelling consistent with the REF are: DGA +0 dB OGA -2dB
Ground absorption	Noise levels at receivers can be influenced by the type of ground between the source of noise and the receiver. A ground absorption factor of 50% for suburban residential areas, 75% for open grass areas and 0% for water has been used, as detailed in the Transport for NSW Road Noise Validation Guideline.
General corrections	The model also includes the following corrections to convert the noise model outputs to the appropriate assessment noise levels: • Facade reflections +2.5 dB • L_{A10} to L_{Aeq} -3 dB • -1.7dB CoRTN correction for Australian conditions consistent with the REF • -0.7dB CoRTN correction for free field conditions consistent with the REF • $L_{Aeq(15hour)}$ to $L_{Aeq(1hour)}$ correction +1.3dB[1] • $L_{Aeq(9hour)}$ to $L_{Aeq(1hour)}$ +4.0dB[1]
Facade prediction point	Noise predictions have been calculated 1 m from each facade as per the requirements of the NSW Road Noise Policy. It is noted that predictions in the REF were calculated 0.01m from each facade.
Noise Contour Map Settings	Grid spacing = 20 m Height above ground = 1.5 m All noise contour maps are free field.

Note 1: Taken from nearby Richmond Road Upgrade (Marsden Park) REF, refer to SLR report 610.19226-R01 v1.1 dated October 2020.

4.3 Noise Model validation

4.3.1 Noise Model Validation

To validate the operational road traffic noise model the 2024 existing scenario was modelled using measured traffic data and compared to existing noise measurements in the study area (see **Section 2.1**).

The measurement sites are shown in **Figure 2** and a summary of the model comparison is provided in **Table 7**.

Table 7 Comparison of Measured and Predicted Road Traffic Noise Levels

LOCATION	NOISE LEVEL (DBA)					
	DAYTIME $L_{AEQ(15HOUR)}$			NIGHT-TIME $L_{AEQ(9HOUR)}$		
	MEASURED	PREDICTED	DIFFERENCE[1]	MEASURED	PREDICTED	DIFFERENCE[1]
L01[2]	67.9	69.8	1.9	65.7	67.4	1.7
L02	65.4	66.6	1.2	61.8	62.5	1.1
L03	67.0	67.3	0.3	65.1	64.0	-1.1
L05	61.7	63.9	2.2	58.7	59.9	1.2
L07	68.6	68.8	0.2	65.4	64.5	-0.9
L09[2]	62.8	63.4	0.6	57.5	57.6	0.1
Median			**0.9**	**Median**		**0.4**

Note 1: Difference is Predicted minus Measured. A negative difference indicates the predicted level of road traffic noise is lower than the measured data, a positive difference indicates the predicted level is higher.

Note 2: These locations are outside the project area.

The TfNSW Road Noise Model Validation Guideline notes that noise models typically result in random scatter error of ±2.0 dB.

The noise level at L05 is likely over-predicted during the daytime due to posted speeds being used in noise model for the ramps due to measured speeds not being available. Traffic is likely to be significantly slower than posted speed given the proximity to the intersection.

The above predictions show that the noise model is within the accepted tolerances at the validation sites and is valid for predicting road traffic noise levels from the project.

5 REF Noise Assessment

5.1 Overview of REF Noise Impacts

Operational road traffic noise impacts were assessed in the REF. The assessment concluded the following:

- The project was not predicted to substantially alter operational noise levels in the study area as noise levels were not predicted to increase by more than 2 dB. The alignment of Richmond Road moves closer to the residents in NCA05 and the assessment detailed that these receivers may experience an increase of 1-2 dB, as Richmond Road moves from 145 m to 115 m from residents.
- In summary, 109 residential receivers and three other-sensitive receivers were predicted to result in noise levels above the cumulative limit or acute criteria, and were therefore eligible for consideration of additional noise mitigation. The three other sensitive receivers include the Baitul Huda Mosque, associated Khilafat Centenary Hall and the childcare centre located at 5 Woodburn Street.

The REF receivers identified as eligible for consideration of additional noise mitigation were not presented in a figure in the REF report however a detailed list of addresses were provided and are shown in **Figure 3**.

In addition to this, a review of the exported noise model results from the REF assessment has been undertaken and this found the triggers to be different from that presented in the REF report. It is also noted that results for select buildings were not included in the noise model provided.

Furthermore, various additional triggers were found to trigger for consideration of additional noise mitigation and at least one incorrect address was listed in the REF report (eg two buildings were identified as 27 Summerland Crescent).

Figure 3 REF Noise Mitigation

5.2 Design Changes from REF

A review of the REF Design used in the REF Noise Model (RRM7Y2T-STANA-0537-RW-M2D-000001_DESN) against the provided SDD (M7 to South of Alderton Drive) (RRM7-GEDT-0537-RW-M3D-000001) shows there are various design changes from the REF, including:

- The flyover (BR01) from the M7 off ramp onto Richmond Road North Bound has been reduced in radius to 320m and also shifted slightly east. The flyover has also been reduced to 5 spans with 4 piers.
- The proposed design reduces the overall length of the flyover by approximately 50m.
- The vertical height of the flyover (BR01) has been reduced by up to 2m and
- The realignment of Richmond Road around 5 m further away from the nearest receivers along Colebee Crescent.
- Richmond Road Northbound has been realigned further to the east (further away from the nearest receivers) and lowered.
- In combination with shifting the horizontal alignment of north-bound carriageway on Richmond Road and the flyover this removes the need for a retaining wall at the pinch point near chainage MC10 350 creating additional separation between the toe of the western batter and BNI land.
- Introduction of a landscape mound on the corner of Rooty Hill Road and the M7 off-ramp and on the corner of Richmond Road and Rooty Hill Road.

These changes have been included in the OTNAR noise model and assessment.

6 Detailed Design Noise Assessment

Operational road traffic noise impacts from the project have been predicted for all sensitive receivers in the study area. The operational impacts are discussed in the following sections.

6.1 Residential Receivers

The predicted operational road traffic noise levels at residential receivers are summarised in **Table 8** for the 2028 at opening and 2038 future design scenarios. The table shows the worst-case impacts in each NCA, which are typically experienced by the receivers nearest to the project. **Table 9** shows the number of triggered buildings in each NCA.

Receivers are generally most affected by the project in the night-time period in 2038 with respect to the RNCG criteria and RNMG triggers, and this scenario is considered to control the assessment in terms of determining the worst-case impacts and requirements for mitigation.

The predicted noise levels for the night-time scenario in 2038 are shown in **Figure 4** and the predicted change in noise levels (Build (with project) minus No Build (without project)) for the same scenario is shown in **Figure 5**. The predicted highest change at individual receivers from all scenarios is also shown in a scatter graph in **Figure 6**.

Table 8 Predicted Road Traffic Noise levels at Most Affected Residential Receivers in each NCA

NCA	PREDICTED NOISE LEVEL (DBA)[1]							
	AT OPENING (2028)				FUTURE DESIGN (2038)			
	NO BUILD (WITHOUT PROJECT)		BUILD (WITH PROJECT)		NO BUILD (WITHOUT PROJECT)		BUILD (WITH PROJECT)	
	DAY	NIGHT	DAY	NIGHT	DAY	NIGHT	DAY	NIGHT
NCA01	59	56	60	56	61	57	61	57
NCA02	-	-	-	-	-	-	-	-
NCA03	71	64	71	64	71	65	71	65
NCA04	78	75	77	74	80	76	79	75
NCA05	65	61	65	61	66	62	66	62
NCA06	64	61	64	60	66	62	65	61
NCA07	76	72	76	73	77	73	77	73
NCA08	76	72	76	72	76	72	76	72

Note 1: Predicted noise levels are for the worst case impacts for all receivers in each NCA.

Table 9 Triggered Residential Receivers in each NCA

NCA	NUMBER OF TRIGGERED RESIDENTIAL BUILDINGS[1]			
	TRIGGER 1 (>2.0 DB)	TRIGGER 2 (CUMULATIVE)	TRIGGER 3 (ACUTE)	TOTAL
NCA01	0	0	0	0
NCA02	0	0	0	0
NCA03	0	0	0	0
NCA04	0	20	21	21
NCA05	0	23	22	23
NCA06	0	7	0	7
NCA07	0	9	8	9
NCA08	0	13	13	13
			TOTAL	**73**

Note 1: Number of buildings that trigger each of the three triggers as outlined in TfNSW RNMG and detailed in **Section 3.2**.

Figure 4 Predicted Operational Nosie Levels with Project (Night-time Scenario 2038)

Note 1: The contours are predicted at 1.5 m above ground level and are free-field.

