MOTT MACDONALD

Operational Traffic Noise Assessment Report

New Richmond Bridge and Traffic Improvements, Stage 1 - The Driftway, Detailed Design

April 2024

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Issue and Revision Record

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Abbreviations

Abbreviation	Description
AVTG	Assessing Vibration: A Technical Guideline
CNVG	TfNSW Construction Noise and Vibration Guideline (Roads)
CNVMP	Construction Noise and Vibration Management Plan
CoRTN	Calculation of Road Traffic Noise
DEC	Department of Environment and Conservation
DECCW	Department of Climate Change, Energy, the Environment and Water
ELVIS	Elevation Information System
MM	Mott MacDonald
NCA	Noise Catchment Area
RNCG	TfNSW Road Noise Criteria Guideline
RNMG	TfNSW Road Noise Mitigation Guideline
RNMVG	TfNSW Road Noise Model Validation Guideline
NPfI	NSW EPA Noise Policy for Industry
PPV	Peak Particle Velocity
RBL	Rating Background Level
RNP	NSW EPA Road Noise Policy
TfNSW Tranpsort	Transport for New South Wales
VDV	Vibration Dose Value

Definitions

Term	Definition
dB	Decibel, a unit of measure for sound
dB(A)	A-weighted decibel
L_{A90}	A-weighted noise level in the lower 90 percentile of the sampling interval
$L_{Aeq,T}$	A-weighted equivalent sound pressure level averaged over a period T
L_{eq}	Equivalent continuous sound pressure level
$L_{eq,T}$	Equivalent continuous sound pressure level averaged over a period T
L_{max}	Maximum sound pressure level in an interval
RBL	Rating background level characterised by the LA90

Executive summary

Mott MacDonald (MM) has been engaged by Transport for New South Wales (TfNSW) to assess the operational noise and construction vibration impacts of The Driftway upgrade (the Project), as part of Stage 1 of New Richmond Bridge Traffic Improvements.

The assessment included a review of the previous acoustic impact assessment undertaken by SLR Consultancy for the Project REF. The noise model that was developed for the Project REF had been validated and therefore was appropriate to be used as a basis for this assessment. The noise model was updated to incorporate the final detailed design and used to determine the impact at surrounding receivers.

The noise modelling is based on the Calculation of Road Traffic Noise (CoRTN) algorithm implemented as implemented in SoundPLAN 8.2 noise modelling software. CoRTN is widely used in Australia as an appropriate noise modelling method for road traffic noise.

Noise triggers that formed the Project operational noise criteria were derived in accordance with guidance from the NSW Environmental Planning Authority (EPA) Road Noise Policy 2011 (RNP) and the relevant Transport guidelines including the Road Noise Model Validation Guideline 2022 (RNMVG), Road Noise Criteria Guideline 2022 (RNCG) and the Road Noise Mitigation Guideline 2022 (RNMG).

Based on the operational road noise modelling, the following outcomes were identified:

- 31 unique receivers exceeded the relevant noise trigger levels and eligible for additional noise mitigation measures due to the Project at the Design Year (2036).
  - This is a 16% reduction in triggered receivers compared to the outcome documented in the previous acoustic REF undertaken by SLR Consultancy (i.e., from 37 receivers).
  - Reduction in triggered receivers is attributed to the addendum REF road realignments.
  - It is identified that many receivers along The Driftway are marginal compliances, and it is recommended that treatment is considered for these receivers. This aligns with the previous recommendations from SLR Consultancy.
- A sensitivity assessment during the Design Year (2036) has been undertaken where modelled traffic noise levels were adjusted by to the measured traffic noise levels.
  - This increased the number of affected receivers to 40 (previously 31). Affected receivers were previously marginal compliance.
- The increase in traffic volume along the Driftway is a result of the design changes proposed by the overall Project (Stage 1 and Stage 2) and not solely due to the upgrades to the Driftway.

Various mitigation measures were considered in accordance with guidance outlined in the RNMG. Within the context of the Project and considering the site's limitations, at source treatment, noise mounds and barriers were not deemed feasible.

Therefore, the only feasible mitigation measures for operational noise are at-receiver treatments. These must be applied to triggered receivers along The Driftway and Londonderry Road.

Compared to the previous acoustic assessment undertaken by SLR as part of the previous REF, the findings of this addendum REF showed a slight decrease in total receivers from 37 to 31 exceeding the noise trigger levels. Therefore, the changes as part of the addendum REF are not expected to result in a greater noise impact than the previously REF design.

A construction vibration assessment of building utilities and services within close proximity to the site was undertaken in accordance with Transport's Construction Noise and Vibration Guidelines (Roads) (CNVG). The potential for cosmetic building damage has been assessed based on the safe working distances established for the most onerous vibration intensive plant in accordance with the CNVG. Receivers have been identified to be located within the minimum safe working distances for the most onerous plant item. Therefore, mitigation measures have been provided in this report.

1 Introduction

1.1 Site and Project Description

The upgrade to The Driftway (the Project) proposes to upgrade 3.6 kilometres of The Driftway between Londonderry Road and Blacktown Road and is located within the suburbs of Richmond, Londonderry and South Windsor, NSW.

The Driftway Project upgrade forms Stage 1 of the New Richmond Bridge Traffic Improvements to manage congestion, cater for future traffic demands and improve safety and connections to the arterial road network.

The Project is expected to include repaving existing surfaces, realignment of existing lanes along The Driftway and implementing roundabouts along the eastern end (intersection of The Driftway with Blacktown Road) and eastern end (intersection of The Driftway with Londonderry Road). To support the realignment along the western end, a new bridge over Rickabys Creek will be required.

1.2 Project Requirements

The Project criteria for noise and vibration were established based on the following documents:

- Operational road noise and vibration guidelines
  - Road Noise Policy (RNP) (DECCW, 2011)
  - Road Noise Criteria Guideline (RNCG) (TfNSW, 2022)
  - Road Noise Mitigation Guideline (RNMG) (TfNSW, 2022)
  - Road Noise Model Validation Guideline (RNMVG) (TfNSW, 2022).
- Construction vibration guidelines.
  - Construction Noise and Vibration Guideline (Roads) (CNVG) (TfNSW, 2023)
  - Assessing Vibration: A Technical Guideline (AVTG) (DEC, 2006)
  - British Standard BS 7385-2 Evaluation and measurement for vibration in buildings guide to damage levels from ground-borne vibration
  - German Standard DIN4150-3 Structural Vibration Part 3: Effects of vibration on structures.

1.3 Scope of Works

This acoustic assessment encompasses the following elements:

- Review of the Noise and Vibration REF report 610.30366-R01-v2.0-20211101 (dated 01/11/2021) prepared by SLR Consultancy
- Produce a validation operational road noise model using the previously conducted SLR unattended noise monitoring data
- Develop an operational road noise model for the build year (2026) and design year (2036) incorporating new changes from the addendum REF and identifying the noise impacts to affected receivers
- Identify receivers that are eligible for additional mitigation and compare to the previously identified receivers by SLR to determine whether any additional recommendations over the previously provided advice is required
- Based on vibration intensive construction equipment, provide safe working distances in accordance with the relevant guidelines to minimise the risk of building damage

2 Existing Acoustic Environment

2.1 Site Location and Sensitive Receivers

The Project is located across the suburbs of Richmond, Londonderry and South Windsor, within the Penrith City Council and Hawkesbury City Council local government areas.

The site is predominantly surrounded by existing residential receivers along The Driftway and Londonderry Road (south of The Driftway). For the purpose of the assessment, the receivers have been divided into seven (7) Noise Catchment Area (NCA), consistent with the approach SLR and is depicted in Figure 2-1.

Although the majority of receivers within close proximity to the site are considered residential, there are notable non-residential receivers which have been captured in Table 2-1.

Table 2-1: Non-residential Receivers within close proximity to the Project

NCA	Type of Receiver	Address
1	Commercial	308-332 Londonderry Road Londonderry (Richmond Race Club)
		281-291 Londonderry Road, Londonderry (Mechanical Repairs)
		307 Londonderry Road, Londonderry (K9 Pro – The K9 Professionals)
4	Industrial	11 Bennett Road, Londonderry (The Junkyard)
6	Industrial	339 Racecourse Road, South Windsor (Turtle Landscape Supplies)
7	Industrial	1 The Driftway, South Windsor (Hawkesbury City Waste Management Facility)
	Educational	Western Sydney University, Hawkesbury Campus

2.2 Unattended Noise Survey

For the purposes of this assessment, the previously conducted noise survey undertaken by SLR has been used. No additional site investigations have been undertaken as part of this assessment. The locations of unattended noise loggers deployed by SLR for the noise surveys are shown on Figure 2-1.

A summary of the relevant unattended noise survey results is provided in Table 2-2.

Table 2-2: Summary of Unattended Noise Logging Results

ID	Address	Measured Average Noise Level, L_{eq} dB(A)	
		Day [1]	Night [1]
L01	281 Londonderry Road, Londonderry	57	54
L02	2-8 Luxford Road, Londonderry	53	49
L03	10-16 The Driftway, Londonderry	58	52
L04	8-14 Reynolds Road, Londonderry	55	51
L06	268-274 The Driftway, Londonderry	50	47

Note 1: Operational road noise periods as defined by the RNP are Day (7am – 10pm) and Night (10pm -7am)

Source: Table 2 from 610.30366-R01-v2.0-20211101 the acoustic REF prepared by SLR Consultancy

The SLR report noted that short-term attended measurements at each logger location was undertaken and it was observed that traffic noise from surrounding road networks were the dominant noise source.

Unattended noise monitoring results at certain locations were also utilised to calibrate road noise models and will be further discussed in Section 5.2 .

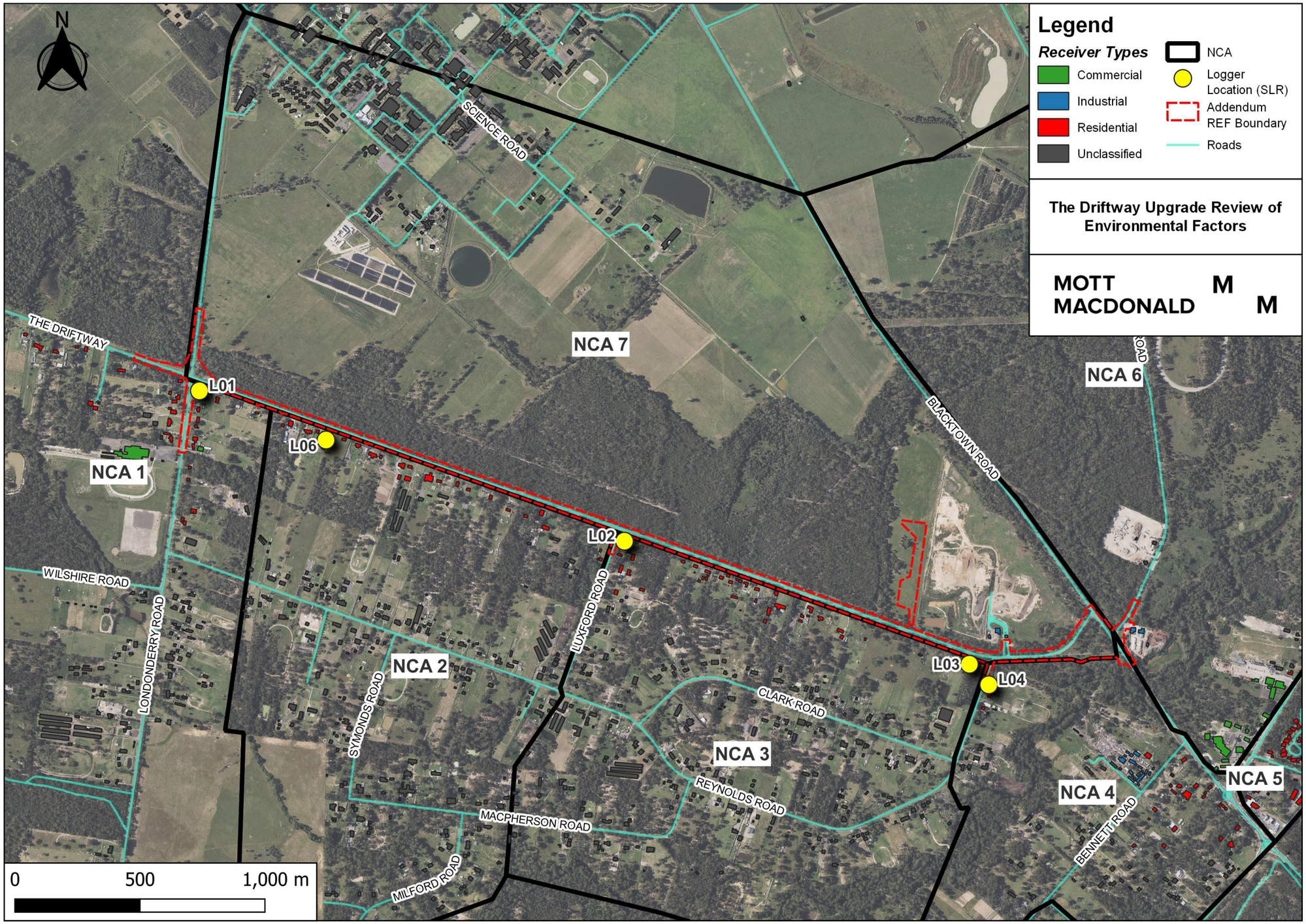

Figure 2-1: Site Layout including Noise Monitoring Location undertaken by SLR Consultancy

3 Operational Noise Criteria

3.1 NSW Road Noise Policy 2011

Operational noise from The Driftway upgrade will include any potential increase in traffic noise from surrounding roadways to sensitive receivers within close proximity.

The noise criteria for operational road traffic are provided by the NSW EPA's RNP. Roads and Maritime (now TfNSW) provides guidance on how the RNP is interpreted via the following guidelines:

- Road Noise Criteria Guideline (RNCG) (TfNSW, 2022)
- Road Noise Mitigation Guideline (RNMG) (TfNSW, 2022)
- Road Noise Model Validation Guideline (RNMVG) (TfNSW, 2022)

Considering the project is a redevelopment of an existing road that will increase its traffic carrying capacity, an assessment in accordance with the RNP will be required with the criteria for a redevelop road project applied.

The RNP considers the overall noise levels in the future, in addition to the change in noise due to the Project. To assess this, two scenarios have been modelled, the No Build scenario and the Build scenario. The definition of these scenario are as follows:

- No Build – scenario used to predict noise levels the existing road arrangement assuming the Project does not go ahead.
- Build –scenario used to predict noise levels when the Project goes ahead.

