Technical Paper

Construction noise and vibration

Appendices C to E

4

APPENDIX C

Construction Scenarios and Equipment

Table 1 Equipment Lists and Sound Power Levels

Equipment			TOTAL SWL	Backhoe (7.5 tonne)	Ballast Tamper	Compressor	Compressor for Air Scrubber	Concrete Mixer Truck	Concrete Pump	Concrete Saw[1]	Concrete Vibrator	Dozer	Dump Truck (approx. 15 tonne)	Elevated Working Platform	Excavator Breaker[1]	Excavator (14 tonne)	Excavator (22 tonne)	Excavator (Diamond Rock Saw)[1]	Forklift	Front End Loader	Grader	Grinder[1]	Hand Tools	Rail Trolley	Lighting Diesel Generator	Mobile Crane	Piling Bored	Rail Saw	Road Header	Rock Anchor Drill[1]	Roller Vibratory (12 tonne)[1]	Shotcrete Rig	Skidsteer Loader	Tower Crane	Truck (30% acceleration)	Ventilation Scrubber	Water Pump	Welding Equipment	Excavator Ripper
Sound Power Level[2]				102	118	95	100	103	106	124	102	112	107	97	126	100	105	111	101	110	108	110	94	100	98	98	111	114	113	113	114	106	97	100	108	98	83	97	105
Estimated on-time in any 15 minutes				15	15	15	15	15	15	5	15	8	3	3	10	8	8	5	15	8	15	5	15	15	15	8	8	15	15	8	15	15	15	8	3	15	8	5	10
Scenario	**Activity**																																						
Site establishment and public domain works	Typical	Deliveries and general work	106											X			X		X				X												X				
	Peak	Construction / decommissioning of facilities and hoarding	111											X			X		X			X	X			X							X		X			X	
Piling	Typical	Supporting work	108					X			X						X						X			X									X		X		
	Peak	Bored piling with support plant	112			X		X	X		X						X						X			X	X								X		X		
Station / facility construction	Typical	Indoor construction and fitout	104											X					X				X			X											X	
	Peak 1	Installation of framing and structure	109											X					X			X	X			X								X	X			X	
	Peak 2	Concrete work	120					X	X	X	X			X									X																
Rail system access shafts	Typical	Surface support	103																X							X													
	Peak	Deliveries and Tunnel Access	115																X							X		X						X	X				
Earthworks	Typical	Stockpiling and support	115	X													X									X						X		X				
	Peak	Excavation and compacting	116	X								X					X				X									X		X		X				
Above ground rail	Typical	Track installation	105														X		X				X														X	
	Peak	Track subgrade, capping and tamping	119		X												X				X		X														X	

Equipment			TOTAL SWL	Backhoe (7.5 tonne)	Ballast Tamper	Compressor	Compressor for Air Scrubber	Concrete Mixer Truck	Concrete Pump	Concrete Saw[1]	Concrete Vibrator	Dozer	Dump Truck (approx. 15 tonne)	Elevated Working Platform	Excavator Breaker[1]	Excavator (14 tonne)	Excavator (22 tonne)	Excavator (Diamond Rock Saw)[1]	Forklift	Front End Loader	Grader	Grinder[1]	Hand Tools	Rail Trolley	Lighting Diesel Generator	Mobile Crane	Piling Bored	Rail Saw	Road Header	Rock Anchor Drill[1]	Roller Vibratory (12 tonne)[1]	Shotcrete Rig	Skidsteer Loader	Tower Crane	Truck (30% acceleration)	Ventilation Scrubber	Water Pump	Welding Equipment	Excavator Ripper
Sound Power Level[2]				102	118	95	100	103	106	124	102	112	107	97	126	100	105	111	101	110	108	110	94	100	98	98	111	114	113	113	114	106	97	100	108	98	83	97	105
Estimated on-time in any 15 minutes				15	15	15	15	15	15	5	15	8	3	3	10	8	8	5	15	8	15	5	15	15	15	8	8	15	15	8	15	15	15	8	3	15	8	5	10
Scenario	**Activity**																																						
Brownfield work	Typical	Deliveries and supporting work	102																				X	X		X												
	Peak 1	Installation of framing and structure	110											X			X		X			X	X	X		X								X			X	
	Peak 2	Removal of existing structures	120							X				X			X					X	X	X		X								X			X	
Excavation	Typical	Mucking out	112									X					X			X						X								X				
	Peak 1	Throung soft soil/rock	115									X					X			X						X				X		X			X				X
	Peak 2	Through rock using a rockbreaker	125									X			X		X			X						X				X		X			X				
Road work	Typical	Supporting work	106														X						X		X										X				
	Peak	Noise intensive work	125							X					X		X						X		X	X									X				
Mined tunnel	Typical	Spoil removal	110				X						X	X		X				X			X												X	X	X		
	Peak	Mining with support	117				X						X			X		X		X									X	X		X			X	X			