Figure 5 Predicted Increase

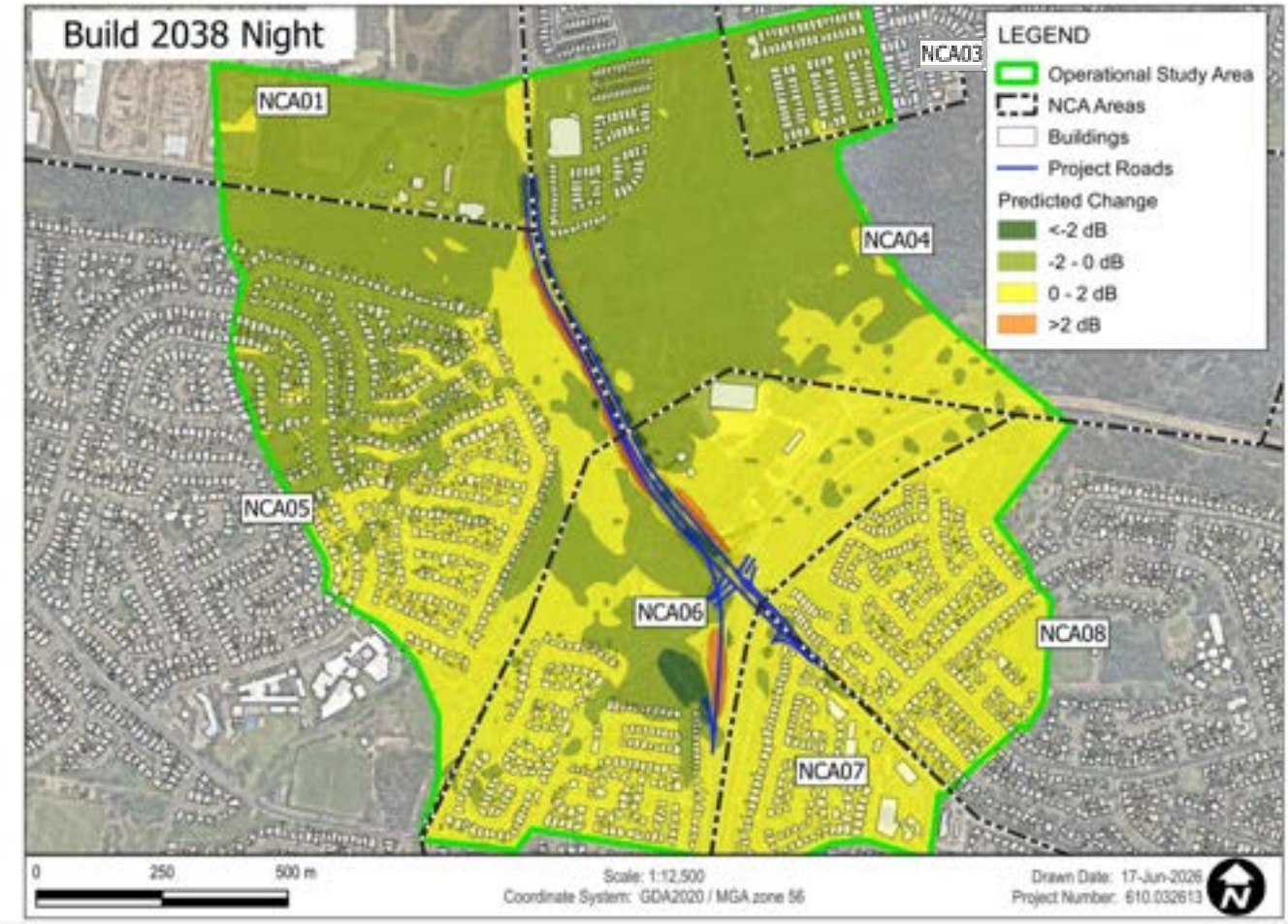
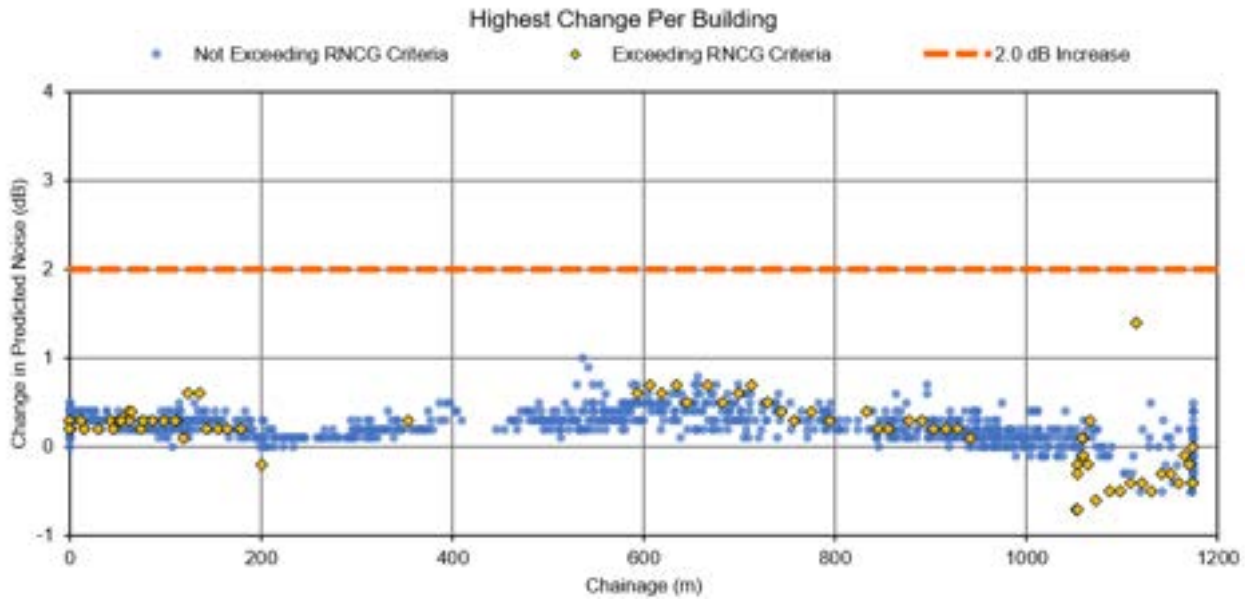


Figure 6 Predicted Change in Road Traffic Noise levels due to the Project



Note: The change in noise level is the predicted highest value per receiver building from all assessed scenarios. The chainage is approximate from the start of the project on Richmond Road (east of the M7) to the end of the project on Richmond Road (towards Alderton Drive).

The results show that:

- The nearest residential receivers to Richmond Road, particularly receivers in NCA03, NCA04, NCA07 and NCA08, are subject to relatively high existing road traffic noise levels, which already exceed the RNCG criterion in many cases.
- The project is not predicted to significantly increase the level of noise at residential receivers surrounding the project.
  - **Figure 5** shows that most receivers are predicted to have a marginal increase as a result of the project (ie less than 1.0 dBA) with some receivers towards Aldington Drive have a decrease as the trafficable lanes shift slightly further away
  - Although Richmond Road is moving closer to receivers in NCA05, the noise levels are not predicted to significantly increase as the southbound traffic is lower and shielded by the northbound lanes at these receivers.
- Exceedances of the RNCG cumulative limit criteria (ie 5 dB or more above the RNCG controlling criterion) are predicted at residential receivers in NCA04, NCA05, NCA06, NCA07 and NCA08.
- Receivers adjacent to Richmond Road in NCA04, NCA05, NCA07, and NCA08 are also predicted to be subject to acute noise levels (ie daytime noise levels are 65 dBA or higher, or night-time noise levels are 60 dBA or higher).
- In summary, the following is predicted for the project:
  - No residential receivers experience increases in traffic noise of greater than 2.0 dB and above the base criteria
  - 72 residential receivers experiencing noise levels above the cumulative limit criteria
  - 64 residential receivers experiencing acute noise levels
- In total, 73 residential receiver buildings are considered eligible for consideration of additional noise mitigation, as per the operational road traffic noise criteria.

6.2 Other Sensitive Receivers

'Other Sensitive' receivers that are predicted to have exceedances of the trigger levels are shown in **Table 10**.

Table 10 'Other Sensitive' Receiver triggers

NCA	RECEIVER	FLOOR	TYPE	RNMG TRIGGERS[1]		
				TRIGGER 1 >2.0 DB	TRIGGER 2 CUMULATIVE	TRIGGER 3 ACUTE
NCA01	Bait-ul Huda Mosque	1&2	Place of Worship	N	Y	Y
		1-3	Place of Worship	N	Y	N
NCA03	Prepare Early Education Centre Greenway Village	1	Child Care Centre	N	Y	N
NCA06	BNI Area	NA	Passive Recreational	N	Y	Y

*Note 1: The RNMG triggers are discussed in **Section 3.2**.*

The above shows that three 'other sensitive' receiver buildings are predicted to exceed the relevant trigger levels.

6.3 Receivers eligible for consideration of 'additional noise mitigation'

The receivers which have been identified as eligible for consideration of 'additional noise mitigation' (ie triggered receivers) are summarised in **Table 11** and shown in **Figure 7**.

Table 11 Receivers Eligible for consideration for 'Additional Noise Mitigation'

NCA	NUMBER OF TRIGGERED BUILDINGS (FLOORS)		COMMENTS
	RESIDENTIAL	OTHER SENSITIVE	
NCA01	0 (0)	2 (5)	Two other sensitive receiver buildings associated with the Bait-ul Huda Mosque are predicted to exceed primarily due to the noise levels being above the cumulative limit criteria or being acute.
NCA02	0 (0)	0 (0)	No sensitive receivers in this catchment are eligible.
NCA03	0 (0)	1 (1)	One other sensitive receiver building (Prepare Early Education Centre Greenway Village) is predicted to exceed due existing levels of noise above the cumulative limit criteria. Noise levels are predicted to generally remain unchanged.
NCA04	21 (39)	0 (0)	21 residential receiver buildings to the east of Richmond Road are triggered primarily due to existing noise levels exceeding the cumulative limit or being acute. These receivers are already behind an existing noise wall.
NCA05	23 (23)	0 (0)	23 residential receiver buildings to the west of Richmond Road are triggered primarily due to existing noise levels exceeding the cumulative limit or being acute. Noise levels are not predicted to significantly increase as a result of the project.
NCA06	7 (7)	1 (1)	Seven residential receiver buildings adjacent to the M7 offramp are triggered primarily due to existing noise levels exceeding the cumulative limit. This also includes the BNI area primarily due to existing noise levels exceeding the cumulative limit or being acute for passive recreation areas. Further discussion on the BNI area is detailed in **Section 6.5**.
NCA07	9 (9)	0 (0)	Nine residential receiver buildings to the south of Richmond Road and adjacent to the M7 on ramp are triggered primarily due to existing noise levels exceeding the cumulative limit or being acute.
NCA08	13 (16)	0 (0)	13 residential receiver buildings to the north of Richmond Road are triggered primarily due to existing noise levels exceeding the cumulative limit or being acute.
Sub Total	**73 (94)**	**4 (7)**	
TOTAL	**77 (101)**		

Note 1: The count of 'floors' represents separate floors within each building.

In summary, the assessment identifies 77 sensitive receivers that are predicted to exceed the RNCG operational road traffic noise criteria and are therefore eligible for consideration of at-property treatment.

Figure 7 Receivers Eligible for Consideration of Additional Mitigation

6.4 Maximum Noise Level Assessment

6.4.1 Existing Maximum Noise Levels

The maximum noise assessment undertaken during the REF assessment has been reproduced in **Table 12**.

Table 12 Existing Maximum Noise Level Events

TIME	L1 – RICHMOND ROAD		L5 – ROOTY HILL ROAD		L7 – RICHMOND ROAD	
	NUMBER OF MAXIMUM NOISE LEVEL EVENTS	MEASURED MAXIMUM SPL	NUMBER OF MAXIMUM NOISE LEVEL EVENTS	MEASURED MAXIMUM SPL	NUMBER OF MAXIMUM NOISE LEVEL EVENTS	MEASURED MAXIMUM SPL
22:00-23:00	0	80	1	86	0	81
23:00-00:00	3	81	2	79	2	87
00:00-01:00	9	85	2	85	2	86
01:00-03:00	11	81	0	70	7	79
02:00-04:00	1	84	3	75	6	79
03:00-04:00	4	84	6	82	8	81
04:00-05:00	3	87	1	73	2	83
05:00-06:00	0	85	2	77	1	85
06:00-07:00	1	89	1	81	1	86
9 hour	32 (total)	89 (max)	18 (total)	86 (max)	29 (total)	87 (max)

The table above shows that the maximum noise level events are a regular feature at the monitoring locations. Maximum noise events were measured to typically range from around 73 to 89 dBA.

Maximum noise level events towards the upper end of the range are likely to be from heavy vehicles, whereas the lower end of the range is likely due to nearby light vehicles.

6.4.2 Future Maximum Noise Levels

As the project is introducing a flyover bridge, there is potential for changes to maximum noise levels in the study area due to the elevation changes and traffic flow changes. A summary of the predicted changes is provided in **Table 13**.

Table 13 Predicted Change in Maximum Noise Levels

NCA	WORST-CASE CHANGE (DB)	DISCUSSION
NCA01	0dB	Negligible change in maximum noise levels predicted in this NCA.
NCA02	0dB	Outside Project Area
NCA03	0dB	Negligible change in maximum noise levels predicted in this NCA.
NCA04	0dB	Negligible change in maximum noise levels predicted in this NCA. Some receivers may experience a decrease as the road moves slightly further away.
NCA05	1-2dB	Maximum noise levels are predicted to increase by up to 2 dB at the closest receivers to Richmond Road due to the new road alignment being nearer than the existing road. The addition of the flyover may also contribute to an increase in noise levels.

NCA	WORST-CASE CHANGE (DB)	DISCUSSION
NCA06	0dB	Negligible change in maximum noise levels predicted in this NCA. Some receivers may experience a decrease in maximum noise levels as traffic utilises the new overpass, however when vehicles utilise the existing off-ramp and Rooty Hill Road no change to maximum noise levels are expected.
NCA07	0dB	Negligible change in maximum noise levels predicted at the closest receivers to Richmond Road.
NCA08	0dB	Negligible change in maximum noise levels predicted at the closest receivers to Richmond Road.