The difference between these two scenarios provides a measure of the noise impact of the project.

The No Build and Build scenarios are assessed at two different time periods, the 'build year' and the 'design year', which is typically 10 years after opening.

The 'build year' represents any immediate risk of noise increase due to the development whereas the 'design year' represents any potential for noise increase once the project is well established and the surrounding road network has stabilised.

This assessment aims to develop an operational noise model that accounts for the increase in traffic flow and road realignments to determine its' relative impact to surrounding receivers. The methodology and results of modelling are further discussed in Section 5.

3.2 Noise Assessment Criteria

The RNP provides a noise criterion for residential and non-residential land uses and is summarised in Table 3-1 and Table 3-2 respectively.

Table 3-1: Relevant Road Traffic Noise Assessment Criteria for Residential Land Uses – Sourced from RNP

Road category	Type of project/land use	Assessment criteria – dB(A)	
		Day (7am – 10pm)	**Night (10pm – 7am)**
Freeway/arterial/sub-arterial roads	Existing residences affected by noise from redevelopment of existing freeway/arterial/sub-arterial road corridors	$L_{eq\ (15\ hours)}$ 60 (external)	$L_{eq\ (9\ hours)}$ 55 (external)

Road category	Type of project/land use	Assessment criteria – dB(A)	
		Day (7am – 10pm)	**Night (10pm – 7am)**
	Existing residences affected by increases in traffic noise of 12 dB(A) or more from a freeway/arterial/ sub-arterial roads	Between $L_{eq(15hour)}$ 42-60 (external)	Between $L_{eq(9hour)}$ 42-55 (external)
Local roads	Existing residences affected by noise from new local road corridors	$L_{eq(1\ hour)}$55 (external)	$L_{eq(1\ hour)}$50 (external)
	Existing residences affected by noise from redevelopment of existing local roads		
	Existing residences affected by additional traffic on existing local roads generated by land use developments		

Noise criteria for sensitive non-residential land uses are provided in Table 3-2. Where a noise criterion is identified as an internal level, an external to internal noise attenuation of 10 dB(A) has been considered, representing a façade reduction across a typical bedroom with an open window.

A review of hourly noise levels has identified that the highest $L_{Aeq(1hour)}$ noise level is driven by peak traffic periods and comparable to the $L_{Aeq(15hour)}$ noise level.

Table 3-2: Road Traffic Noise Criteria for Non-residential Receivers

Existing sensitive land use	Assessment criteria – dB(A)		Additional considerations
	Day (7am – 10pm)	**Night (10pm – 7am)**	
Industrial	$L_{Aeq,\ (1\ hour)}$ 70 (external) when in use		Criteria for industrial premise adopted from recommended internal noise level range for 'workshop' as per the guideline AS/NZS2107-2016. The lower value of the range is adopted, and a 10 dB reduction is typically applied for reduction across the façade with an open window.
Commercial	$L_{Aeq,\ (1\ hour)}$ 55 (external) when in use		Commercial receivers surrounding the site are represented as 'restaurant' / 'cafeterias' in accordance with AS/NZS2107-2016. Therefore, the maximum design sound level for the occupancy is adopted and a 10 dB reduction is assumed through a façade.

3.3 Consideration for Maximum Noise Levels

Although sleep assessment goals are not defined within the RNP and are not considered as part of forming the Project criteria, consideration to the potential increase in sleep disturbance occurring at nearby receivers due to the Project should still be considered.

The RNP references international sleep disturbance research indicating that:

- Maximum internal noise levels below 50-55 dBA are unlike to cause awakening reactions, and
- One or two noise events per night with maximum internal noise levels of 65-70 dBA are not likely to significantly affect health and well-being.

The RNCG notes that a maximum noise assessment may be used to help prioritise and rank mitigation strategies but does not form the definitive criterion. Therefore, this assessment will consider the relative increase for a maximum noise level event due to the Project's realignment.

3.4 Project Criteria

The RNMG provides guidance on reasonable and feasible mitigation measures.

Consideration of a noise mitigation strategy is hierarchical, with source controls, path controls, and finally receiver controls considered in order. The RNMG provides further guidance on how to determine appropriate noise barrier heights, and when at-property noise treatment is preferred to noise barriers.

Additionally, the guideline provides a hierarchal process to determine whether residential receivers qualify for additional mitigation measures. This process is depicted in Figure 3-1.

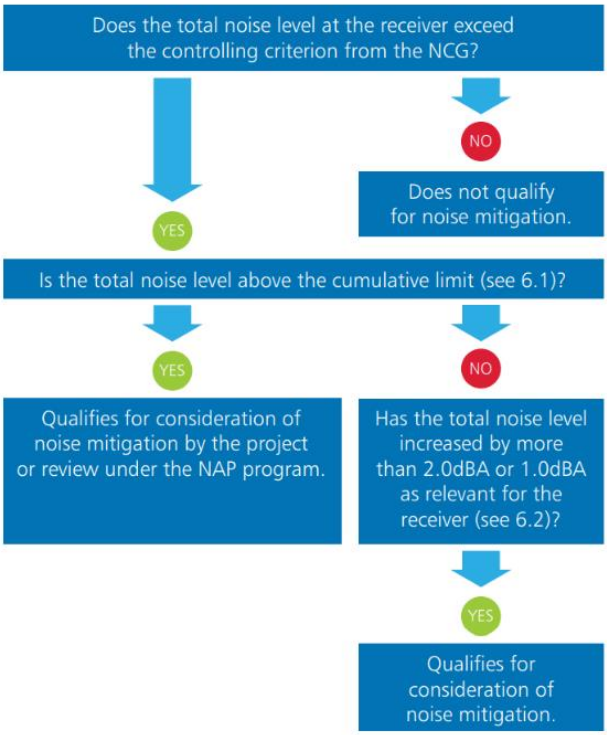

Figure 3-1: Summary of qualifying process for a receiver – Sourced from Figure 5-1 of the RNMG

Therefore, based on this process the Project criteria will consist of three discrete triggers as follows:

Trigger 1 The predicted 'Build' scenario noise level at the receiver exceeds the controlling criterion from the RNMG and the increase when compared to the 'No-build' scenario is greater than 2.0 dBA (2.1 dBA or higher).

Trigger 2 The predicted 'Build' scenario noise level at the receiver is 5 dB or more above the RNCG controlling criterion (deemed cumulative limit as per the RNMG)

Trigger 3 The predicted 'Build' scenario noise level at the receiver is acute (Daytime $L_{Aeq\ (15\ hour)}$ 65 dB(A) or higher or night-time $L_{Aeq\ (9\ hour)}$ 60 dB(A) or higher) even if noise levels are controlled by a non-project road.

It should be noted that within the context of the Project, receivers that are expected to exceed the criteria for Trigger 2 (cumulative limit) will also exceed Trigger 3 (acute limit). This is typically observed for redevelopment projects and has been acknowledged within the RNMG.

4 Construction Vibration Criteria

Vibration associated with construction activities can result in impacts on human comfort or damage of physical structures. These two impacts have different criteria, with the effects of vibration on human comfort having a lower threshold.

Importantly, cosmetic damage is regarded as minor in nature; it is readily repairable and does not affect a building's structural integrity. If there is no significant risk of cosmetic damage, then structural damage is not considered a risk.

As part of this addendum REF, cosmetic and structural damage due to vibration during construction has been assessed on nearby Public Utilities and Heritage structures.

4.1 Vibration criteria for Cosmetic Building Damage and Structural Integrity

There are no vibration limits for buildings and structures in the AVTG. Therefore, the limits set out in British Standard BS 7385-2: *Evaluation and measurement for vibration in buildings guide to damage levels from ground-borne vibration* for normal structures and DIN4150-3 *Structural Vibration Part 3: Effects of vibration on structures* for heritage structures are adopted in NSW.

A summary of the limits are provided in Table 4-1 and Table 4-2 respectively.

These peak vibration limits are set so that the risk of cosmetic damage is minimal. They have been set at the lowest level above which damage has been credibly demonstrated. The limits also assume that the equipment causing the vibration is only used intermittently.

Table 4-1: BS7385-2 – Transient Vibration Guide Values for Cosmetic Damage

Group	Type Of Structure	Peak Component Particle Velocity, mm/s [1]		
		4–15 Hz	15–40 Hz	40 Hz and above
1	Reinforced or framed structures Industrial or heavy commercial buildings	50		
2	Un-reinforced or light framed structures Residential or light commercial buildings	15 – 20	20 – 50	50

Note 1: Values referred to are at the base of the building, on the side of the building facing the source of vibration (where feasible).

Note 2: For Group 2, at frequencies below 4 Hz, a maximum displacement of 0.6 mm (zero to peak) should not be exceeded.

Table 4-2: DIN4150-3 – Guideline Values for Vibration Velocity to be used when Evaluating the Effects of Short-Term Vibration on Structure

Line	Types of structure	Guideline values for velocity, v in mm/s			Vibration at horizontal plane of highest floor at all frequencies
		Vibration at the foundation at a frequency of:			
		1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz [1]	
1	Buildings used for commercial purposes, industrial buildings, and buildings of similar design	20	20 to 40	40 to 50	40
2	Dwelling and buildings of similar design and/or occupancy	5	5 to 15	15 to 20	15

Line	**Types of structure**	**Guideline values for velocity, v in mm/s**			**Vibration at horizontal plane of highest floor at all frequencies**
		Vibration at the foundation at a frequency of:			
		1 Hz to 10 Hz	**10 Hz to 50 Hz**	**50 Hz to 100 Hz [1]**	
3	Structures that, because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value (e.g. listed buildings under preservation order)	3	3 to 6	8 to 10	8

Note 1: At frequencies above 100 Hz, the value given in this column may be used as minimum values

5 Operational Noise Impact Assessment

5.1 Noise Model Input Parameters and Assumptions

Traffic noise emissions from The Driftway and surrounding roadways have been modelled using SoundPLAN version 8.2. The noise model considered multiple factors, including local terrain, geometrical spreading and shielding from the terrain and structures.

The study aims to identify receivers that are eligible for additional mitigation measures due to an increase in road traffic noise from the Project for the Build Year and Design Year. To develop this, the noise model inputs and assumptions utilised are summarised in Table 5-1.

Table 5-1: Noise Model Inputs and Assumptions

Item	Description
Calculation method	Calculation of Road Traffic Noise (CoRTN) 1988 as implemented in SoundPLAN 8.2.
Ground topography	From existing topographical maps provided by ELVIS Spatial Data (1m resolution).
Road gradient	Existing - Gradient calculated from topographical data. Proposed - Gradient calculated from elevation information from proposed road alignment.
Ground absorption	Set at 75% ground absorption due to surrounding environment primarily consisting of open grass areas in accordance with the RNMVG.
Pavement	For the existing scenario, pavement corrections in accordance with the REF prepared by SLR has been adopted, that is: - Chip Seal [+ 2.5 dBA for cars and + 0 dB for trucks] for a portion of The Driftway (see Figure 5-1) - Dense Grade Asphalt (DGA) (AC14) [+ 0 dB] for all other sections of The Driftway For the proposed build, pavement is expected to be DGA AC14 for the entire section of The Driftway (sourced from Table 7-8 of the 50% Detailed Design document 703100305 | RBS1-MOTTM-NWW-DN-RPT-001001 | B, dated 19/07/2023)
Noise source	Traffic noise is calculated in accordance with the NSW CoRTN module and the RNMVG. Noise source heights and the respective corrections have been modelled as follows: Car source - 0.5m [+ 0 dB] Truck source - 0.5m (tires) [-5.4 dB] - 1.5m (engines) [-2.4 dB] - 3.6m (truck exhaust) [-8.5 dB] Noise source have been modelled for each lane.
Receiver locations	Receivers are modelled in accordance with the RNMVG. Receivers are modelled at 1 metre from the facade and 1.5 metre above ground level. Height between floors is assumed to be 3 metres. Façade correction of +2.5 dB have been applied 1m from the façade
Traffic volume	Traffic volumes for the validation and proposed models including heavy vehicle percentages are based on the day (7am – 10pm) and night-time (10pm – 7am) volumes sourced from Appendix D of the Acoustic REF prepared by SLR Consultancy. This has been summarised in Appendix B.

Item	Description
Traffic speed	The existing vehicle speeds are as follows: - The Driftway (between Blacktown Rd and Reynolds Rd) – 60km/hr - The Driftway (all other sections) – 80km/hr - Londonderry Rd – 80km/hr - Blacktown Rd – 80km/hr Proposed vehicle speeds are adopted from Table 8-2 of the 50% Detailed Design document 703100305 | RBS1-MOTTM-NWW-DN-RPT-001001 | B|, dated 19/07/2023) and are as follows: - The Driftway (approaching Hawksbury Waste Management Facility) – 60km/hr - The Driftway (all other sections) – 80km/hr - Londonderry Rd – 80km/hr - Blacktown Rd – 80km/hr
Study Area	As per guidance from the RNCG, the study area is 600m from the centreline of the Project in all directions.
L10 to Leq correction	-3dB