Note 1: Equipment classed as 'annoying' in the ICNG and requires a 5 dB correction.

Note 2: Sound power level data is taken from the DEFRA Noise Database, RMS *Construction and Vibration Guideline* and TfNSW *Construction Noise and Vibration Strategy*.*Construction and Vibration Guideline* and TfNSW *Construction Noise and Vibration Strategy*.

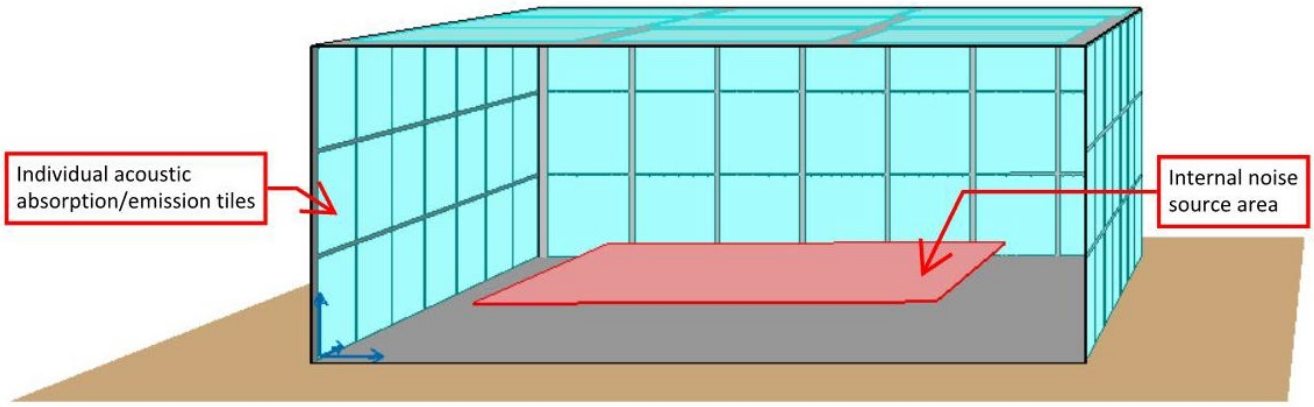
APPENDIX D

Acoustic Shed Acoustic Properties

The acoustic sheds have been modelled with a height of between 15 metres and 25 metres. The footprint of each shed was determined from indicative design information and the sheds were positioned to cover the excavation and internal spoil handling areas.

The sheds were modelled with sound absorption and transmission loss properties applied to each wall, floor and ceiling surface using a five metre grid as shown in **Figure 1**. The various internal construction noise sources were represented in the model using area sources.

Figure 1 Example Acoustic Shed Arrangement



The sheds were modelled with internal acoustic absorption applied to surfaces five metres above ground level and the shed floors were conservatively modelled as reflective as they would mostly be concrete or other equivalent hard ground.

An additional 'doors open' scenario was modelled for locations where trucks are required to drive in and out of the sheds to collect spoil. No specific mitigation measures were included regarding noise transmitted through open doors.