The results show that:

- The traffic data indicates that overall volumes are expected to remain largely unchanged following project completion. The one exception is that approximately 95% of traffic currently using the exit ramp will instead use the new flyover bridge, providing a direct connection to Richmond Road.
- This flyover will likely reduce the number of maximum noise events in NCA06 as a result of the traffic no longer traveling through the Rooty Hill Road intersection.
- The total number of vehicles along Richmond Road is expected to remain the same and therefore not introduce any additional maximum noise events. For receivers in NCA05, the slight realignment of Richmond Road closer to these receivers is predicted to result in an increase of maximum noise levels by up to 2dB. Additionally, as heavy vehicles descend from the flyover on to Richmond Road, engine breaking may be more apparent to receivers in NCA05.

While receivers are not triggered for consideration of 'additional noise mitigation' by maximum noise levels alone, the selection of feasible and reasonable mitigation measures should consider the potential change in maximum noise levels and the effect the potential mitigation would have on those levels.

The recommended operational mitigation measures are discussed in **Section 7**.

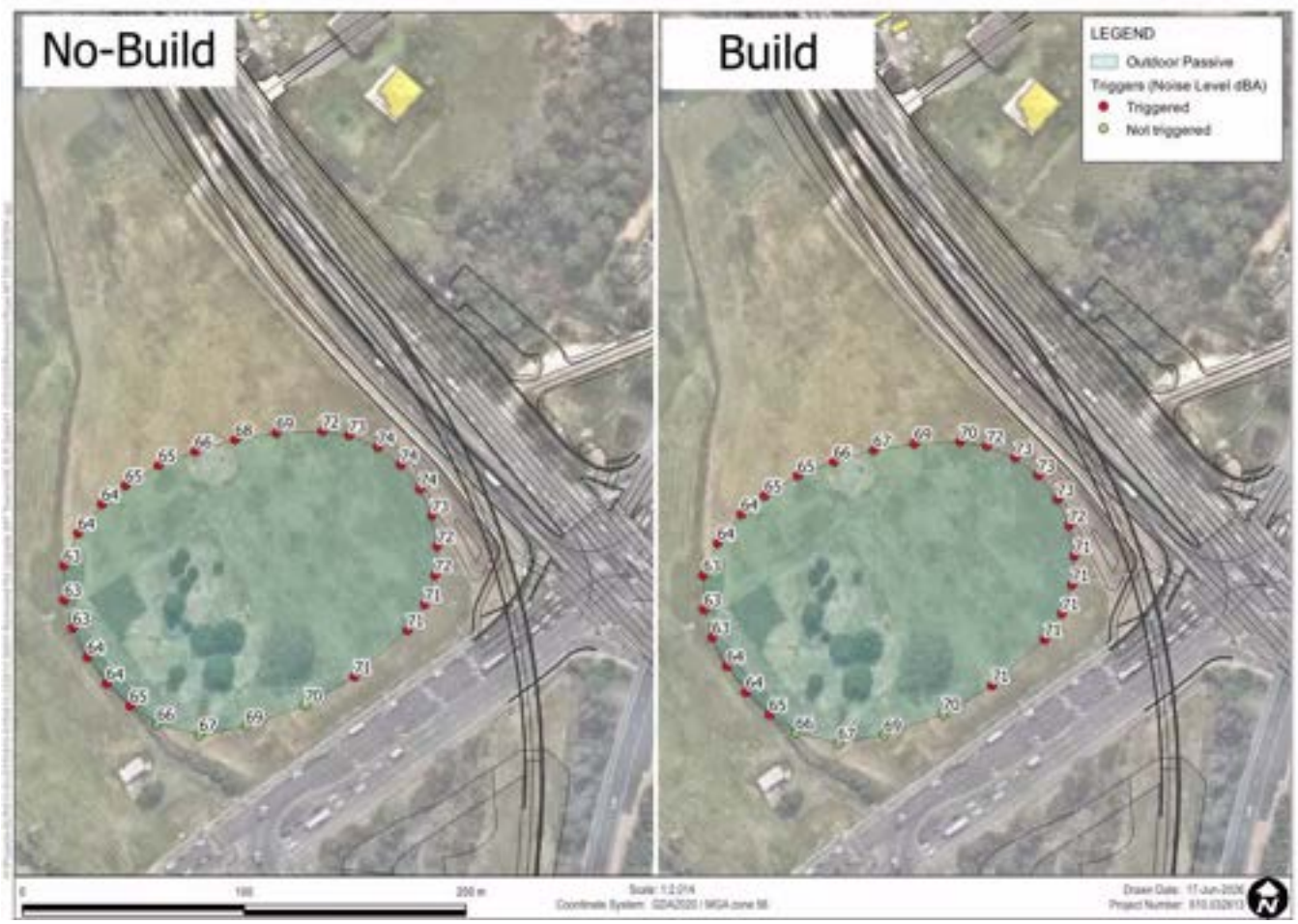
6.5 Blacktown Native Institution (BNI) Area

Noise levels predicted in the BNI area shown in **Figure 2** are predicted to exceed the criteria for a passive recreation area as detailed in **Section 3.1.1.2**.

The figure shows that noise levels from the project are not predicted to increase. Instead, the predictions result in some minor decreases (ie -1 dB) towards Richmond Road as the southbound traffic lanes move further away and shielding is provided by the bridge abutment.

These operational noise levels can be used during consultation with DSMG regarding the management of operational noise levels.

Figure 8 BNI Noise Assessment



7 Detailed Design Noise Mitigation

7.1 At-Source Mitigation – Low Noise Pavements

The type of road surface can affect road traffic noise levels experienced by sensitive receivers. Jointed concrete pavements tend to be the noisiest road surface with low noise pavements such as open grade asphalt (OGA) being the quietest.

Low noise pavements are to be considered first when specifying noise mitigation as they reduce source noise levels, which provides noise level benefit to both outside areas and internal spaces. Low noise pavements have no associated visual impact and are also likely to provide noise benefits to receivers at greater distances than noise barriers. They are generally considered feasible to use where there are four or more closely spaced receivers that exceed the operational road traffic noise criteria.

Road pavement surfaces and textures must meet a number of criteria besides noise performance including structural integrity, skid resistance, water shedding, maintenance requirements and design life.

Low noise pavements are generally most effective where vehicle speeds are high, such as on motorways, and less effective where traffic speeds are slower or where traffic is required to slow down or stop. It is noted that the project has several intersections, which would reduce the effectiveness of low noise pavements due to stop/start traffic.

7.1.1 Assessment of Pavements

The project includes the use of quieter noise pavements in the form of dense grade asphalt (DGA) for all roads in the study area. DGA is generally quieter compared to chip seal, concrete and some stone mastic asphalts, as documented in the RNMVG.

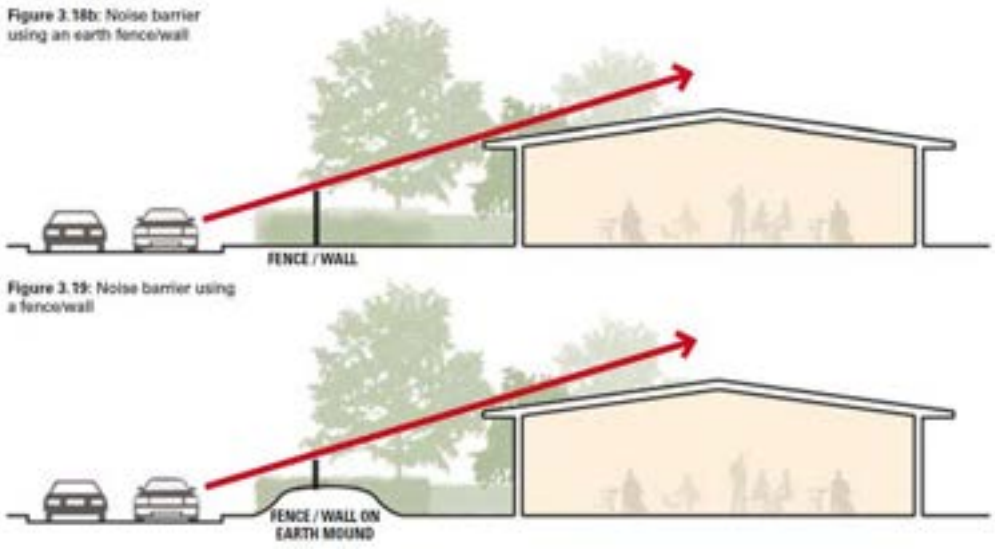
The use of low noise pavements, such as OGA, was not considered to be a suitable approach on the project roads given the presence of intersections which require traffic to stop and start, and relatively low vehicle speeds of 60km/hr and 70km/hr.

7.2 In-Corridor Mitigation – Noise Barriers

After at-source mitigation has been investigated, in-corridor mitigation should be considered, which aims to block line-of-sight from the source of noise to nearby receivers.

Noise barriers (in the form of walls or mounds) can provide significant noise reductions and also reduce both external and internal noise levels. Where space allows, raised earth mounds can be used as noise barriers and can be enhanced by placing a low wall on top. Noise walls are often more feasible than a mound as the footprint is much smaller. These methods are shown in **Figure 9**

Figure 9 Noise barriers



Note: Taken from DP&I Development near Rail Corridors and Busy Roads – Interim Guideline.

Noise barriers can, however, result in other impacts such as reduced access to property and utilities, visual impacts, overshadowing, changes to drainage, and safety concerns. These potential impacts need to be considered when determining if installation of noise barriers is justified.

Noise barriers are typically most efficient when receivers are located at ground floor level. As the height of a receiver increases, the noise reduction from barriers reduces due to line of sight over the top of the barrier. Because of this, noise barriers are assessed using noise predictions at ground and first floor only, with at property treatment of individual dwellings being used for higher floors if necessary.

7.2.1.1.1 Assessment of noise barriers

The RNMG requires noise barriers to be considered where there are four or more closely spaced receivers with exceedances of the RNMG triggers. The RNMG defines closely spaced receivers as residences that are separated by less than 20 metres.

The REF considered noise barriers and detailed the constraining factors for barriers in each NCA and is reproduced in **Table 14** below.

Table 14 Barrier Constraints

NCA	CONSTRAINING FACTORS
NCA04	NCA04 has a pre-existing acoustic barrier to mitigate traffic noise from Richmond Road. Clarification is required around the ownership of the existing barriers. It is not considered feasible or practical to construct higher barriers in front of the existing barriers due to space constraints and aesthetics.
NCA05	A barrier for this location would need to be constructed adjacent to Richmond Road as constructing a barrier adjacent to the residential properties on Colebee Crescent may not be feasible as the barrier would be on land that is not owned by TfNSW. A barrier constructed along Richmond Road may have reduced effectiveness due to the elevation of the road and receivers. Due to space constraints, the barrier alignment may sit off the road shoulder at a lower level. Additionally, bridges create additional design issues.
NCA07 **NCA08**	NCA07 and NCA08 are located close to Richmond Road, separated by a small nature strip with a footpath. Therefore, space constraints are the main issue with barriers in these locations. Further complicating potential barrier design is the likelihood of services in the vicinity of potential barrier footings.

Noise barriers are not considered feasible and reasonable, this is consistent with the findings of the REF.

7.3 At-Property Mitigation – Architectural Treatments

Residual impacts which remain after the use of at-source and in-corridor mitigation are typically addressed using at property mitigation. At-property mitigation is also considered the most reasonable noise mitigation strategy where receivers are not grouped together or where there is community preference for this measure.