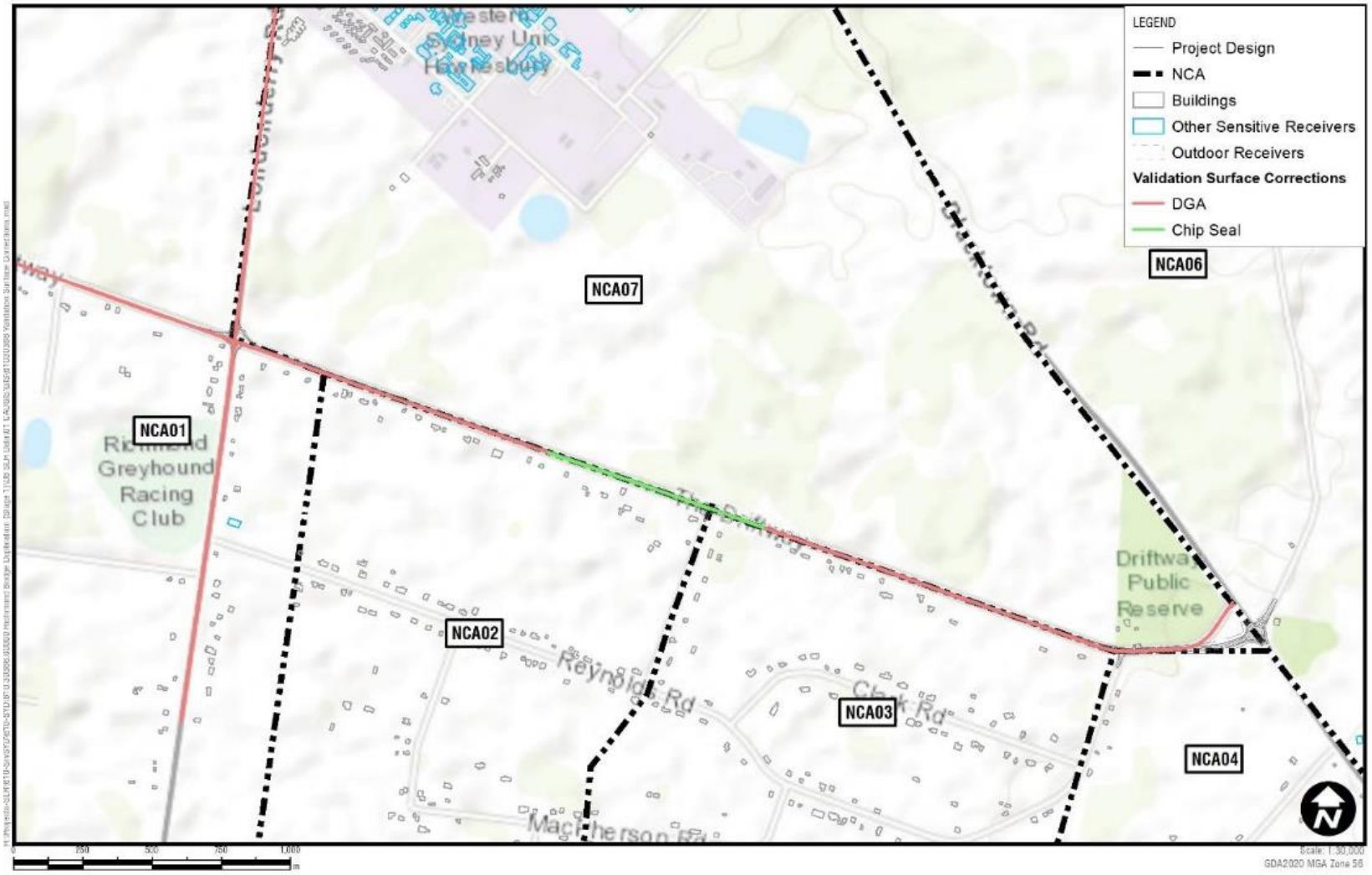

Figure 5-1: Existing pavement correction for The Driftway – Sourced from Figure 6 of the acoustic REF prepared by SLR Consultancy.

5.2 Validation Modelling

To develop an operational noise model that predicts the acoustic impacts to surrounding receivers due to the Project, a noise validation model must first be produced to represent the existing noise level on-site captured by unattended noise monitoring.

The validation methodology previously undertaken by SLR included the modelling of traffic noise levels based on known traffic volumes and comparing them with measured noise levels at a number of representative monitoring locations.

Table 5-2 summarises the noise monitors utilised for validation purposes and the predicted noise levels from SLR's previous results compared to this assessment.

Table 5-2: Measured Noise Levels at Validation Locations Compared to Predicted Noise Levels

Location	Daytime $L_{eq\ (15\ hour)}$ dB(A)					Night-time $L_{eq\ (9\ hour)}$ dB(A)				
	Logger	SLR	MM	SLR Delta	MM Delta	Logger	SLR	MM	SLR Delta	MM Delta
L02	53.0	53.9	53.6	0.9	0.6	48.9	49.3	48.2	-0.4	-0.7
L03	57.7	58.6	56.7	0.9	-1.0	52.5	55.1	51.5	1.9	-1
L06 [1]	49.7	49.9	49.1	0.2	-0.6	46.7	45.1	43.6	-1.6	-3.1
	Median (including L06)			0.9	-0.6	Median (including L06)			0.4	-1
	Median (excluding L06)			-	-0.2	Median (excluding L06)			-	-0.9

Note 1: Logger L06 is approximately 70m from the edge of The Driftway and is outside the recommended distance as per Section 4 of the RNMVG.

Although the sample size is relatively small, it can be observed that the SLR predicted noise levels are typically overpredicted by 0.9 dB and 0.4 dB for the day and night-time periods respectively, whereas this assessment underpredicted by -0.6 dB and -1 dB during the same periods respectively. However, it should be noted that the median value is heavily influenced by the large delta at L06 during the night-time period.

It is our understanding that at the receiver location (268-274 The Driftway, Londonderry), two noise monitors were installed at set distances from the edge of The Driftway. This is depicted in the overlay image from SLR's report shown in Figure 5-2.

Figure 5-2: Overlay of noise monitors at 268-274 The Driftway, Londonderry – Sourced from Appendix B of the 610.30366-R01-v2.0-20211101 the acoustic REF prepared by SLR Consultancy

It is evident that L05 was meant to serve as the validation location, however due to unforeseen logger failure documented in SLR's REF, noise data from L06 had to be supplemented at this location.

The RNMVG provides good practices to minimise the chance of errors and includes the following recommendation:

Logging includes free field measurement locations within 30m of the road (no closer than 10m) and having unobstructed line of sight to approximately 150 degrees of road and tyre interface to verify representative road traffic source levels.

Therefore, the measured noise levels during the night-time period at L06 could be influenced by natural ambience due to low traffic volumes and is deemed not indicative of the traffic noise levels during the night-time period at that location.

Adopting this, Table 5-2 shows a significant improvement to the accuracy of this assessment's model during the daytime period and a marginal improvement during the night-time period. This aligns with the understanding that night-time ambient levels are affected by natural ambience due to the lower and more intermittent flow of traffic.

5.2.1 Sensitivity Assessment

It should be noted that the noise model prepared as part of this assessment typically underpredicts by approximately 1 dB at noise monitoring locations as shown in Table 5-2. Therefore, a sensitivity study is undertaken to adjust noise levels at the façades by 1 dB to accurately reflect the results of unattended noise monitoring.

The results of this sensitivity assessment are included in Appendix C and are further discussed in Section 5.6.

5.3 Modelling Scenario

Table 5-3 summarises the scenarios assessed for potential increase in traffic noise due to the Project.

Table 5-3: Modelling Scenarios

Scenario	Description
Build Year (2026) – No Project	Existing road alignment and conditions updated with the forecasted traffic growth without the Project.
Build Year (2026) – With Project	Proposed road alignment including roundabout upgrades on the eastern end of The Driftway with Blacktown Road and western end with Londonderry Road. Updated with forecasted traffic growth assuming the Project was built.
Design Year (2036) – No Project	Existing road alignment and conditions updated with the forecasted traffic growth without the Project 10 years from the Build Year.
Design Year (2036) – With Project	Proposed road alignment including roundabout upgrades on the eastern end of The Driftway with Blacktown Road and western end with Londonderry Road. Updated with forecasted traffic growth 10 years after the Build Year assuming the Project was built.

Regarding changes caused by the Project, it should be noted that an additional dedicated left-turn lane opens on Londonderry Road approximately 190m north of the proposed roundabout with The Driftway.

Similarly, a dedicated slip lane on Londonderry Road south of the proposed roundabout accommodating vehicles turning left from The Driftway is included prior to merging back into one lane approximately 260m south of the roundabout.

5.4 Results

The noise contour maps at affected receivers and façade noise levels for each scenario summarised in Table 5-3 are included in Appendix A and Appendix C accordingly.

Noise increases for the day and night-time periods due to the Project for the Build Year are depicted in Figure 5-3 and Figure 5-4 respectively.

Similarly, noise increases for the day and night-time periods due to the Project for the Design Year are depicted in Figure 5-5 and Figure 5-6 respectively.

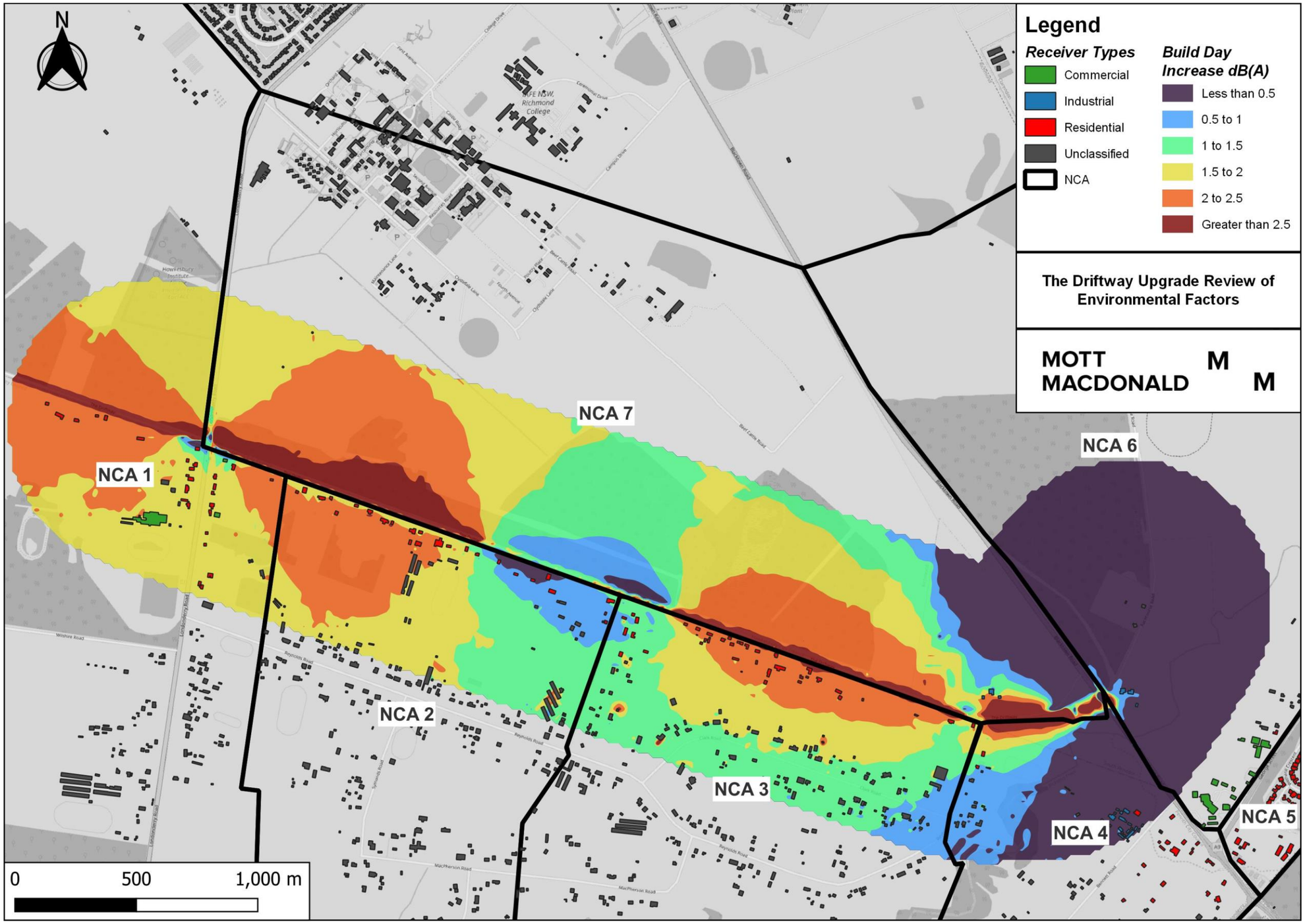

Figure 5-3: Increase in Day Noise Level due to the Project for the Build Year (2026)

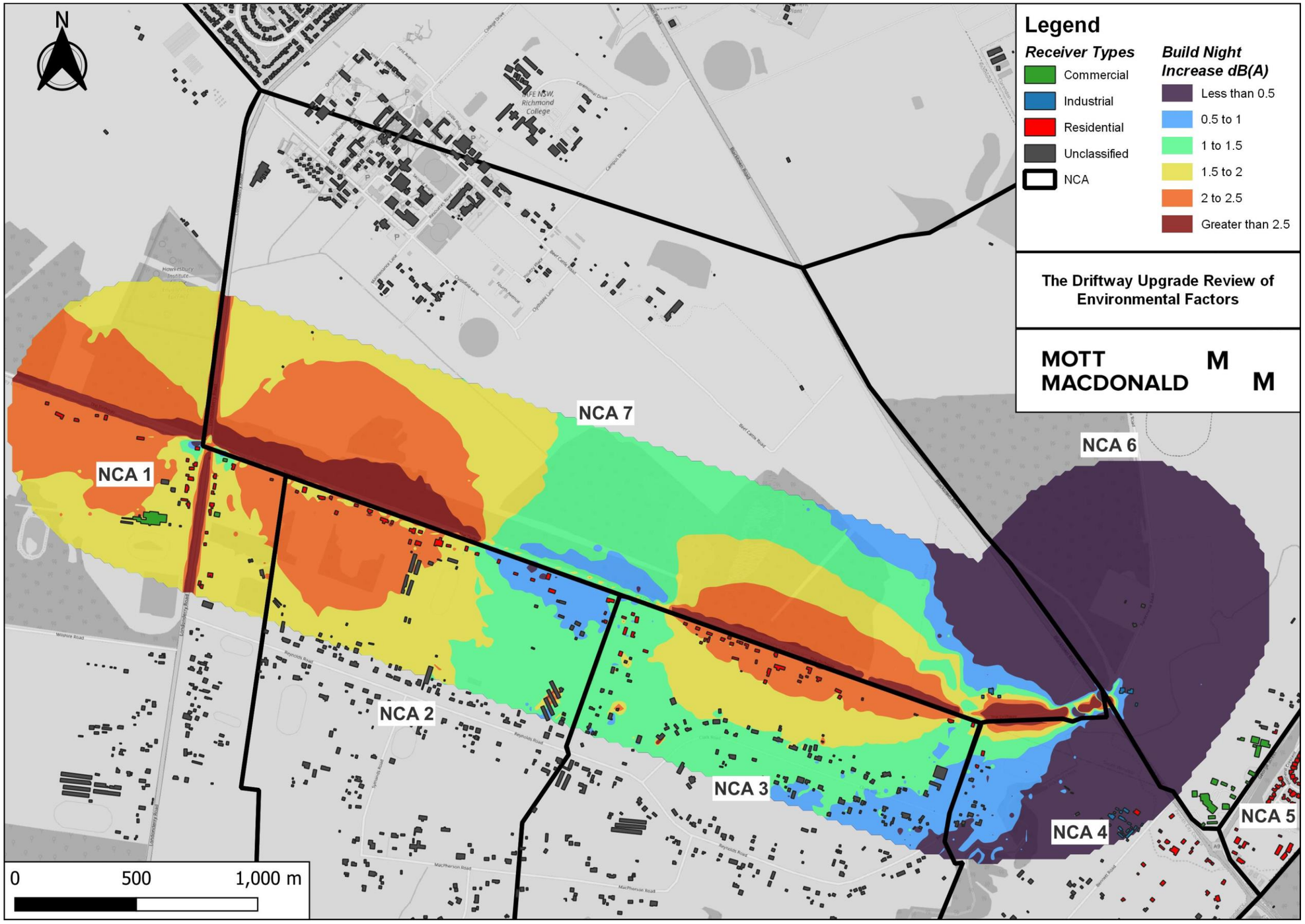

Figure 5-4: Increase in Night-time Noise Level due to the Project for the Build Year (2026)