At-property treatment typically involves using architectural treatments to improve building elements such as doors, windows, vents, etc. Installation of boundary acoustic fences or walls close to the receiver can also be considered, which can have the benefit of reducing noise levels in outdoor spaces.

As at-source mitigation and in-corridor mitigation are not considered feasible and reasonable as outlined above, the impacts are likely to be mitigated using at-property treatment.

Sensitive receivers that are predicted to be impacted by the project and have not previously received treatment under the Transport Noise Abatement Program (NAP) would most likely be mitigated using at-property treatment.

The requirements for at-property treatments would be determined using the Transport At-receiver road noise treatment guideline. The guideline details the approach for specifying feasible and reasonable at-property treatments for Transport road projects. Five categories of treatment are specified based on the predicted exceedance of the operational road traffic noise criteria (see **Appendix B** for more details).

The architectural treatments provided by Transport may include:

- Ventilation systems that meet Building Code of Australia fresh air requirements with the windows and doors shut
- Upgraded windows, glazing and solid core doors on the exposed facades of substantial structures only (eg masonry or insulated board cladding each with sealed underfloor)

- Upgrading window and door seals
- The sealing of wall vents
- The sealing of the underfloor below the bearers and appropriately treating sub-floors ventilation
- Roof insulation
- The sealing of eaves.

All noise mitigation works would be undertaken in accordance with the relevant council requirements including any restraints for heritage buildings. Noise mitigation options would be evaluated for each building to identify any considerations which may reduce the effectiveness of the solution (ie heritage open facades or lack of maintenance). Secondary glazing may also be a more appropriate, and possibly the only option for heritage buildings, where existing lead light glazing is to be retained.

7.3.1 Comparison to REF

The receivers identified as being eligible for consideration of at-property treatment during detailed design are compared to those identified in the REF in **Table 15** and presented in **Figure 10.**

The number of receivers identified as eligible for consideration of at-property treatment has generally remained consistent with the REF with some increases in select locations. They key reasons for changes in predicted noise levels in the OTNAR assessment include:

- The OTNAR noise model using a higher resolution ground model which includes current 3D survey for the road corridor and existing barriers where available.
- Sensitive receiver buildings being updated based on the most recent dataset including additional buildings not previously included in the REF noise model.
- Incorrect analysis of the results in the REF Assessment where buildings were not identified for treatment when the results indicate they should have been.
- Amendment to traffic volumes in select locations as determined in consultation with TfNSW based on the available information.
- Prediction points representative of facade reflected position (1m from the facade). Noting that the REF Assessment incorrectly predicted to 0.01 m from facades.
- The design changes have reduced the noise impacts as adopting the REF design in the amended model would result in more properties being eligible for treatment.

Table 15 Buildings eligible for Consideration of At-Property Treatment (OTNAR vs REF)

NCA	BUILDINGS ELIGIBLE FOR CONSIDERATION OF AT-PROPERTY TREATMENT[1]		COMMENTS (OTNAR COMPARED TO REF)
	REF	OTNAR	
NCA01	0 (2)	0 (2)	Two other sensitive building associated with the Bait-ul Huda Mosque remain eligible.
NCA02	0	0	No receivers are eligible for at-property treatment.
NCA03	0 (1)	0 (1)	One other sensitive building associated with the Prepare Early Education Centre Greenway Village remain eligible.
NCA04	56 (0)	21 (0)	The number of residential receivers eligible for mitigation are reduced as the extents for this project does not include the Northern Section (Portion 1). However, two properties not identified in the REF report are now eligible. These are 41 Summerland Crescent, Colebee and 25 Summerland Crescent, Colebee.

NCA	BUILDINGS ELIGIBLE FOR CONSIDERATION OF AT-PROPERTY TREATMENT[1]		COMMENTS (OTNAR COMPARED TO REF)
	REF	OTNAR	
			41 Summerland Crescent was incorrectly named 27 Summerland Crescent in the REF Noise model and 25 Summerland Crescent was not included in the REF assessment.
NCA05	28 (0)	23 (0)	The number of residential receivers eligible for mitigation has reduced as the building dataset was updated to include various buildings not previously included in the REF. This identified a number of changes to the triggered buildings along the front row of receivers. In addition to this, a number of properties are no longer eligible. These are: 64 Kirsty Crescent, Hassall Grove 1 Varga Place, Hassall Grove 78 Colebee Crescent, Hassall Grove 109 Colebee Crescent, Hassall Grove 111 Colebee Crescent, Hassall Grove 99 Colebee Crescent, Hassall Grove This is a result of these buildings previously being slightly above the cumulative limit noise criteria and now are predicted to be slightly below. These are in addition to the changes associated with additional dwellings constructed on the same lot, where triggers have changed.
NCA06	2 (0)	7 (1)	The number of residential receivers eligible for mitigation has increased in this NCA. However a review of the noise results from the REF indicates that these should have been identified as eligible for mitigation as they were above the cumulative limit criteria. The project extents have also reduced along the M7 off ramp and Rooty Hill Road. This NCA also includes the BNI area as discussed in **Section 6.5**.
NCA07	10 (0)	9 (0)	The number of residential receivers eligible for mitigation has decreased by one due to the reduction of the project extents along Richmond Road. The receiver at 7 Josephine Way, Glendenning, is no longer eligible as it is no longer Project Road Dominant or Acute.
NCA08	13 (0)	13 (0)	The number of residential receivers eligible for mitigation remain the same, however this is due to an additional building at 669 Richmond Road, Dean Park that was modelled as one building in the REF and is now modelled as two separate structures. One Residential receiver located at 4 Shipton Place, Dean Park is no longer eligible due to the reduction of the project extents along Richmond Road and is no longer Project Road Dominant or Acute.
Total	**109 (3)**	**73 (4)**	-

Note 1: The number included in brackets details the 'Other Sensitive Receivers' (OSR) triggered.

7.4 Implementation of Operational Noise Mitigation

The SWTC states that TfNSW is responsible for the implementation of all at-property treatment works that were identified in the REF.

Based on the detailed design assessment, the properties eligible for at-property treatment have been revised. These changes arise from errors and omissions in the REF assessment rather than altered noise impacts due to the detailed design. In fact the detailed design for the project has lower noise impacts than the REF due to the refinements to the road alignment and project extents. Therefore, it is expected that the changes to the at-property treatment outlined in this report will be managed by the TfNSW Noise Abatement team and will not be the responsibility of GEA DTA JV.

Figure 10 Comparison to REF

Appendix A
Acoustic Terminology

Sound Level or Noise Level

The terms 'sound' and 'noise' are almost interchangeable, except that 'noise' often refers to unwanted sound.

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

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

'A' Weighted Sound Pressure Level

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

People's hearing is most sensitive to sounds at mid frequencies (500 Hz to 4,000 Hz), and less sensitive at lower and higher frequencies. Different sources having the same dBA level generally sound about equally loud.

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

Sound Pressure Level (dBA)	Typical Source	Subjective Evaluation
130	Threshold of pain	Intolerable
120	Heavy rock concert	Extremely noisy
110	Grinding on steel	
100	Loud car horn at 3 m	Very noisy
90	Construction site with pneumatic hammering	
80	Kerbside of busy street	Loud
70	Loud radio or television	
60	Department store	Moderate to quiet
50	General Office	
40	Inside private office	Quiet to very quiet
30	Inside bedroom	
20	Recording studio	Almost silent

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

Sound Power Level

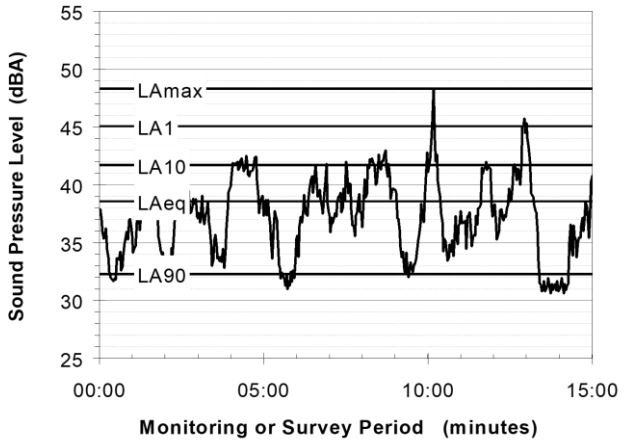
The Sound Power of a source is the rate at which it emits acoustic energy. As with Sound Pressure Levels, Sound Power Levels are expressed in decibel units (dB or dBA), but may be identified by the symbols SWL or LW, or by the reference unit 10^{-12} W.

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

Statistical Noise Levels

Sounds that vary in level over time, such as road traffic noise and most community noise, are commonly described in terms of the statistical exceedance levels LAN, where LAN is the A-weighted sound pressure level exceeded for N% of a given measurement period. For example, the LA1 is the noise level exceeded for 1% of the time, LA10 the noise exceeded for 10% of the time, and so on.

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



Of particular relevance, are:

LA1 The noise level exceeded for 1% of the 15 minute interval.

LA10 The noise level exceeded for 10% of the 15 minute interval. This is commonly referred to as the average maximum noise level.

LA90 The noise level exceeded for 90% of the sample period. This noise level is described as the average minimum background sound level (in the absence of the source under consideration), or simply the background level.

LAeq The A-weighted equivalent noise level (basically, the average noise level). It is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.

Frequency Analysis

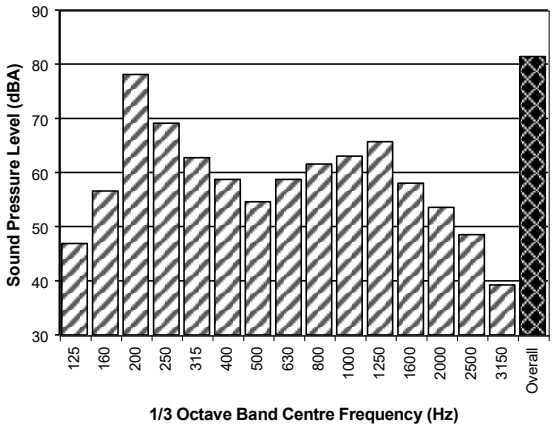
Frequency analysis is the process used to examine the tones (or frequency components) which make up the overall noise or vibration signal.

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

Frequency analysis can be in:

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

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



Annoying Noise (Special Audible Characteristics)

A louder noise will generally be more annoying to nearby receivers than a quieter one. However, noise is often also found to be more annoying and result in larger impacts where the following characteristics are apparent:

- Tonality - tonal noise contains one or more prominent tones (ie differences in distinct frequency components between adjoining octave or 1/3 octave bands), and is normally regarded as more annoying than 'broad band' noise.
- Impulsiveness - an impulsive noise is characterised by one or more short sharp peaks in the time domain, such as occurs during hammering.
- Intermittency - intermittent noise varies in level with the change in level being clearly audible. An example would include mechanical plant cycling on and off.
- Low Frequency Noise - low frequency noise contains significant energy in the lower frequency bands, which are typically taken to be in the 10 to 160 Hz region.

Vibration

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

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

Vibration measurements may be carried out in a single axis or alternatively as triaxial measurements (ie vertical, longitudinal and transverse).

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

Human Perception of Vibration

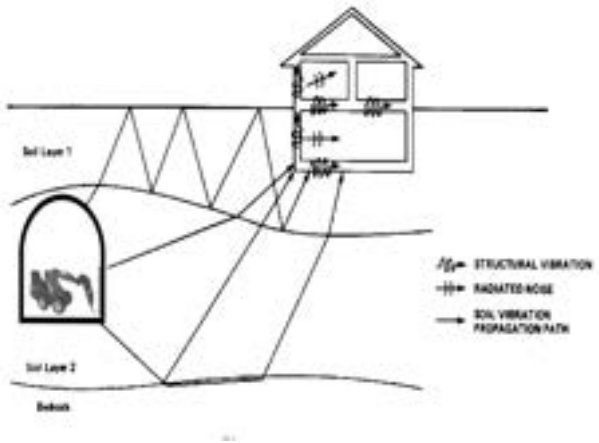
People are able to 'feel' vibration at levels lower than those required to cause even superficial damage to the most susceptible classes of building (even though they may not be disturbed by the motion). An individual's perception of motion or response to vibration depends very strongly on previous experience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

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

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

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

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

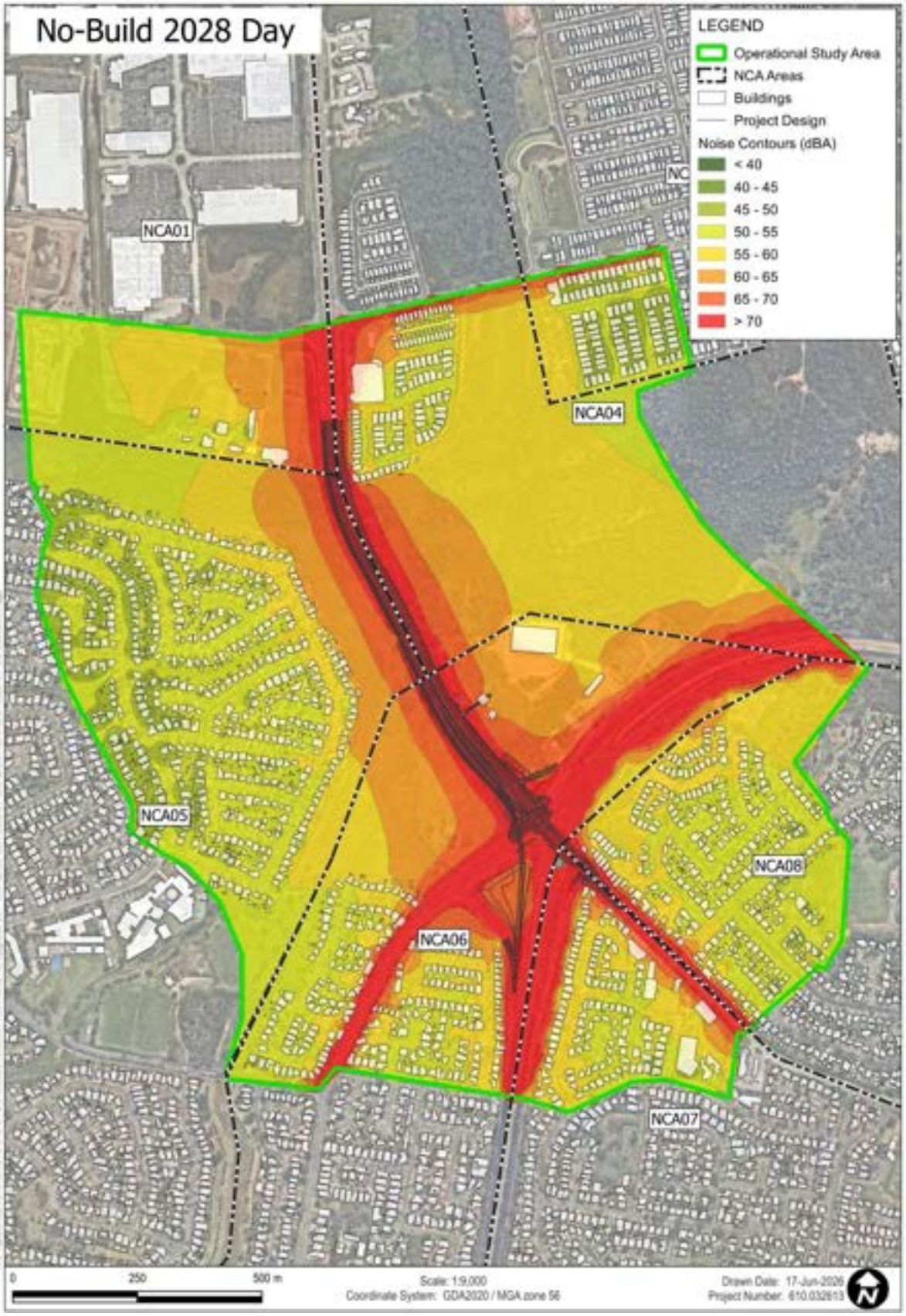


The term 'regenerated noise' is also used in other instances where energy is converted to noise away from the primary source. One example would be a fan blowing air through a discharge grill. The fan is the energy source and primary noise source. Additional noise may be created by the aerodynamic effect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

Appendix B Operational Information

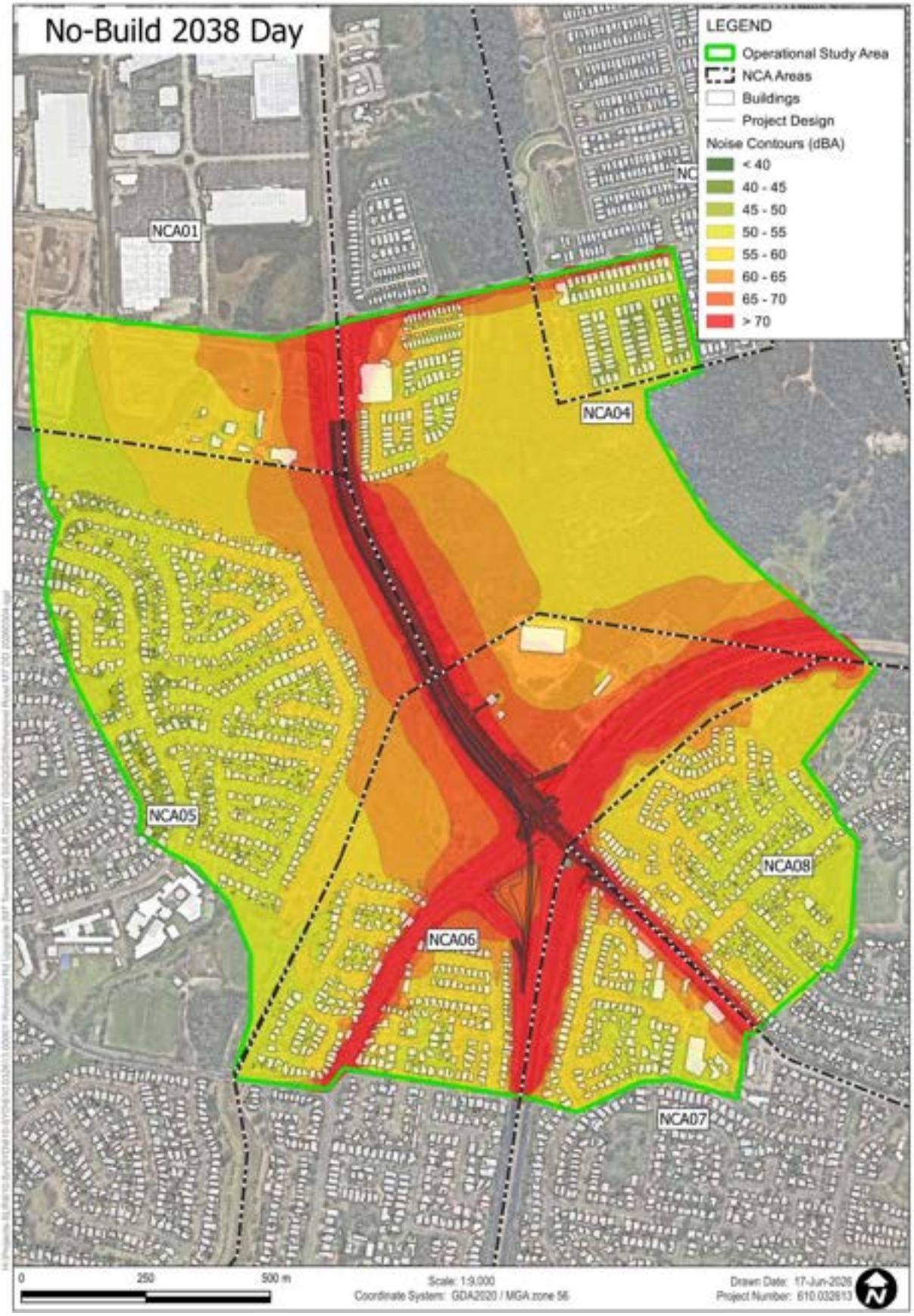
Operational Road Traffic Noise Maps

Predicted Noise Levels No Build 2028 Day



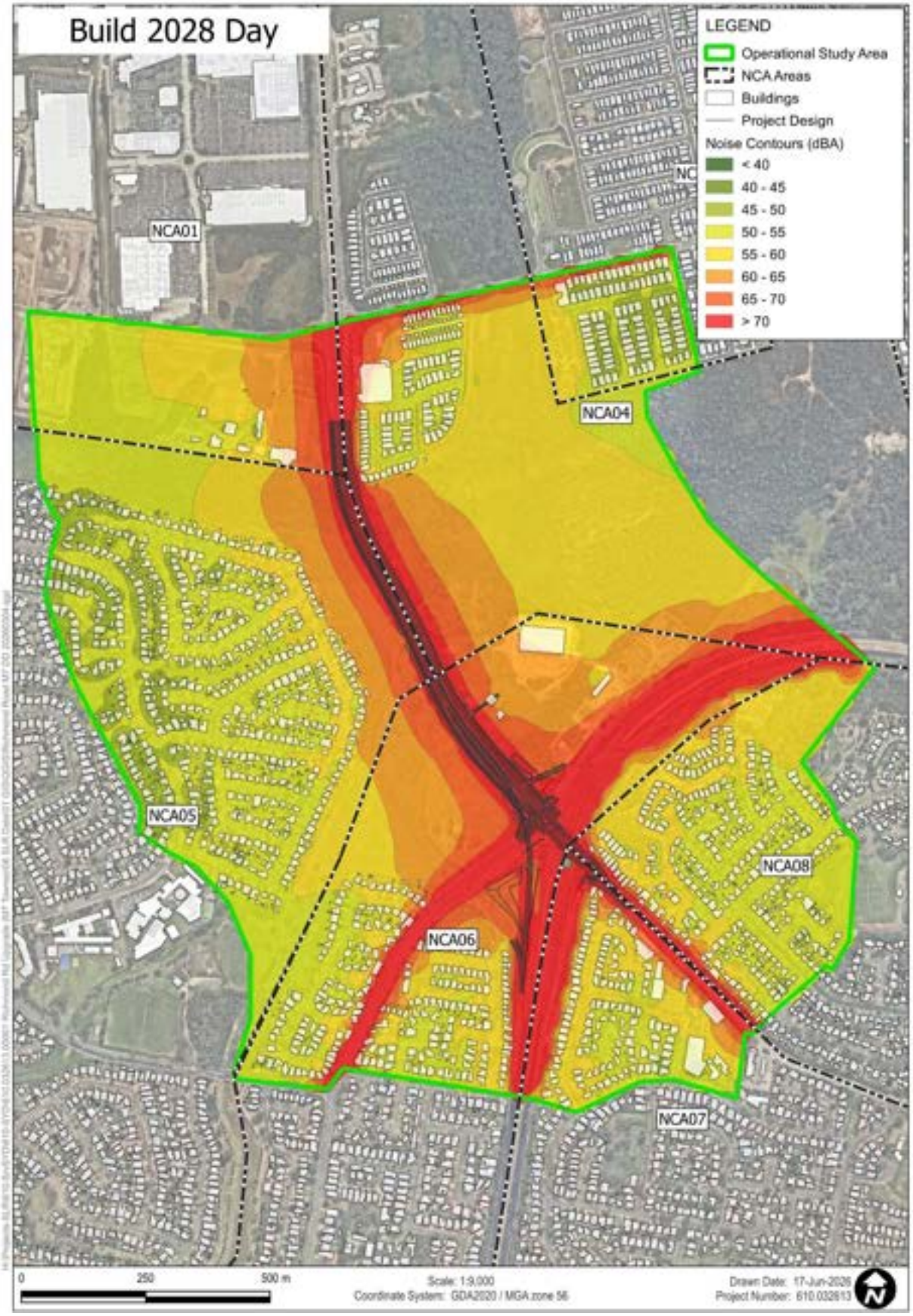
Predicted Noise Levels No Build 2028 Night