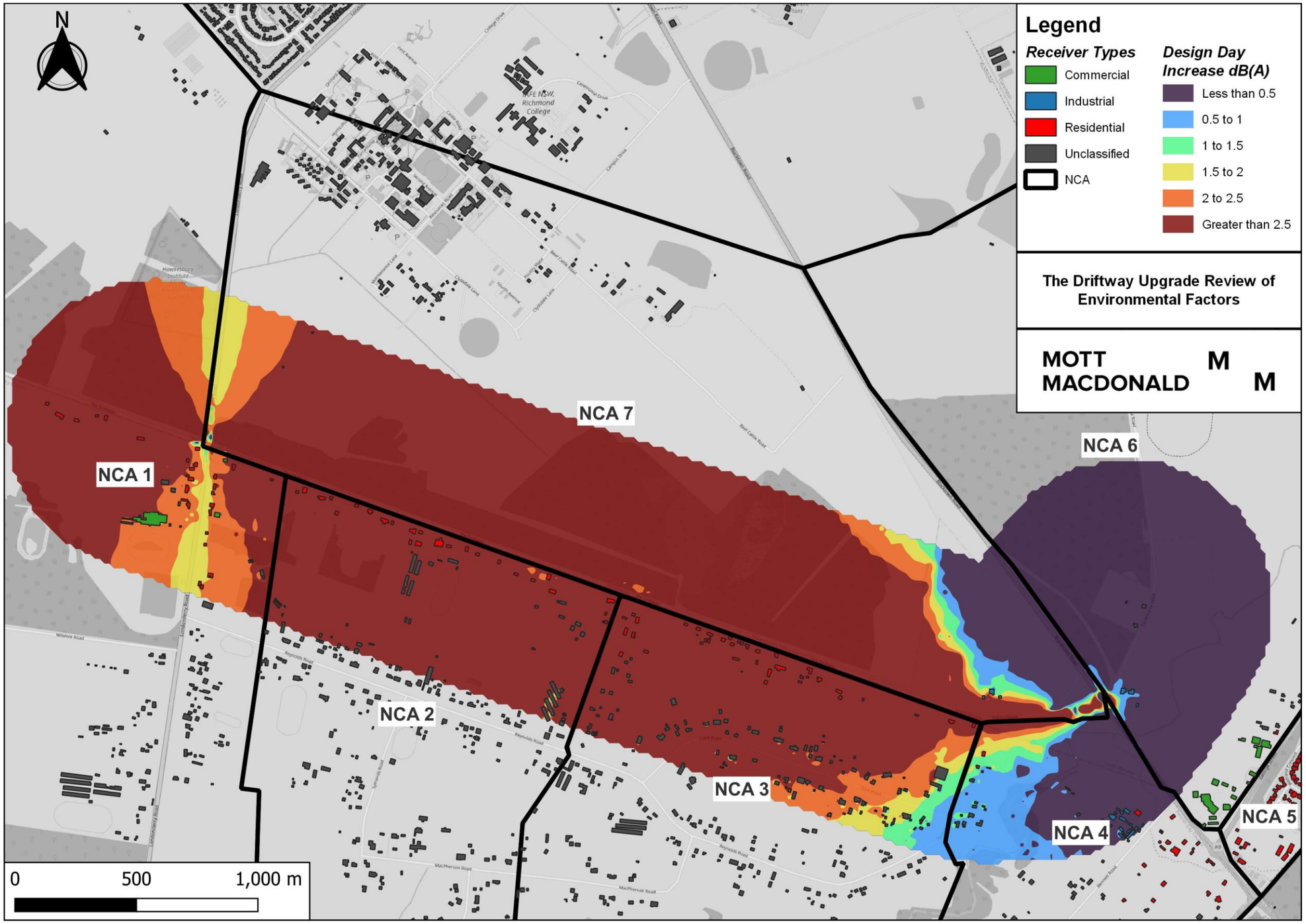

Figure 5-5: Increase in Day Noise Level due to the Project for the Design Year (2036)

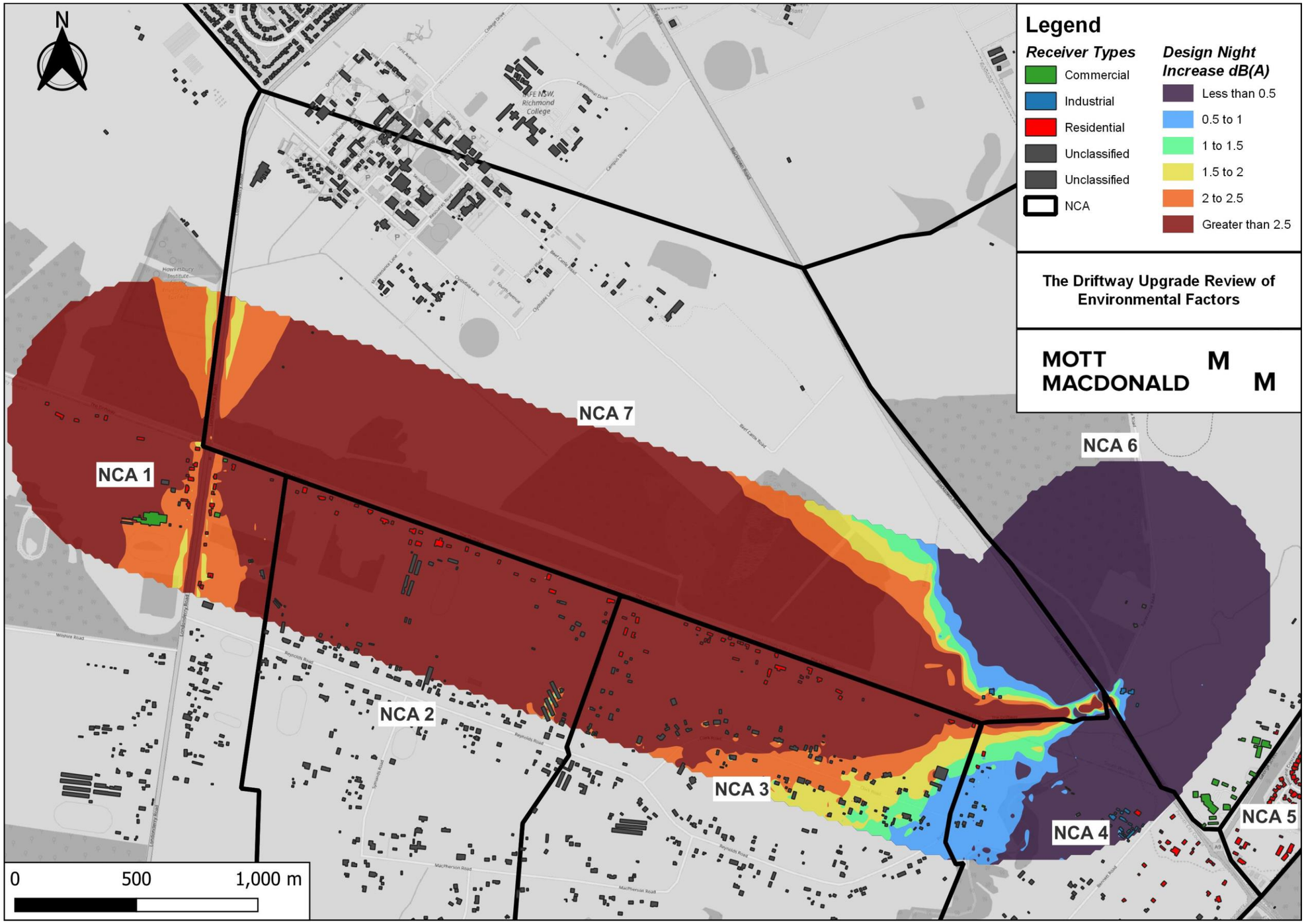

Figure 5-6: Increase in Night-time Noise Level due to the Project for the Design Year (2036)

Receivers eligible for additional mitigation measures are identified and discussed in Section 5.5.

5.5 Receiver Eligible for Mitigation Measures

Receivers eligible for mitigation measures due to exceeding the Project criteria in either the Build Year or Design Year are summarised in Table 5-4 and depicted in Figure 5-7.

Table 5-4: Eligible Receivers for Mitigation Measures

NCA	Address [1, 2]	Buildings Affected	Subtotal
NCA 1	280-282 Londonderry Road Londonderry	1	11
	281-291 Londonderry Road Londonderry	2	
	284-288 Londonderry Road Londonderry	1	
	290 Londonderry Road Londonderry	1	
	296 Londonderry Road Londonderry	1	
	300-314 The Driftway Londonderry	1	
	301-307 Londonderry Road Londonderry	1	
	302-306 Londonderry Road Londonderry	1	
	372-376 The Driftway Londonderry	1	
	378-380 The Driftway Londonderry	1	
NCA 2	156-160 The Driftway Londonderry	1	10
	180-186 The Driftway Londonderry	1	
	220-226 The Driftway Londonderry	1	
	228-234 The Driftway Londonderry	1	
	236-242 The Driftway Londonderry	1	
	244 The Driftway Londonderry	1	
	260-266 The Driftway Londonderry	1	
	268-274 The Driftway Londonderry	1	
	276-280 The Driftway Londonderry	1	
	286-290 The Driftway Londonderry	1	
NCA 3	106-114 The Driftway Londonderry	1	10
	116-124 The Driftway Londonderry	2	
	2-8 The Driftway Londonderry	1	
	74-80 The Driftway Londonderry	1	
	8/126 The Driftway Londonderry	1	
	82 The Driftway Londonderry	1	
	90-96 The Driftway Londonderry	1	
	98-104 The Driftway Londonderry	2	
NCA 4	No receivers triggered	-	-
NCA 5	Residential receivers are outside the study area	-	-
NCA 6	No residential receivers	-	-
NCA 7	No residential receivers	-	-
		Total	31

Note 1: Address are derived from SIXMaps sources and should be verified prior to applying treatment.

Figure 5-7: Receiver Eligible for Mitigation Measures

5.6 Discussion

From the predicted noise modelling for the Build and Design year, a total of 31 receivers summarised in Table 5-4 have been identified as eligible for additional mitigation measures. These receivers have been identified as eligible due to exceeding one or more of the triggers derived as the Project criteria in Section 3.4.

The main contributor to the increased operational noise levels is due to the subsequent increase in traffic through The Driftway and surrounding road networks as a result of the development. This is supported by the fact that only 10 receivers were triggered for mitigation measures at the Build Year. Between the Build and Design year, no additional road alignment or developments were accounted for and the only variable considered was the increase in traffic flow as the Project stabilises.

The majority of receivers that qualified for mitigation measures exceeded Trigger 1 where the noise level between the Build and No-build scenarios exceeded 2 dB and the receiver exceeded the controlling noise criterion summarised in Table 3-1.

Additionally, once the methodology proposed by the sensitivity assessment summarised in Section 5.2.1 was adopted, the number of receivers that qualify for mitigation measured increased to 40. The increase in eligible receivers were identified as receivers previously considered marginal compliance. The outcome of this assessment with and without the sensitivity assessment can be considered a lower and upper range of eligible receivers respectively.

Furthermore, the resulting range agrees with the previous assessment undertaken by SLR Consultancy which identified 37 receivers qualifying for mitigation measures.

Therefore, it is likely that any mitigation measures discussed in Section 5.8 would encompass receivers identified in both assessments and would be effective in reducing the impact of the Project's operational noise to the triggered receivers.

5.7 Maximum Road Traffic Noise

Maximum noise levels as defined in Section 3.3 are not assessed in accordance with the CoRTN prediction method and is not an explicit requirement of the RNP.

However, the predicted increase in maximum noise level events due to the Project has been considered based on the existing and proposed lane realignments.

Table 5-5 summarises the maximum noise level increase predicted due to the Project within each NCA.

Figure 5-8 summarises the increase in the predicted maximum road traffic noise level due to the Project development.

Table 5-5: Worst-case Maximum Noise Level increase per NCA

NCA	Worst-case L_{max} Increase, dB(A)
NCA 1	4
NCA 2	2
NCA 3	2
NCA 4	2
NCA 5	Residential receivers are outside the study area
NCA 6	No residential receivers
NCA 7	No residential receivers

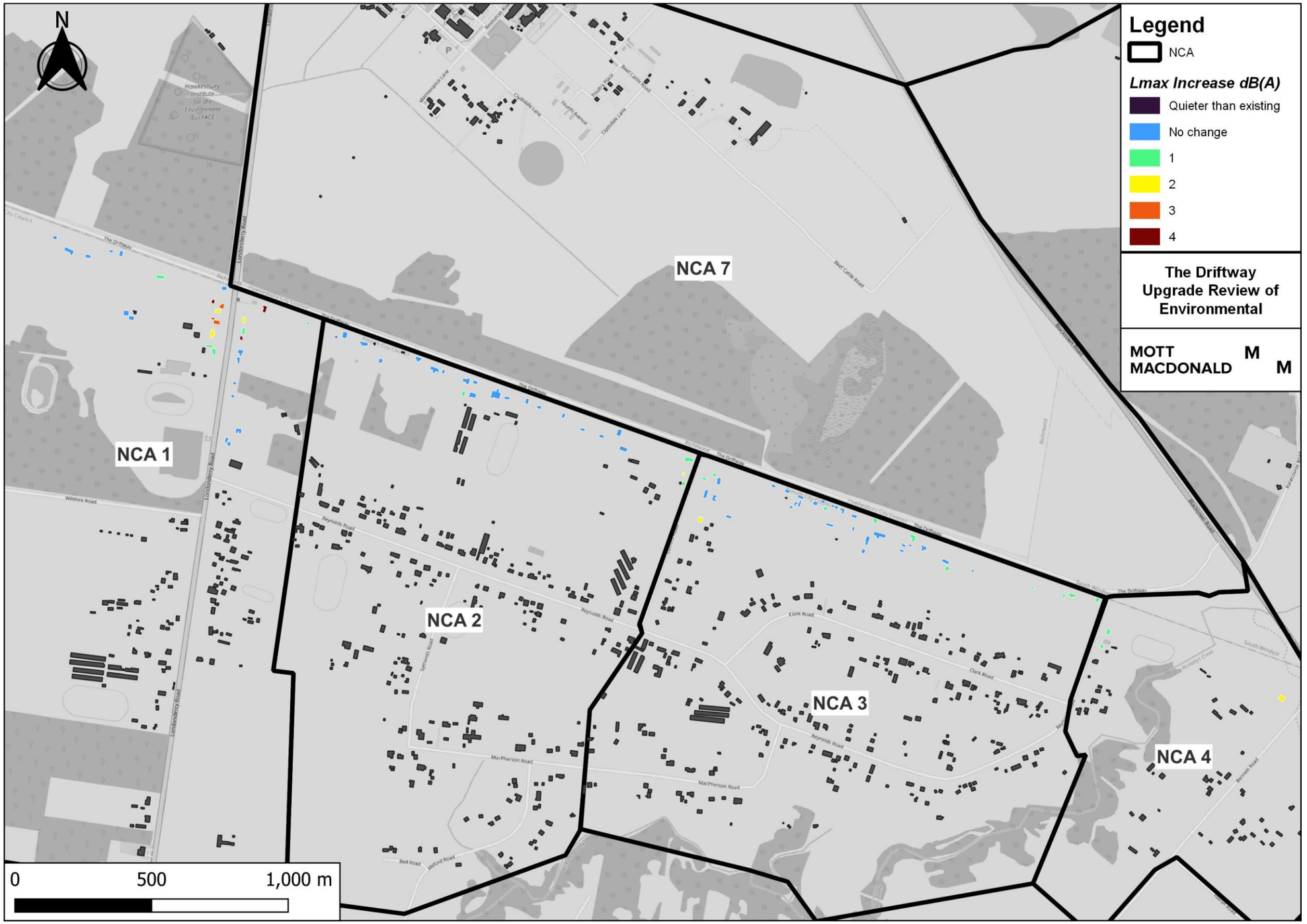

Figure 5-8: Predicted Maximum Noise Level increase due to the Project.

A notable increase in maximum traffic noise levels due to the Project is observed for receivers within NCA 1 surrounding the intersection of The Driftway with Londonderry Rd. This is anticipated to be a result of the Project's realignment and the inclusion of an additional merge lane southbound along Londonderry Rd which brings traffic closer to receivers.

Aside from this, most receivers along The Driftway observe a minor (less than or equal to 2 dB) increase in maximum noise levels or are expected to have lower maximum noise levels due to the Project's realignment.

Additionally, due to the predicted traffic growth and subsequent heavy vehicle increase during the night-time period, it is likely that there is a proportional increase in maximum noise level event occurrences. The predicted percentage increase in maximum traffic pass-by noise events based on the expected increase in traffic volume compared to the existing environment is summarised in Table 5-6.

Table 5-6: Predicted Percentage Increase in Maximum Noise Level Events for Build Year and Design Year compared to the 'no build' scenario

NCA	Receiver Location	Maximum Noise Event Increase (%)	
		Build Year	Design Year
NCA 1	Along The Driftway	67	175
	Along Londonderry Rd	50	56
NCA 2	Along The Driftway	67	175
NCA 3		67	175
NCA 4		67	175
NCA 5	Residential receivers are outside the study area	-	-
NCA 6	No residential receivers	-	-
NCA 7	No residential receivers	-	-

Although maximum road traffic noise is not used to derive triggers limits, the potential impact on the night-time amenity for residents surrounding the site should be considered.

It is expected that the treatment measures summarised in Section 5.8 is considered sufficient in minimising the risk of sleep disturbance due to maximum traffic noise events.

5.8 Operational Noise Mitigation Measures

For receivers that qualify for mitigation measures in accordance with the RNCG, the RNMG provides guidance on various options of treatment that can be applied to the Project and at the receiver. The preference for treatment is provided in accordance with the hierarchy given in the RNP:

1. Quieter pavement surfaces
2. Noise mounds
3. Noise walls
4. At-property treatments

The RNMG notes that community views should be considered when determining the method of mitigation and should be undertaken via community engagement activities. Additionally, the community benefits to the noise mitigation approach from the Project development should also be considered.

To be considered a reasonable approach, noise mounds, walls or quieter pavement surfaces should be able to benefit a wide range of affected receivers within close proximity of the road corridor (defined as within 20m of each other by the RNMG). Where this is true, a more detailed investigation is required to determine the most suitable approach.

5.8.1 Quieter Pavement

Quieter pavement is typically the most preferred form of mitigation as it reduces noise levels at the source without creating a visual impact. Based on the RNMG, tyre noise is dominant at around 70 km/hr, thus within the context of the Project where the design speed along The Driftway is 80 km/hr, this would yield notable improvement and would reduce the operational noise impacts at multiple triggered receivers within proximity. By selecting a quieter pavement, such as Open Grade Asphalt (OGA), predicted noise levels for the build scenarios could be reduced by up to 2.5 dB.

Although OGA application is expected to reduce the noise impact to affected receivers, it does not align with Transport's expectations of the Project. Potential challenges associated with the implementation of OGA include:

- Unfavourable properties for high-shear portions of the road (i.e roundabouts)
- Life cycle and maintenance implications (worn OGA can lead to worst tyre noise).

The proposed (and modelled) DGA AC14 is considered a suitable alternative road surface. A quieter pavement has therefore not been investigated further.

5.8.2 Noise Barriers

Noise barriers can be separated into two main categories including: noise walls and mounds. They both provide similar benefits to quieter pavement by providing external noise reductions before reaching the receiver.

There are both advantages and disadvantages to each option as typically noise mounds are more cost-effective for an extended height but would require a larger footprint to achieve the same benefits as a wall. A middle-ground solution could include noise mounds with smaller barriers above to achieve a higher performance at a reduced cost.

The RNMG recommends barriers are only considered when receivers are considered closely spaced (within 20m). Most residential receivers for the Project are sparsely located and further than 20 metres apart. Due to the scattering of triggered receivers along Londonderry Rd and The Driftway, noise barriers are not considered feasible. Additionally, triggered receivers along The Driftway require driveway access and this would further limit the effectiveness of the barriers. Therefore, the implementation of noise barriers has not been investigated further.

5.8.3 At Property Treatment

At property treatment including façade treatments and localised screens can replace at-road treatments but are typically the least preferred scenario and are not recommended unless under the following circumstances:

- Isolated single residences or isolated groups of closely spaced residences
- Where the affected community expresses a preference for at-property treatment and the cost is less than a combination of a barrier and at-property treatment
- Where noise barriers cannot achieve the level of noise mitigation (insertion loss) required
- Where the only applicable noise criteria are internal (e.g., places of worship, hospitals or schools and childcare facilities where play areas meet external criteria)
- Where other noise mitigation measures have been shown not to be feasible or reasonable.

It should be noted that building construction and conditions heavily influence the feasibility of at-receiver treatments as buildings in poor state of repairs would not fully benefit from the treatment.

The following acoustic treatments provided by Transport for NSW are limited to:

- The installation of courtyard screen walls
- Fresh air ventilation systems that meet Building Code of Australia requirements with the windows and doors shut (Note: in certain circumstances air conditioning that includes fresh air intake may also be considered particularly, where adverse climate conditions prevail)
- Upgraded windows and glazing and solid core doors on the exposed facades of substantial structures only (e.g., masonry or insulated weather board cladding with sealed underfloor). These techniques would be unlikely to produce any noticeable benefit for light frame structures with no acoustic insulation in the walls
- Upgrading window and door seals and appropriately treating sub-floor ventilation
- The sealing of wall vents
- The sealing of the underfloor below the bearers
- The sealing of eaves.

5.8.4 Mitigation Recommendations

Based on guidance from the RNMG and the available options of mitigation treatment, it is recommended that at-property treatment is considered for triggered receivers and receivers within proximity should be considered on a case-by-case due to marginal compliance.

A site investigation will be required to evaluate existing building condition and construction to determine the most suitable treatment. It is likely that this would be a case-by-case situation and will require community engagement.

The recommendations provided in this report align well with the previously undertaken acoustic assessment as part of the REF by SLR Consultancy.

6 Construction Vibration Assessment

6.1 Minimum Safe Working Distances

The CVNG provides recommended minimum working distances for various vibration intensive construction plants. At this stage of the project, proposed equipment is not known and the assessment should be reviewed once the construction methodology and schedule have been developed.

Table 6-1 summarises vibration relevant construction plants and their respective minimum working distance to minimise the risk of cosmetic damage in accordance with BS 7385.

Table 6-1: Minimum Working Distance for Vibration Intensive Plant

Plant item	Rating/Description	Minimum working distance
		Cosmetic damage (BS 7385)
Vibratory Roller	> 300 kN (> 18 tonnes)	25 m
Large Hydraulic Hammer	(1600 kg – 18 to 34t excavator)	22 m
Jackhammer	Hand held	1 m (nominal)

For the most onerous plant item, a minimum safe working buffer around the perimeter of the Project boundary is formulated and buildings identified as within the minimum safe working distance are depicted in Figure 6-1.

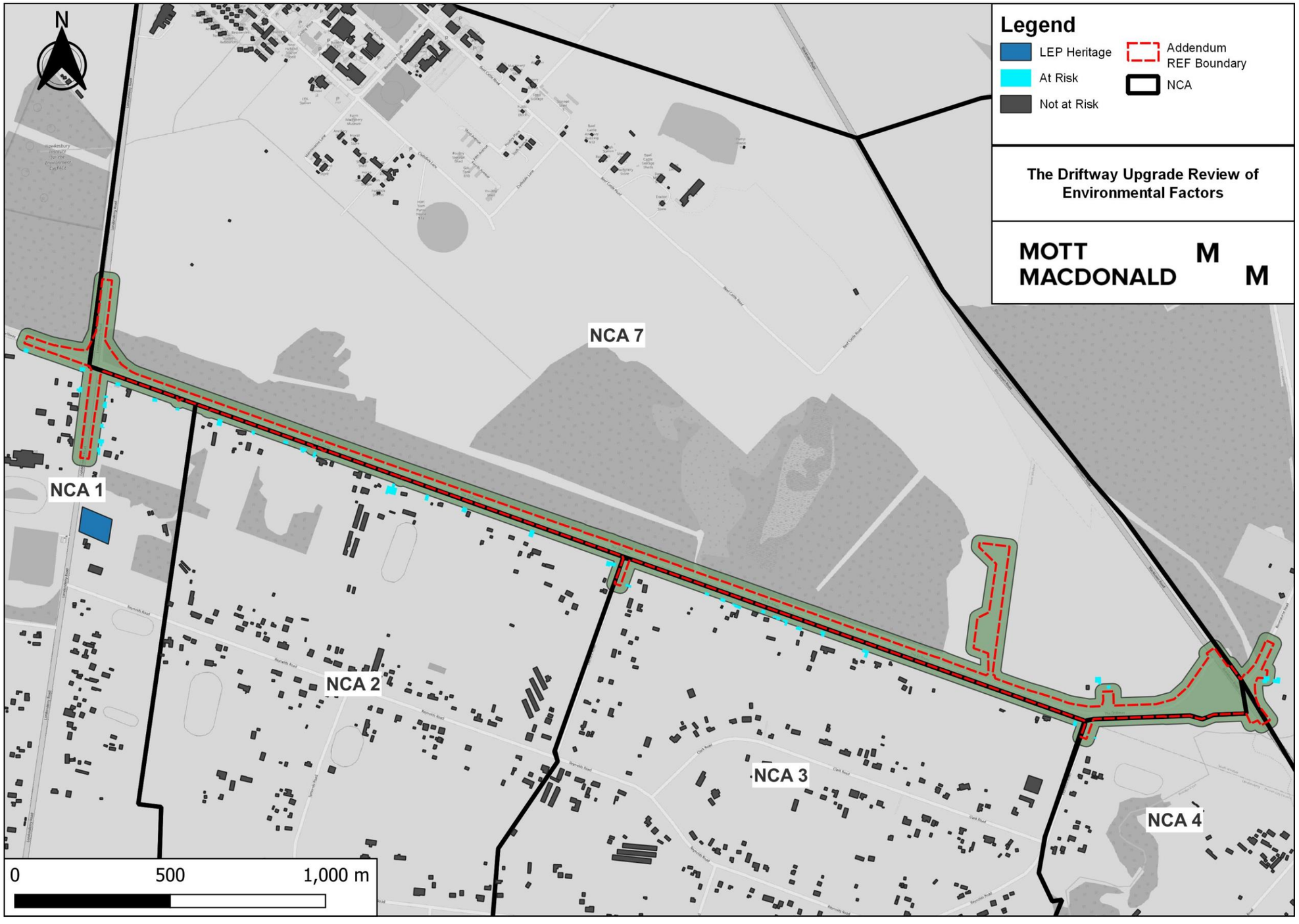

Figure 6-1: Buildings at Risk of Cosmetic Damage and Heritage Site Location

Receivers identified to be within this buffer are at risk of cosmetic damage and are summarised in Table 6-2.

Table 6-2: Receivers Identified as at risk of Cosmetic Damage

NCA	Address [1,2]	Buildings Affected	Receiver Type
NCA 1	280-282 Londonderry Road Londonderry	2	Residential
	281-291 Londonderry Road Londonderry	3	Residential
	284-288 Londonderry Road Londonderry	1	Commercial
	293 Londonderry Road Londonderry	1	Residential
	300-314 The Driftway Londonderry	2	Residential
	301-307 Londonderry Road Londonderry	2	Residential
NCA 2	156-160 The Driftway Londonderry	1	Residential
	180-186 The Driftway Londonderry	1	Residential
	204-210 The Driftway Londonderry	1	Residential
	220-226 The Driftway Londonderry	1	Residential
	228-234 The Driftway Londonderry	1	Residential
	260-266 The Driftway Londonderry	2	Residential
	268-274 The Driftway Londonderry	1	Residential
	276-280 The Driftway Londonderry	1	Residential
	286-290 The Driftway Londonderry	1	Residential
NCA 3	106-114 The Driftway Londonderry	1	Residential
	116-124 The Driftway Londonderry	3	Residential
	2-8 Luxford Road Londonderry	2	Residential
	74-80 The Driftway Londonderry	1	Residential
	8/126 The Driftway Londonderry	1	Residential
	82 The Driftway Londonderry	1	Residential
	90-96 The Driftway Londonderry	1	Residential
	98-104 The Driftway Londonderry	3	Residential
NCA 4	2-6 Reynolds Road Londonderry	1	Residential
NCA 6	339 Racecourse Road South Windsor	2	Industrial
NCA 7	1 The Driftway South Windsor	2	Industrial

Note 1: Address are derived from SIXMaps sources and should be verified prior to applying treatment.