Predicted Noise Levels No Build 2038 Day

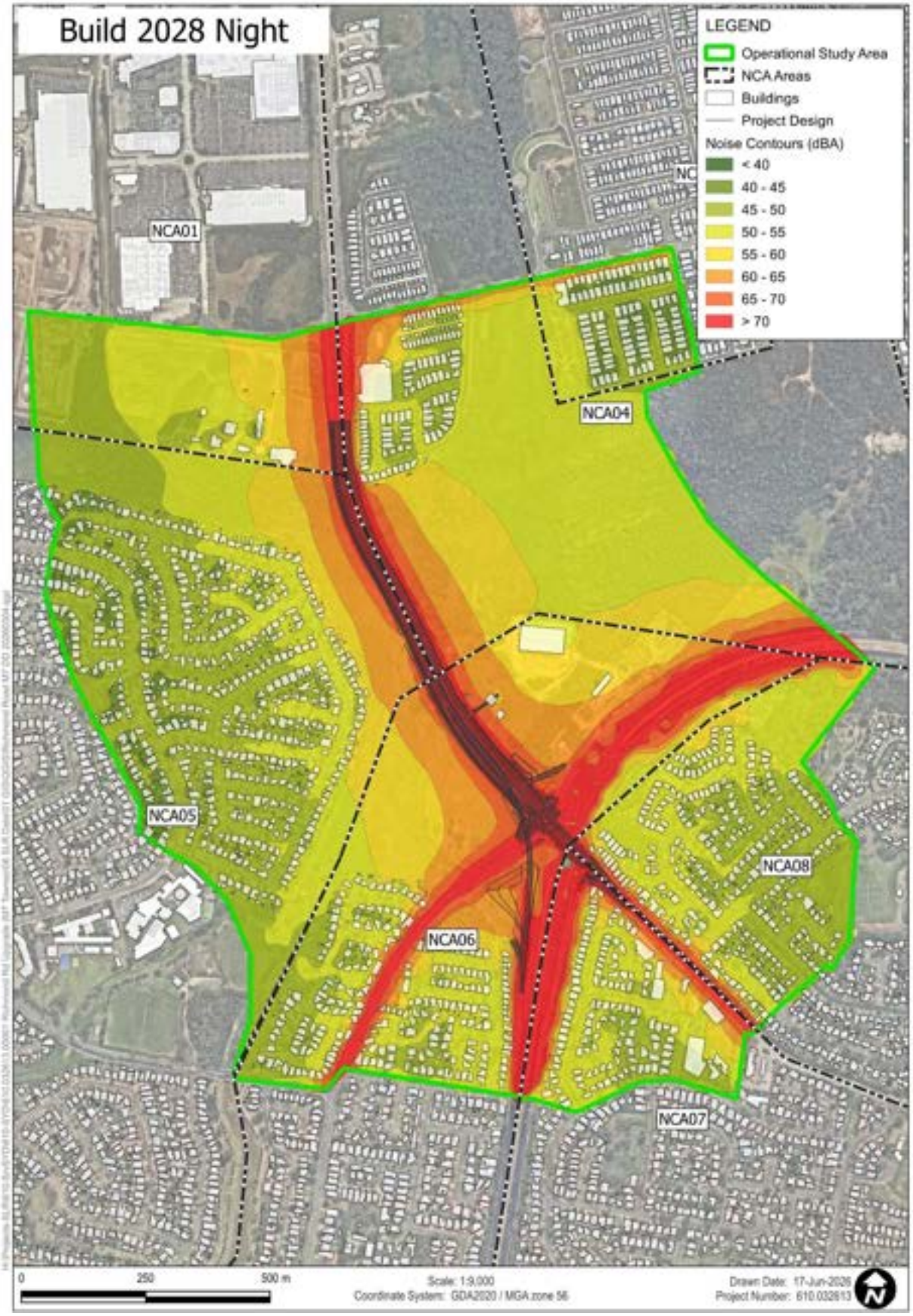


Predicted Noise Levels No Build 2038 Night

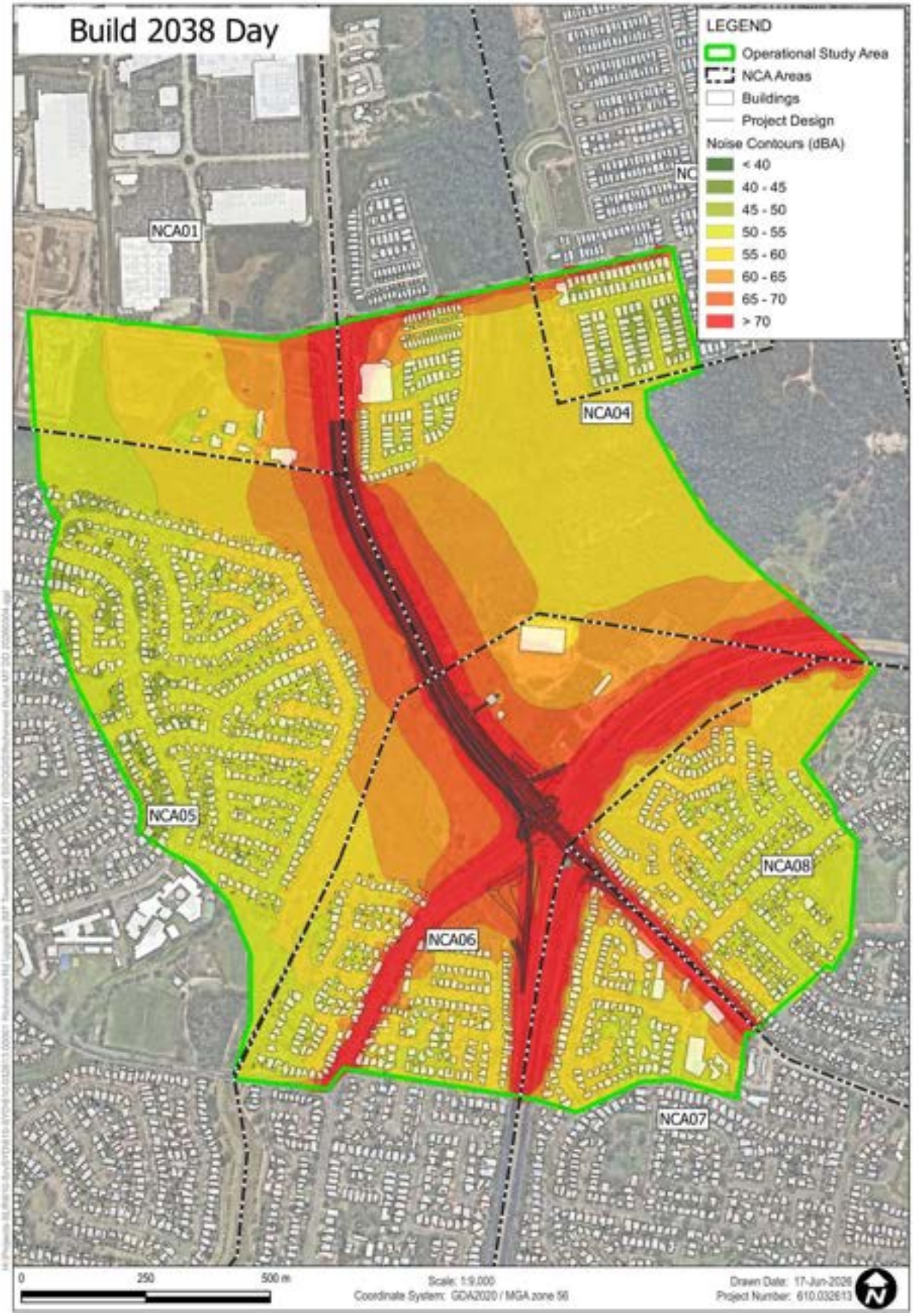
Predicted Noise Levels Build 2028 Day



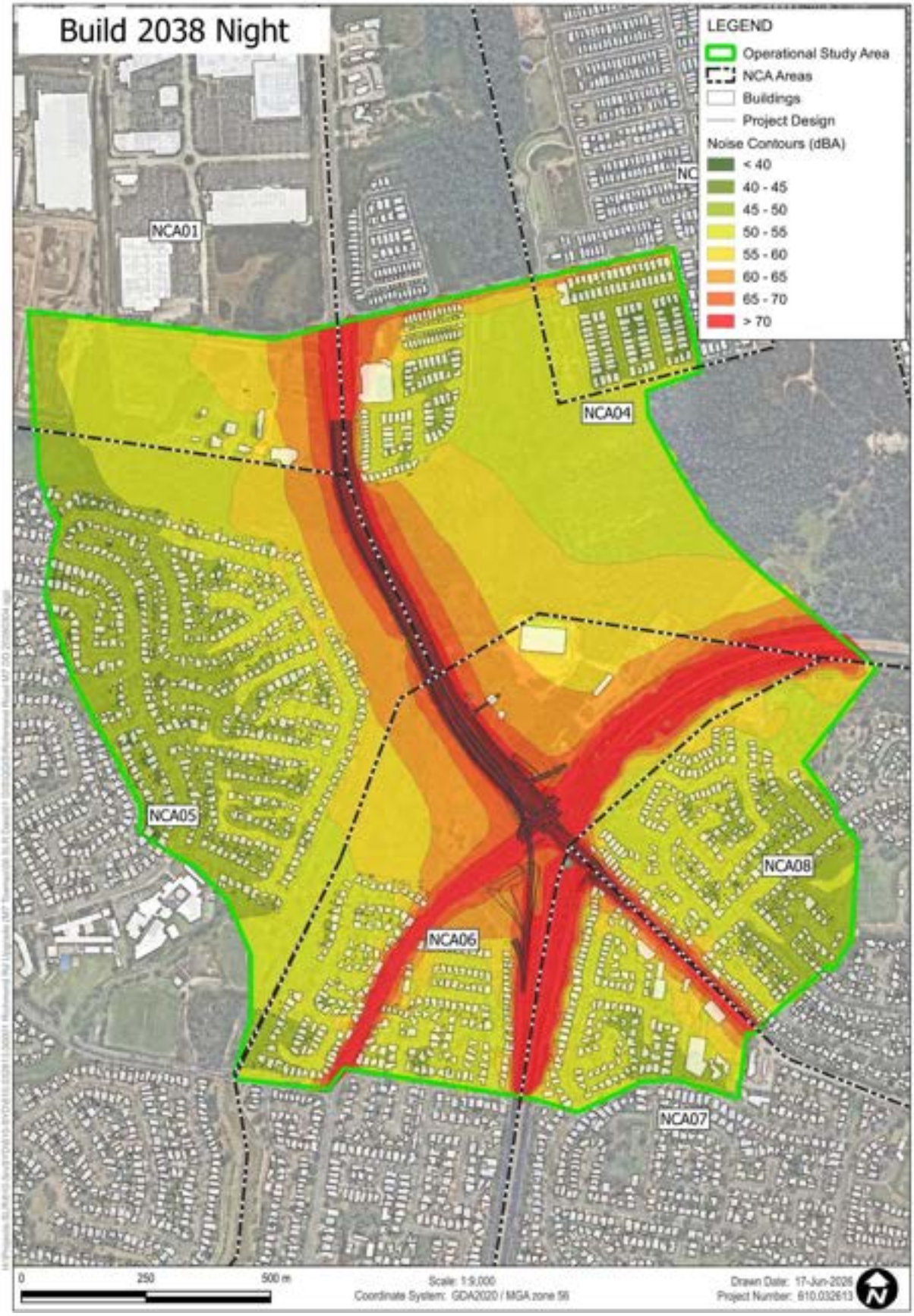
Predicted Noise Levels Build 2028 Night



Predicted Noise Levels Build 2038 Day

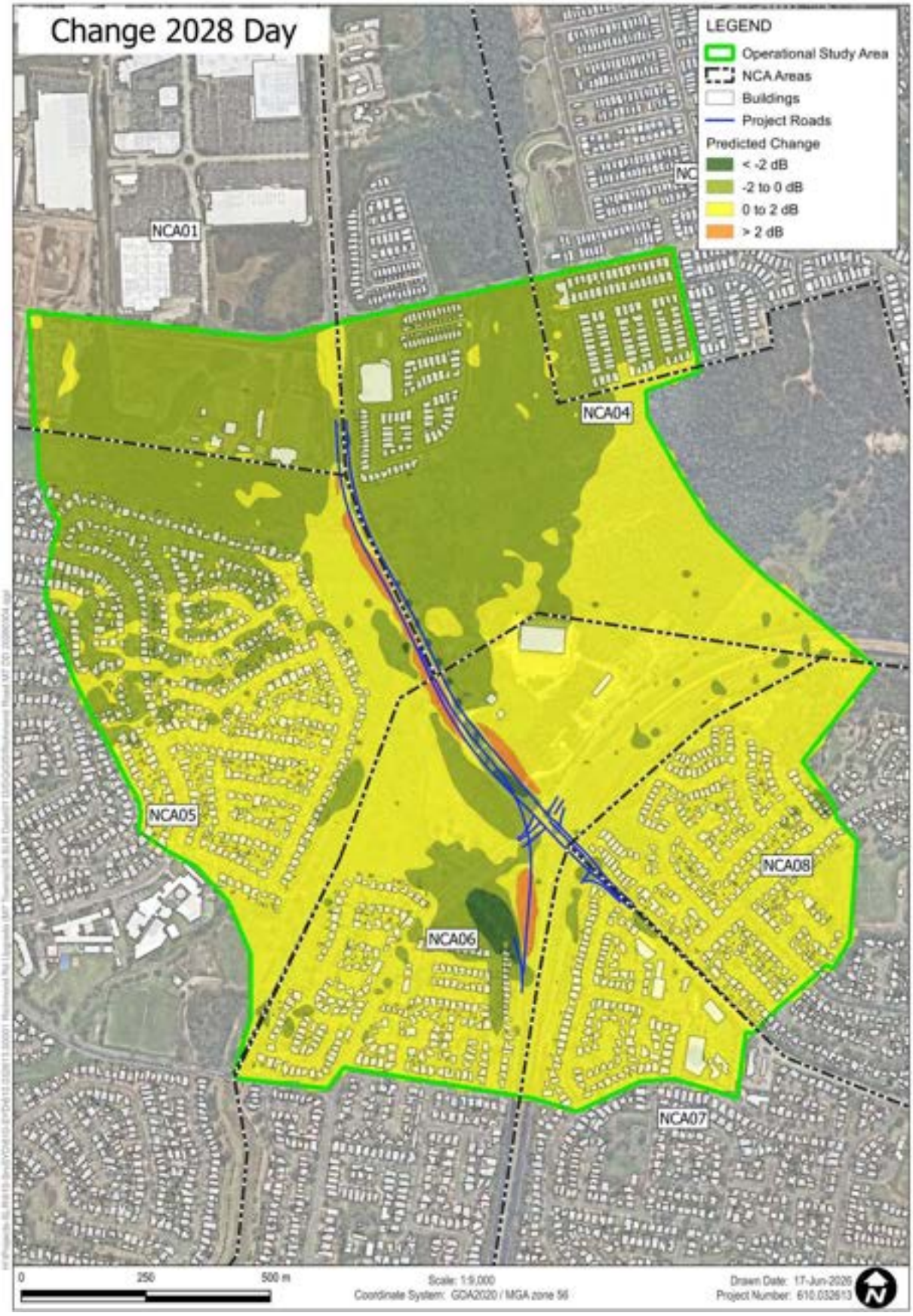


Predicted Noise Levels Build 2038 Night

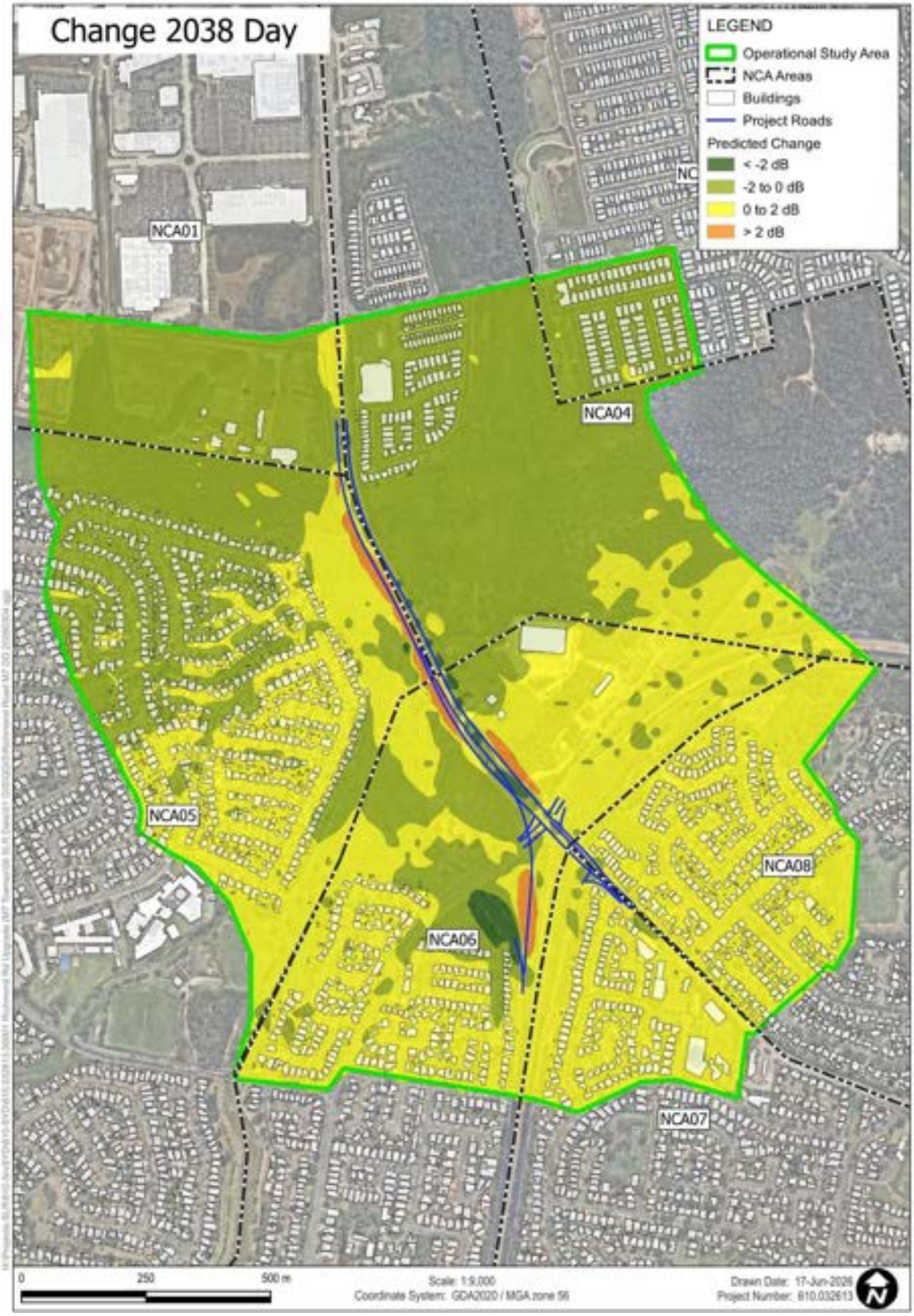


Predicted Noise Level Change 2028 Day

Predicted Noise Level Change 2028 Night



Predicted Noise Level Change 2038 Day



Predicted Noise Level Change 2038 Night

Project and Non-Project Roads

No-Build Surface Corrections

Build Surface Corrections

Receiver Assessment Table

Deemed to Comply At-Property Treatment Mitigation Packages (TfNSW At Receiver Noise Treatment Guideline)

Construction	Treatment Package Type				
	1	2	3	4	5
Exceedance, dBA	1-5	6-8	9-11	12-14	>14
All	• Optional ceiling fans[1] • Mechanical ventilation (MV)[2] • New acoustic seals for windows • Seal around window architraves / door jambs • Seal all vents and openings	• As per Category 1 treatments • External solid core door (40mm) with perimeter acoustic seals, drop seals and threshold seals			
Brick veneer or double brick Window area less than or equal to 20% floor area		For 6 dBA exceedance: • 6.38mm laminate and roof insulation (R4.0 215mm thick) or 6.5mm lam with acoustic interlayer For 7 dBA exceedance: • 8.5mm lam with acoustic interlayer or 10.38mm lam For 8 dBA exceedance: • 8.5mm lam with acoustic interlayer or 10.5mm lam with acoustic interlayer or 10mm acrylic panel with nominally 100mm gap or >4mm secondary window with 100mm gap or equivalent	• Roof insulation (R4.0 215mm thick) For 9 dBA exceedance: • 8.5mm lam with acoustic interlayer or 10.38mm lam Otherwise: • 10.5mm lam with acoustic interlayer or 10mm acrylic panel with nominally 100mm gap or >4mm secondary window with 100mm gap or equivalent	• >4mm secondary window with 100mm gap, or equivalent • Roof insulation (R4.0 215mm thick)	• >6mm secondary window with nominally 100mm gap, or equivalent • Roof insulation (R4.0 215mm thick)