6.1.1 Heritage Structures

It is understood that the Londonderry Cemetery located at 325-331 Londonderry Rd, Londonderry is considered a heritage site and is approximately 150m from the edge of the addendum REF site boundary.

It should be noted that the addendum REF boundary has been extended to accommodate a suitable transition between the Project and existing environment. Therefore, there is a notable extension to the southern site boundary along Londonderry Rd.

Incorporating the changes from the addendum REF, the Londonderry Cemetery is considered within close-proximity to the site boundary and is detailed in Table 6-3 and shown in Figure 6-1.

Table 6-3: Heritage Sites within Close Proximity to the Project

Site	Address	Significance	Distance to Project site
Londonderry Cemetery	325-331 Londonderry Road, Londonderry	Local	150 m

The CNVG advises that the safe working distances provided in Table 6-1 are expected to increase for heritage sites. However, risk of structural damage to the Londonderry Cemetery is low based on the expected vibration levels from the operation of the equipment included in Table 6-1. To determine Londonderry Cemetery's vulnerability to vibration impacts, the need to carry out a structural assessment should be considered prior to construction based on the finalisation of plant and equipment requirements determined by the contractor. If the structural assessment is required, this should be undertaken prior to the commencement of works in the areas. Therefore, an additional safeguard has been included in the AREF to consider this assessment as a mitigation measure.

It is recommended that any vibration intensive plant proposed to work within close proximity to the heritage site is carried out with attended vibration measurements to ensure the recommended vibration limit for structures categorised as Line 3 in Table 4-2 is not exceeded.

6.1.2 Public Utilities

A Utilities Management (RBS1-MOTTM-NWW-UT-PLN-001001) has been prepared during the detailed design process. Extensive utilities surveys have been undertaken identifying utilities that may be impacted by the Project. A significant number of utilities will be relocated during construction to achieve better alignment, avoid clashes and allow easier access for maintenance.

PS 311 requires identification of utilities that may be impacted by vibration during the construction of the Project, and identification of public utilities that require structural assessment prior to commencement of impacting works.. For the purpose of this assessment utilities have been identified for damage inspections if they are:

- not being relocated
- are made of materials vulnerable to damage caused by construction vibration, such as ductile iron cement lined (DICL) or cast iron concrete lined (CICL).

No polyvinyl chloride (PVC) pipes are included as the material is less vulnerable to vibration impacts.

Table 6-4 presents public utilities that require structural assessment prior to commencement of impacting works.

Table 6-4 Public utilities that require structural assessment prior to commencement of impacting works.

Asset ID	Location	Chainage	Utility Description	Utility Owner	Size (mm)	Type / Material	Utility information / Location
W-010	The Driftway CH2290 – 3400	MC20 Ch2290 – MC20 Ch3400	Water	Sydney Water	100	DICL	Water main
W-011	Reynolds Road CH 35 – 110	MCR0 Ch30 - MCR0 CH70	Water	Sydney Water	150	CICL	Water Main
W-017	Blacktown Road CH 0 - 25	MC70 CH0 – MC70 CH25	Water	Sydney Water	150	DICL	Water main, off Blacktown Road
BH1	The Driftway (north side)	MC20 CH3322	Gas well	Hawkesbury City Council	NA	NA	Adjacent to proposed road edge
BH2	The Driftway (north side)	MC20 CH3670	Gas well	Hawkesbury City Council	NA	NA	Adjacent to the REF boundary
G1	The Driftway (north side)	MC20 CH3078	Gas well	Hawkesbury City Council	NA	NA	Adjacent to the REF boundary
Gas1	The Driftway (south side)	MC20 CH3336	Gas well	Hawkesbury City Council	NA	Standpipe piezometer	Adjacent to proposed road edge
Gas3	The Driftway (north side)	MC20 CH3284	Gas well	Hawkesbury City Council	NA	NA	Adjacent to proposed road edge
Gas4	The Driftway (north side)	MC20 CH3234	Gas well	Hawkesbury City Council	NA	NA	Adjacent to the REF boundary
Gas5	The Driftway (north side)	MC20 CH3180	Gas well	Hawkesbury City Council	NA	Standpipe piezometer	Adjacent to the REF boundary

GWM1	The Driftway (north side)	MC20 CH3074	Groundwater monitoring well	Hawkesbury City Council	NA	NA	Adjacent to the REF boundary
GWM7	The Driftway (north side)	MC20 CH3656	Groundwater monitoring well	Hawkesbury City Council	NA	NA	Adjacent to the REF boundary

6.2 Construction Vibration Mitigation Measures

The CNVG requires that the following mitigation measures are incorporated when vibration levels are expected to exceed the cosmetic damage objectives:

- Construction method revision to include lower source vibration level plant where feasible and reasonable
- Attended vibration verification at affected receiver at commencement of works to confirm site-specific safe working distance
- Installation of permanent vibration monitors during construction at affected receiver with an alarm system (flashing light, audible alarm, SMS etc) to warn relevant parties when approaching vibration limits.

7 Conclusion

Mott MacDonald has been engaged to assess the operational noise and construction vibration impacts of detailed design of The Driftway, as part of the Stage 1 works of the New Richmond Bridge Traffic Improvements. The assessment considered operational noise impacts from road traffic, and the construction vibration impacts from the Project to the surrounding sensitive receivers.

The preliminary operational traffic noise assessment included reviewing the previous acoustic assessment for the project REF undertaken by SLR to develop and validate the operational noise model for this assessment.

The detailed design includes changes to concept design such as an updated road alignment at the intersection of Londonderry Road and The Driftway and design speed changes along The Driftway within proximity to Hawkesbury City Waste Management Facility. These changes were incorporated as part of the detailed design operational traffic noise assessment to determine the noise impact to affected receivers.

The outcomes of the assessment identified receivers eligible for additional mitigation measures and provided mitigation measures in the form of at-receiver treatments.

The feasibility and effectiveness of at-source treatment in the form of quieter pavement and noise barriers was considered and it is expected to reduce the noise impact to surrounding receivers. However, the implications and challenges associated with the implementation of these mitigation measures were considered unsuitable within the context of the Project and does not align with Transport's expectations.

The outcome and conclusions of this assessment generally aligned with the previously undertaken assessment by SLR. The changes proposed for the detailed design are not expected to result in significant changes to the acoustic amenity.

A building condition and public utilities assessment considered the potential impacts from construction related vibration sources and has indicated that the minimum safe working distances for vibration intensive equipment, as provided by the CNVG are not likely to be achieved to surrounding receivers. The Londonderry Cemetery which is identified as a heritage site has been considered and vibration levels from the proposed plant items are not expected to cause structural damage.

To minimise the risks of vibration levels exceeding the cosmetic damage objectives, mitigation measures in accordance with the CNVG will need to be considered and included in the CNVMP. These recommendations should be incorporated and considered once formulating the Project's CNVMP to ensure risk of building damage is minimised.

A. Appendix – Noise Contour Maps

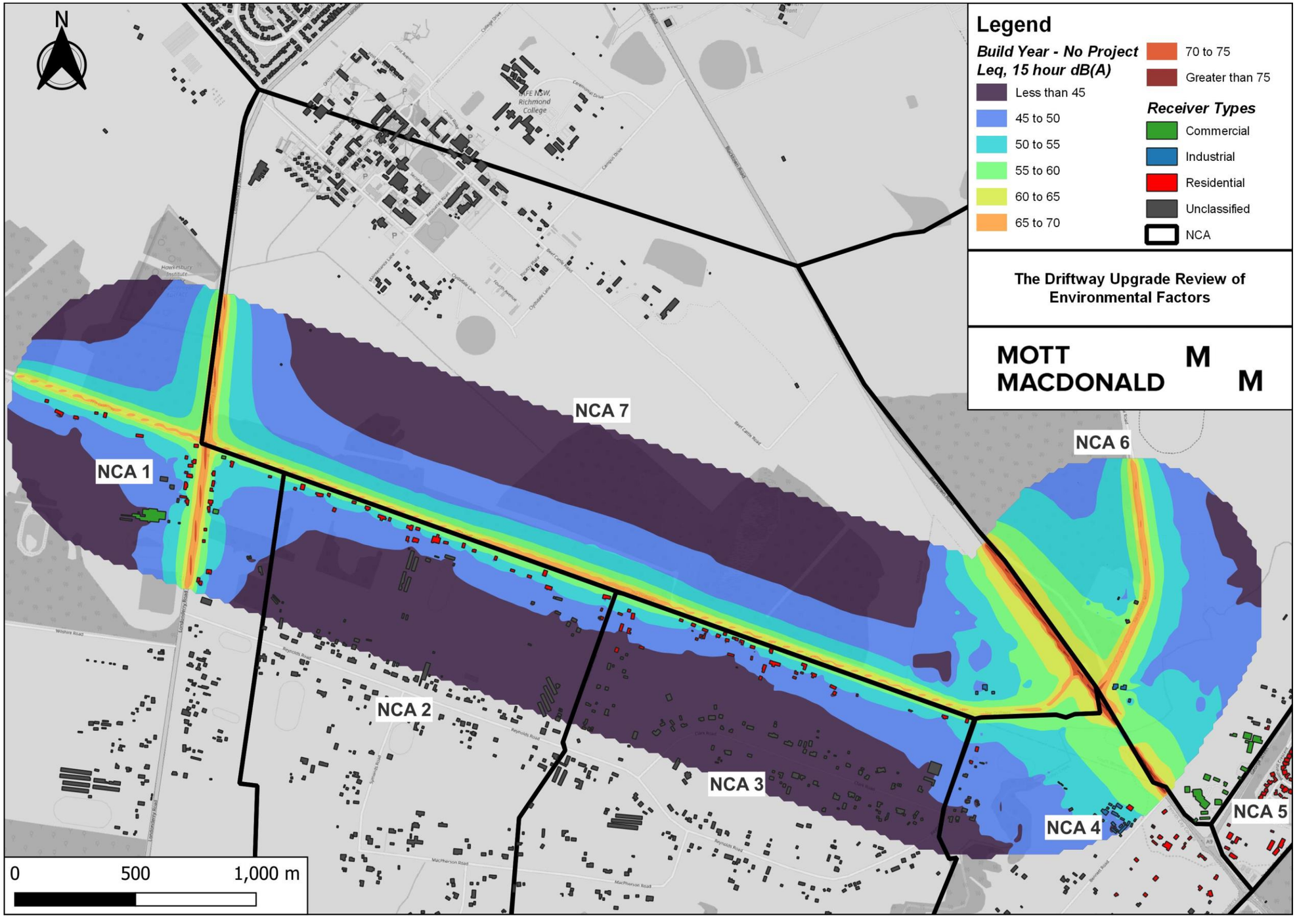

Figure A.1: Build Year (2026) – No Project – Daytime Noise Contour Maps

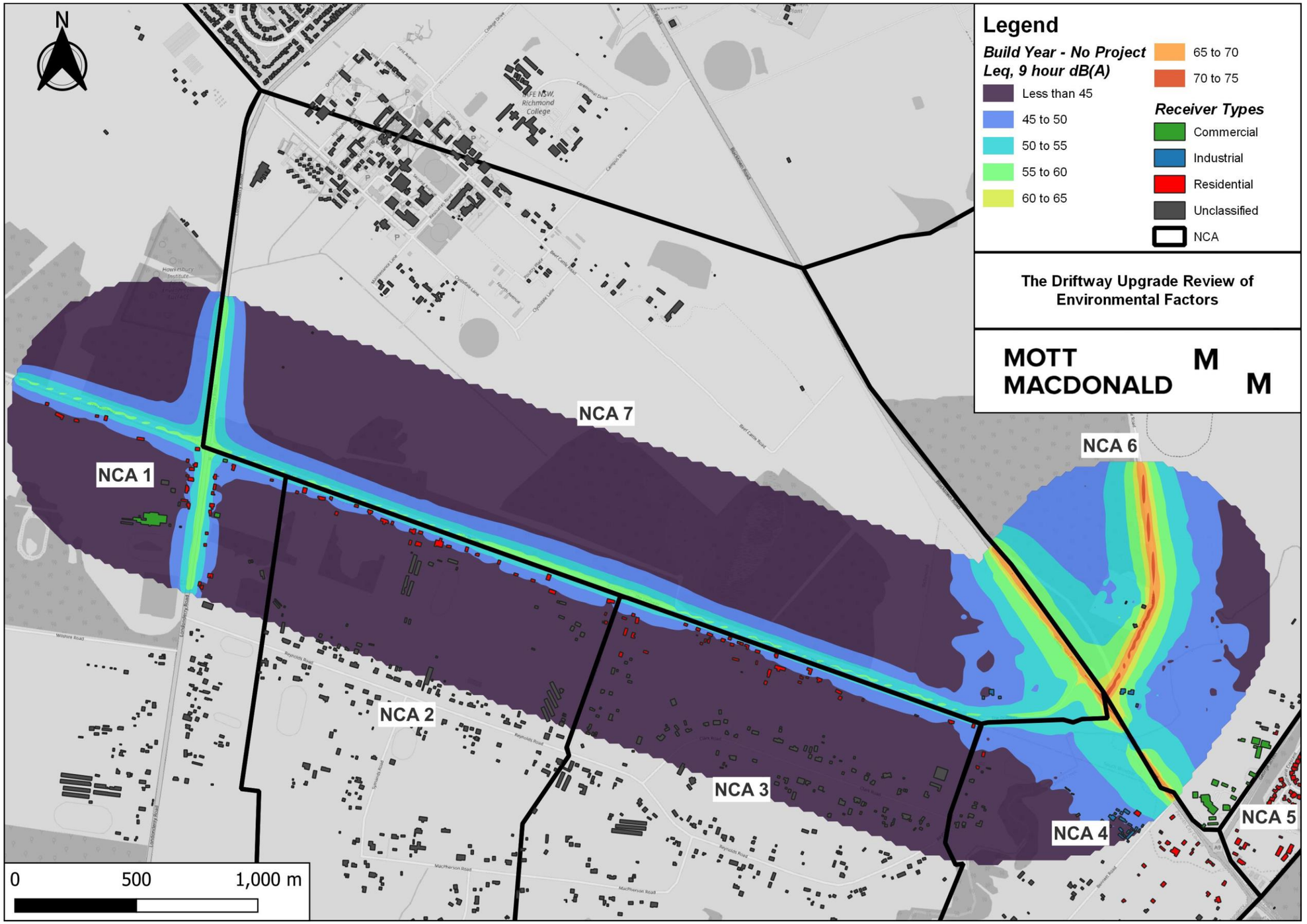

Figure A**.2: Build Year (2026) – No Project – Night-time Noise Contour Maps**

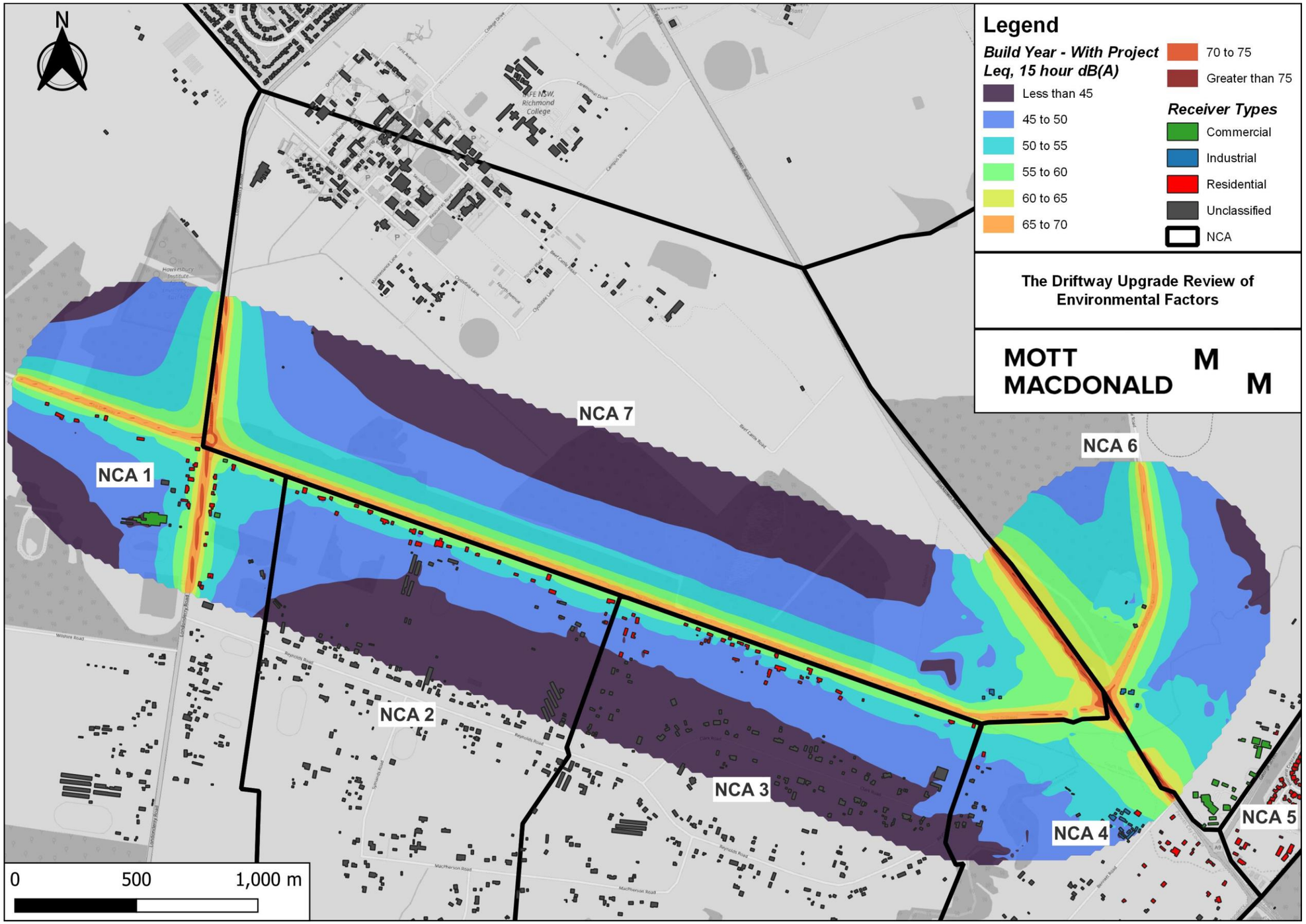

Figure A.3: Build Year (2026) – With Project – Daytime Noise Contour Maps

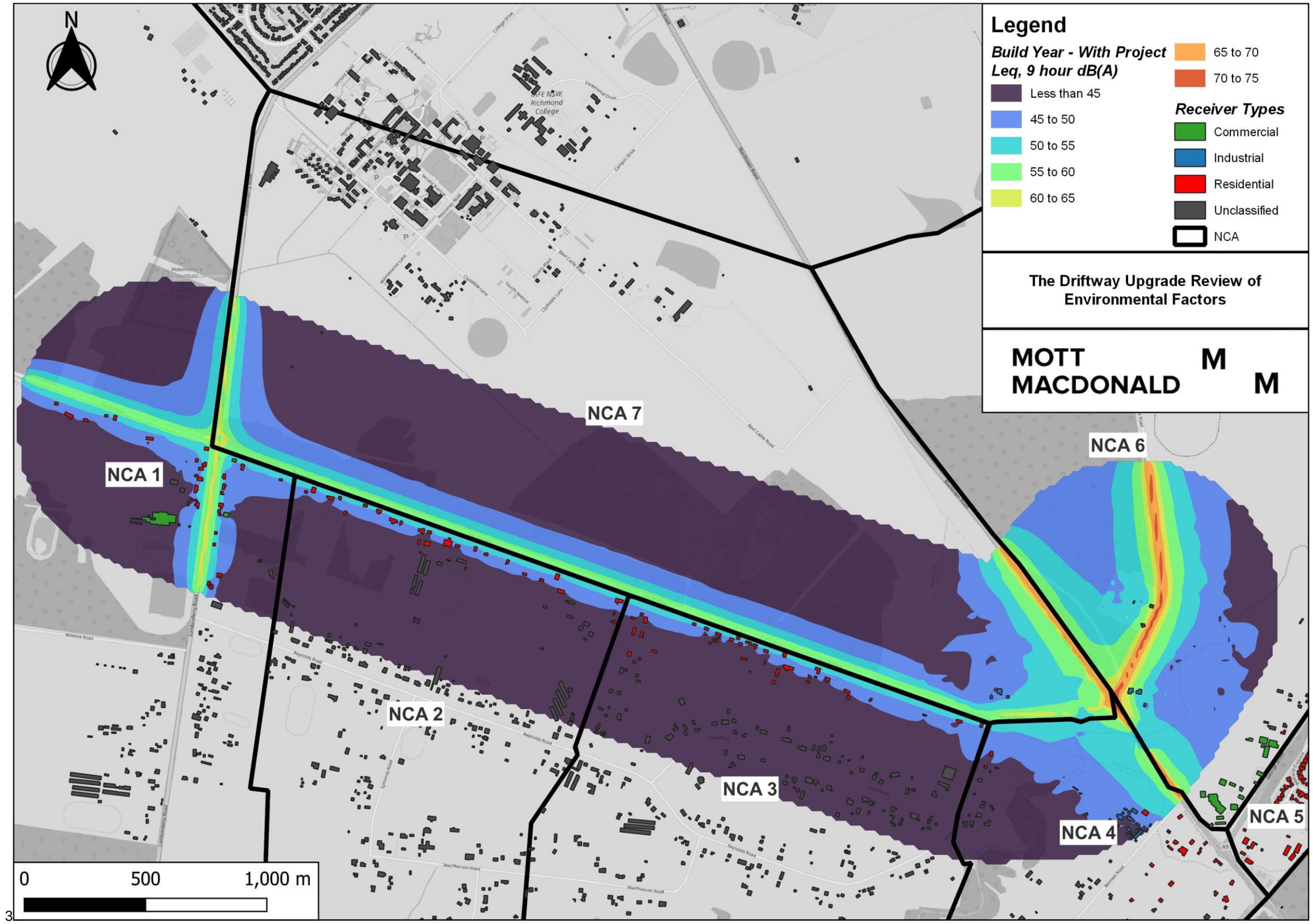

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Figure A.4: Build Year (2026) – With Project – Night-time Noise Contour Maps