Brick veneer or double brick Sliding door area less than or equal to 50% wall area	• 6.38mm lam, or equivalent	• 8.5mm lam with acoustic interlayer, or equivalent • Roof insulation (R4.0 215mm thick) Or • 8.5mm lam with acoustic interlayer, or equivalent	• 8.5mm lam with acoustic interlayer or >4mm secondary window with nominally 100mm gap, or equivalent • Roof insulation (R4.0 215mm thick)	• >6mm secondary window with nominally 100mm gap, or equivalent • Roof insulation (R4.0 215mm thick)	• >6mm secondary window with nominally 100mm gap, or equivalent • Roof insulation (R4.0 215mm thick)
Lightweight Window area less than or equal to 20% floor area	• Seal subfloor • Roof insulation (R4.0 215mm thick)	• As per Category 1 treatments For 8 dBA exceedance: • 10mm acrylic panel with nominally 100mm gap, or equivalent • Re-sheet wall lining (1x 6mm fibre cement sheeting with nominal board weight of 11 kg/m^2 and 1 x 13mm plasterboard with nominal board weight of 10.5 kg/m^2 to finish, or equivalent) • Wall insulation (R2.7 90mm thick) Otherwise: • 10mm acrylic panel with 100mm gap, or equivalent • Additional wall lining (1 x 13mm plasterboard with nominal board weight of 10.5 kg/m^2 to finish, or equivalent)	• As per Category 1 treatments • 10mm acrylic panel with nominally 100mm gap, or equivalent • Re-sheet wall lining (1x 6mm fibre cement sheeting with nominal board weight of 11 kg/m^2 and 1 x 13mm plasterboard with nominal board weight of 10.5 kg/m^2 to finish, or equivalent) • Wall insulation (R2.7 90mm thick) • Resilient mount to isolate wall lining and stud	• As per Category 1 treatments • >4mm secondary window with nominally 100mm gap, or equivalent • Re-sheet wall lining (1x 6mm fibre cement sheeting with nominal board weight of 11 kg/m^2 and 1 x 13mm plasterboard with nominal board weight of 10.5 kg/m^2 to finish, or equivalent) • Wall insulation (R2.7 90mm thick) • Resilient mount to isolate wall lining and stud	• As per Category 1 treatments • >6mm secondary window with nominally 100mm gap, or equivalent • Re-sheet wall lining (1x 6mm fibre cement sheeting with nominal board weight of 11 kg/m^2 and 1 x 13mm plasterboard with nominal board weight of 10.5 kg/m^2 to finish, or equivalent) • Wall insulation (R2.7 90mm thick) • Resilient mount to isolate wall lining and stud