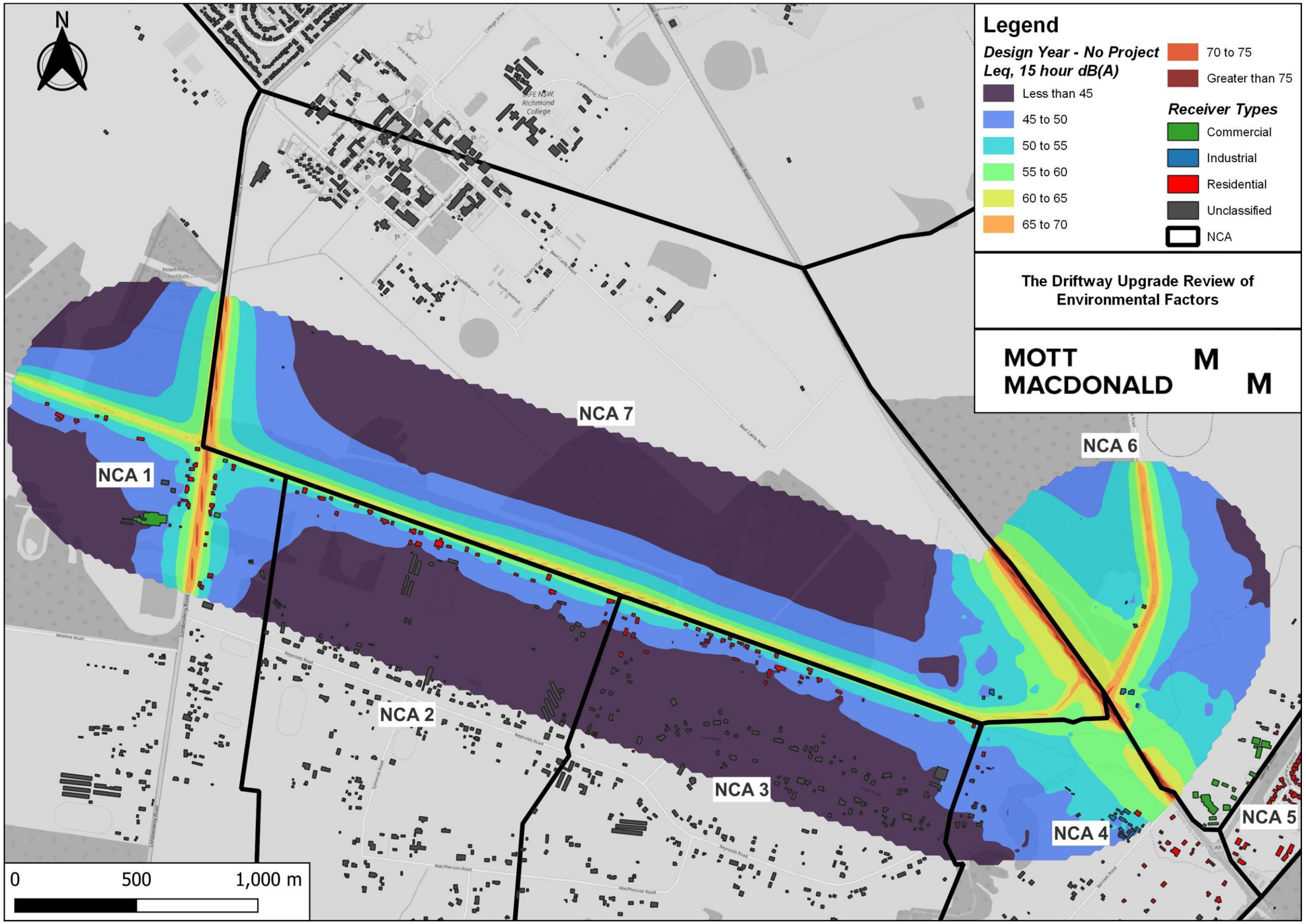

Figure A.5: Design Year (2036) – No Project – Daytime Noise Contour Maps

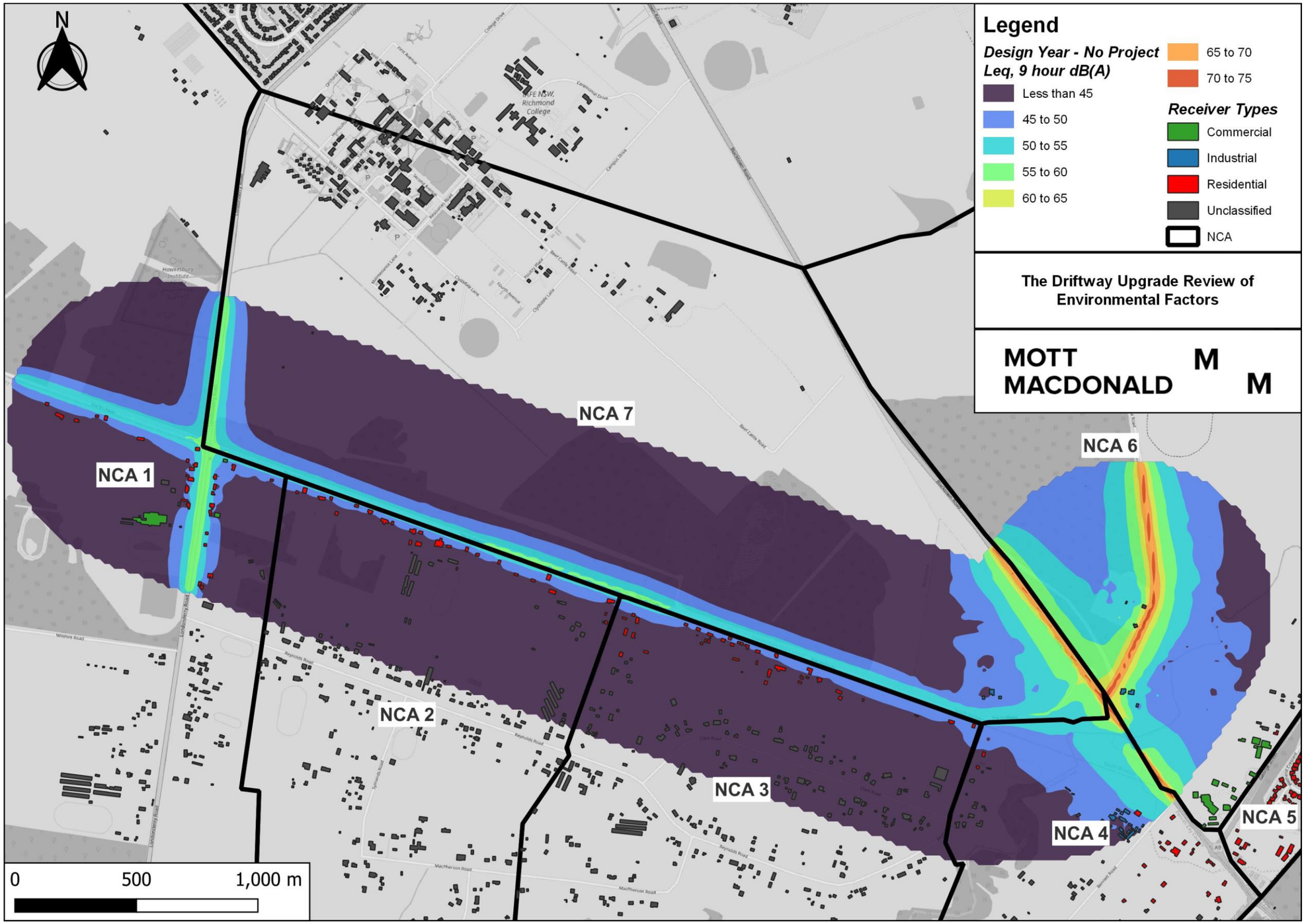

Figure A.6: Design Year (2036) – No Project – Night-time Noise Contour Maps

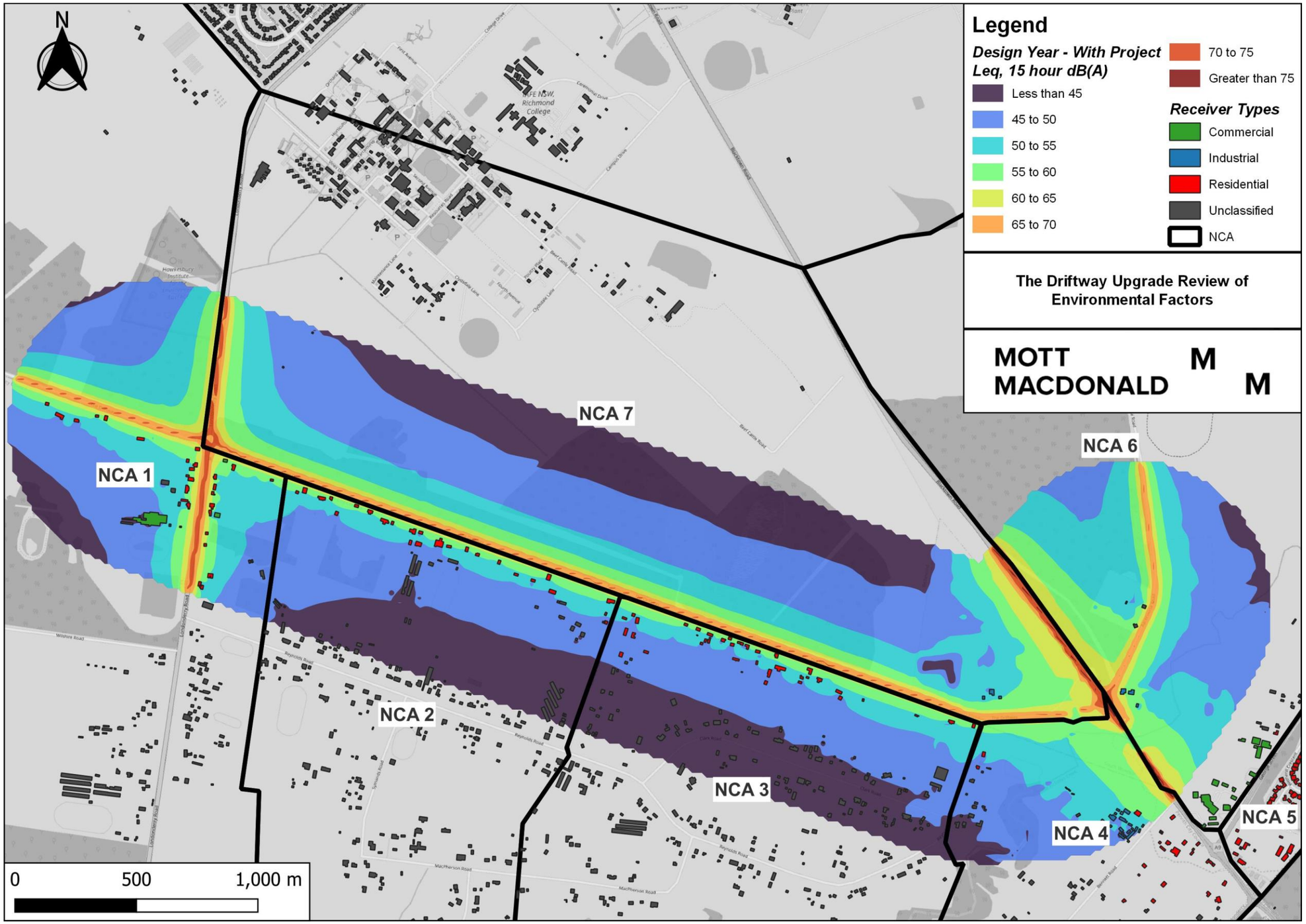

Figure A.7: Design Year (2036) – With Project – Daytime Noise Contour Maps

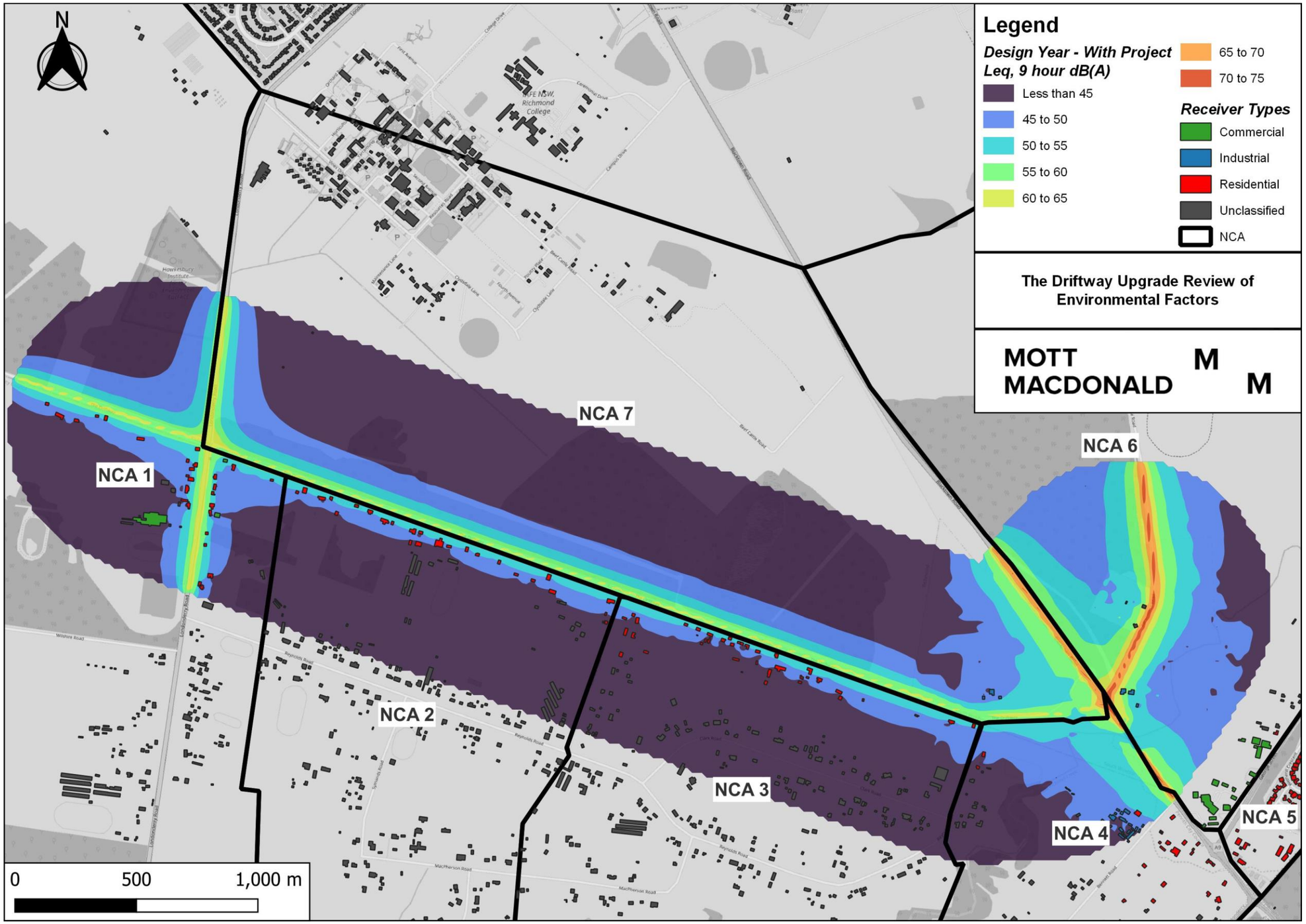

Figure A.8: Design Year (2036) – With Project – Night-time Noise Contour Map

B. Appendix – Traffic Volume Information

Table B-1: Existing Traffic Volume utilised for Validation Modelling

Existing Traffic Volume – 2020

	Day (15-hour)		Night (9-hour)	
Road Section	**Light**	**Heavy**	**Light**	**Heavy**
The Driftway – Eastbound				
West of Londonderry Road	996	75	206	23
Between Londonderry and Luxford Road	869	140	185	48
Between Luxford Road and Reynolds Road	791	218	168	84
Between Reynolds Road and Blacktown Road	1242	187	265	61
The Driftway – Westbound				
Between Reynolds Road and Blacktown Road	1585	213	139	26
Between Luxford Road and Reynolds Road	1087	196	103	21
Between Londonderry and Luxford Road	1140	114	109	15
West of Londonderry Road	1397	118	111	14
Londonderry Road – Northbound				
South of The Driftway	4006	200	423	34
North of Driftway	3536	246	377	35
Londonderry Road – Southbound				
North of Driftway	3379	409	348	62
South of The Driftway	3440	548	360	86

Table B-2: Build Year Traffic Volume

			Opening Without Project				**Opening With Project**			
			Daytime		**Night-time**		**Daytime**		**Night-time**	
			7am-10pm		**10pm-7am**		**7am-10pm**		**10pm-7am**	
Road	**Section**	**Direction**	**LV**	**HV**	**LV**	**HV**	**LV**	**HV**	**LV**	**HV**
Driftway	Between Blacktown Road and Reynolds Road	Eastbound	1600	213	314	66	2667	355	524	110
		Westbound	1963	231	187	26	3272	385	312	43
Driftway	Between Reynolds Road and Luxford Road	Eastbound	1160	155	228	48	1934	258	380	80
		Westbound	1423	168	136	19	2372	279	226	31
Driftway	Between Luxford and Londonderry Road	Eastbound	1131	151	222	47	1886	251	370	78
		Westbound	1388	163	132	18	2313	272	220	31
Driftway	West of Londonderry Road	Eastbound	1240	165	243	51	2067	275	406	86
		Westbound	1521	179	145	20	2536	298	242	34
Londonderry Road	South of The Driftway	Northbound	3190	224	353	34	4784	336	530	50
		Southbound	3045	382	312	57	4567	573	468	86
Londonderry Road	North of Driftway	Northbound	2926	205	324	31	4389	308	486	46
		Southbound	2793	350	286	53	4190	525	429	79
Blacktown Road	South of The Driftway	Northbound	10696	1012	1760	360	10433	987	1717	351
		Southbound	10772	608	1225	106	10508	594	1195	103
Blacktown Road	North of The Driftway	Northbound	8706	824	1433	293	8493	803	1397	285
		Southbound	8769	495	997	86	8554	483	973	84
Racecourse Road	East of Blacktown Road	Eastbound	1000	1000	1000	1000	1000	1000	1000	1000
		Westbound	1000	1000	1000	1000	1000	1000	1000	1000

Table B-3: Design Year Traffic Volume

			Opening Without Project				**Opening With Project**			
			Daytime		**Night-time**		**Daytime**		**Night-time**	
			7am-10pm		**10pm-7am**		**7am-10pm**		**10pm-7am**	
Road	**Section**	**Direction**	**LV**	**HV**	**LV**	**HV**	**LV**	**HV**	**LV**	**HV**
Driftway	Between Blacktown Road and Reynolds Road	Eastbound	1245	166	244	52	3423	456	672	142
		Westbound	1527	180	145	20	4199	494	400	56
Driftway	Between Reynolds Road and Luxford Road	Eastbound	902	120	177	37	2482	331	487	103
		Westbound	1107	130	105	15	3044	358	290	40
Driftway	Between Luxford and Londonderry Road	Eastbound	880	117	173	36	2420	322	475	100
		Westbound	1079	127	103	14	2969	349	283	39
Driftway	West of Londonderry Road	Eastbound	965	129	189	40	2653	353	521	110
		Westbound	1183	139	113	16	3254	383	310	43
Londonderry Road	South of The Driftway	Northbound	3638	255	403	38	5681	399	630	60
		Southbound	3473	435	356	65	5424	680	556	102
Londonderry Road	North of Driftway	Northbound	3338	234	370	35	5212	366	578	55
		Southbound	3186	399	327	60	4976	624	510	94
Blacktown Road	South of The Driftway	Northbound	11587	1096	1907	389	11587	1096	1907	389
		Southbound	11670	659	1327	115	11670	659	1327	115
Blacktown Road	North of The Driftway	Northbound	9432	892	1552	317	9432	892	1552	317
		Southbound	9499	537	1081	93	9499	537	1081	93
Racecourse Road	East of Blacktown Road	Eastbound	1000	1000	1000	1000	1000	1000	1000	1000
		Westbound	1000	1000	1000	1000	1000	1000	1000	1000

C. Appendix – Façade Noise Levels