Note 1: Ceiling fans should have Direct Current (DC) electric motors to minimise noise.

Note 2: Mechanical ventilation (MV) should be installed so that fresh air is ducted from an unaffected building facade. Mechanical fan noise should meet the recommended noise levels in AS2107.

Appendix C
SWTC Compliance Matrix

Requirement Information					Design Compliance			
DOORS ID	Source Document	Section	Preamble	Description	Design Package Number	Design Package Name	Compliance Statement	Design Reference
1211381	RVTM D.1 Additional Environment	4.5	Operational Noise and Vibration	Operational Noise and Vibration	NV-01	Operational Noise and Vibration Report	NA	General statement noted
1211382	RVTM D.1 Additional Environment			a) The Contractor must complete an operational noise assessment of the Design Documentation in accordance with, and to satisfy the requirements of the Road Noise Policy (RNP) (Department of Environment, Climate Change and Water NSW2011), TfNSW's Road Noise Criteria Guideline (RNCG) EMF-NV-GD-0025 and TfNSW's Road Noise Mitigation Guideline (RNMG) EMF-NV-GD-0024.	NV-01	Operational Noise and Vibration Report	Compliant	The Operational Traffic Noise Assessment Report RRM7-GEDT-0537-NV-RPT-010001 is undertaken in accordance with the required documents.
1211383	RVTM D.1 Additional Environment			b) The Contractor must prepare a Preliminary Operational Traffic Noise Design Report (POTNR) as part of the Developed Concept Design Stage to identify the likely operational noise impact of any changes since environmental assessment of the Project. The POTNR must include but not be limited to the following:	NV-01	Operational Noise and Vibration Report	Compliant	Refer to RRM7-GEDT-0537-NV-RPT-010001 Revision A
1211384	RVTM D.1 Additional Environment			(i) review the Noise and Vibration assessment undertaken for the REF to provide relevant data for input into the Design Documentation for noise mitigation;	NV-01	Operational Noise and Vibration Report	Compliant	Refer to RRM7-GEDT-0537-NV-RPT-010001 Revision A
1211385	RVTM D.1 Additional Environment			(ii) identification of design changes to the Project since the completion of any operational noise assessment included within the Environmental Documents for the Project;	NV-01	Operational Noise and Vibration Report	Compliant	Refer to RRM7-GEDT-0537-NV-RPT-010001 Revision A
1211386	RVTM D.1 Additional Environment			(iii) any changes to parameters used for calculations or computer modelling for the operational noise assessment within the Environmental Documents for the Project; and	NV-01	Operational Noise and Vibration Report	Compliant	Refer to RRM7-GEDT-0537-NV-RPT-010001 Revision A
1211387	RVTM D.1 Additional Environment			(iv) a qualitative assessment of the likely noise impacts associated with the any design or parameter changes. This assessment is to be tabulated with a qualitative assessment of the likely operational noise impacts of each design and parameter change.	NV-01	Operational Noise and Vibration Report	Compliant	Refer to RRM7-GEDT-0537-NV-RPT-010001 Revision A
1211388	RVTM D.1 Additional Environment			c) The POTNR should be a short summary of any changes to the Project or where noise mitigation measures are required. The Contractor is to further investigate noise mitigation specified in the Environmental Documents. If no changes have occurred, the above tasks are still to be completed for due diligence purposes. The POTNR should not be prepared as a detailed operational noise assessment of the Project.	NV-01	Operational Noise and Vibration Report	Compliant	Refer to RRM7-GEDT-0537-NV-RPT-010001 Revision A
1211389	RVTM D.1 Additional Environment			d) The Contractor must prepare a Detailed Design Operational Traffic Noise Assessment Report (OTNAR) where there is likely to be material change to predicted operational noise levels as a result of the changes to design or modelling parameters.	NV-01	Operational Noise and Vibration Report	Compliant	Refer to RRM7-GEDT-0537-NV-RPT-010001
1211390	RVTM D.1 Additional Environment			e) The OTNAR must be prepared in accordance with operational traffic noise assessment requirements of TfNSW's Noise and Vibration Assessment Procedure (for road traffic and construction) EMF-NV-PR-0083, TfNSW's Road Noise Model Validation Guideline EMF-NV-GD-0026, TfNSW's Road Noise Criteria Guideline EMF-NV-GD-0025 and TfNSW's Road Noise Mitigation Guideline EMF-NV-GD-0024, inclusive of an assessment of barrier height in accordance with TfNSW's Road Noise Mitigation Guideline EMF-NV-GD-0024.	NV-01	Operational Noise and Vibration Report	Compliant	The Operational Traffic Noise Assessment Report RRM7-GEDT-0537-NV-RPT-010001 is undertaken in accordance with the required documents.
1211391	RVTM D.1 Additional Environment			f) The Contractor is to fully design and specify all the noise attenuation measures required for the Project (such as: noise walls, noise mounds, architectural treatments, pavement treatments). This is to include design and specification of the architectural and structural features of any noise wall or mounds.	NV-01	Operational Noise and Vibration Report	Compliant	The Operational Traffic Noise Assessment Report RRM7-GEDT-0537-NV-RPT-010001 addresses the requirement for noise attenuation measures. The OTNAR details that this is limited to at-property treatments in section 7 of the report.
1211392	RVTM D.1 Additional Environment			g) Where noise mounds are specified, the design must include heights, lengths, cross-sectional detail, material requirements, drainage and landscaping requirements. The design is also to ensure the stability of mounds.	NV-01	Operational Noise and Vibration Report	NA	No noise mounds are specified in the Operational Traffic Noise Assessment Report.
1211479	RVTM D.1 Additional Environment	6	Environmental Management Report	Environmental Management Report	NV-01	Operational Noise and Vibration Report	NA	General statement noted
1211505	RVTM D.1 Additional Environment			a) The Contractor must implement and install all the at-property noise mitigation treatments required by the Environmental Documents except those identified in Table D.1-1 of this Appendix D.1.	NV-01	Operational Noise and Vibration Report	Compliant	The Operational Traffic Noise Assessment Report addresses Noise Mitigation requirements. Section 7.4 of the OTNAR details that it is assumed that TfNSW will be responsible for properties in addition to those listed in Appendix D.1 as the additional properties are not as a result of the design and arise from errors and omissions in the REF Assessment.
1211506	RVTM D.1 Additional Environment			b) The Contractor must ensure its Design Documentation and Contractor's Activities are consistent with the Environmental Documents, including the results of the Project REF and Submissions Report Appendices Noise and Vibration, unless amended in accordance with section 7.1 c) of this Appendix D.1.	NV-01	Operational Noise and Vibration Report	Compliant	Refer to RRM7-GEDT-0537-NV-RPT-010001 documents the differences as required under clause 7.1c)
1211507	RVTM D.1 Additional Environment			c) Should the Contractor wish to amend the results of Project REF and/or Submissions Report Appendices - Noise and Vibration, the amended report must be prepared by a suitably qualified noise and vibration consultant and approved by the Principal's Representative prior to the Contractor adopting the amended report for the Contractor's Activities.	NV-01	Operational Noise and Vibration Report	Compliant	TfNSW will be responsible for any required update to the REF Appendices as the differences in the results generally arise from errors and omissions in the REF Assessment. RRM7-GEDT-0537-NV-RPT-010001 documents all the results that shall be included in any anebded report
1211508	RVTM D.1 Additional Environment			Table D.1-1 – At-Property Noise Mitigation Treatments to be installed by the Principal:	NV-01	Operational Noise and Vibration Report	NA	General statement noted
1211509	RVTM D.1 Additional Environment				NV-01	Operational Noise and Vibration Report	NA	General statement noted
1211510	RVTM D.1 Additional Environment	7.2	Existing Noise Walls	Existing Noise Walls	NV-01	Operational Noise and Vibration Report	Compliant	The Operational Traffic Noise Assessment Report details in section 4.2 that existing noise walls have been included in the assessment based on survey where available or the M7 as-built drawings as provided where no survey is available.
1211511	RVTM D.1 Additional Environment			a) The Contractor must retain existing noise walls, for the duration of the Contractor's Activities, unless:	NV-01	Operational Noise and Vibration Report	Compliant	The Operational Traffic Noise Assessment Report details in section 4.2 that no changes to existing barriers are proposed and all existing barriers are to be retained.
1211512	RVTM D.1 Additional Environment			(i) if the Contractor removes, alters or relocates any of the existing noise walls the Contractor must provide a temporary noise wall. The temporary noise wall must:	NV-01	Operational Noise and Vibration Report	NA	The Operational Traffic Noise Assessment Report details in section 4.2 that no changes to existing barriers are proposed and all existing barriers are to be retained.
1211513	RVTM D.1 Additional Environment			A. provide at least an equivalent top level and length as the existing noise wall and is to be installed prior to removal of any part of an existing noise wall commencing;	NV-01	Operational Noise and Vibration Report	NA	The Operational Traffic Noise Assessment Report details in section 4.2 that no changes to existing barriers are proposed and all existing barriers are to be retained.
1211514	RVTM D.1 Additional Environment			B. provide similar noise mitigation characteristics, to the satisfaction of the Principal's Representative, of the permanent noise wall it is temporarily replacing; and	NV-01	Operational Noise and Vibration Report	NA	The Operational Traffic Noise Assessment Report details in section 4.2 that no changes to existing barriers are proposed and all existing barriers are to be retained.
1211515	RVTM D.1 Additional Environment			C. remain in place until the permanent replacement noise wall has been completed.	NV-01	Operational Noise and Vibration Report	NA	The Operational Traffic Noise Assessment Report details in section 4.2 that no changes to existing barriers are proposed and all existing barriers are to be retained.