Acoustic absorption and transmission loss values were based on data for products used to construct acoustic sheds on previous stages of Sydney Metro.

A summary of the modelled sound absorption coefficients is shown in **Table 1** and the transmission loss values for each shed element are summarised in **Table 2**.

Table 1 Acoustic Shed Absorption Coefficient Values

Internal Shed Element	Assumed Construction	Absorption Coefficient, α							
		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	Total α_ω
Roof	0.48 mm steel cladding with 55 mm Permastop building blanket (12 kg/m3)	0.15	0.45	0.70	0.70	0.70	0.70	0.70	0.70
Wall above 5 m	78.0 mm SpeedWall panel (400kg/m3) with 55 mm Permastop building blanket (12 kg/m3)	0.15	0.45	0.70	0.70	0.70	0.70	0.70	0.70
Wall below 5 m	78.0 mm SpeedWall panel (400kg/m3)	0.30	0.40	0.30	0.15	0.10	0.04	0.12	0.10
Open Door[1]	Opening	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Floor	Concrete	0.02	0.02	0.02	0.02	0.03	0.04	0.05	0.05

Note 1: Open doors are modelled as fully absorptive inside the shed to stop reflections from this element contributing to internal noise levels.

Table 2 Acoustic Shed Transmission Loss Values

Internal Shed Element	Assumed Construction	Sound Reduction, R (dB)							
		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	Total R_w
Roof	0.48 mm steel cladding with 55 mm Permastop building blanket (12 kg/m3)	6	17	28	38	48	59	69	39
Walls[1]	78.0 mm SpeedWall panel (400kg/m3)1	26	24	32	47	59	70	79	45
Open Door	Opening	0	0	0	0	0	0	0	0

Note 1: 55 mm Permastop building blanket (12 kg/m^3) does not significantly affect transmission loss

Sound power level data for the noisiest equipment used in the sheds was based on data from the Department for Environment Food & Rural Affairs (DEFRA) *Noise Database For Prediction Of Noise On Construction And Open Sites* and is shown in **Table 3**.

The below octave band data was adjusted based on the quantity of equipment and number of construction faces in each scenario.

Table 3 Noise Source Sound Power Level Spectra

Noise Source[1]	Sound Power Level (dB)							
	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
Circular Bench Saw	85	74	72	80	72	76	82	77

Note 1: Octave band sound power level data based on DEFRA Noise Database.

APPENDIX E

Construction Road Traffic Noise

312000
313000
314000
6257000

NCA01

Bailey Street
Hawkesbury Road
Hassall Street
Priddle Street
Alexandra Avenue
Great Western Highway
Pitt Street

Westmead Centre for Oral Health
Westmead Hospital
University Clinics
Women's Health & Treatment
Diagnostic and Newborn
Visitor Car Park 3
Visitor Car Park 1
Marist High School
Westmead Station
Parramatta Park
Queens St
Parramatta Golf Club
Sydney Smith Park
Westmead Park
Wentworthville Park
Lytton Park
Mays Hill Reserve

Darcy Rd
Gleneavy St
Bourne St
Hill St
Railway St
Water St
Short St
Lydbrook St
Reid Ave
Byrne St
The Kingsway
Wentworthville Station
Wentworth Ave
Cumberland Hwy
Pritchard St E
Veron St
McKern St
Garfield St
Perry St
Station St
Lane St
Lytton St
Bennett St
Hudson St
Killeen St
Barry Pl
Fullagar Rd
Bransgrove St
Essington St
Old Prospect Rd
A44
Great Western Hwy
Western Mtwy
M4
Alto St
Pearson St
Benson St
Brewer Cres
Tooheys Rd
Gowrie Cres
Curtin Pl
McArthur Cres
School Pde
Nolan Cres
Fenwick Pl
Grand Ave
Moree Ave
Jordan St
Austral Ave
Haig St
Church Ave
Ralph St
Mimosa St
Cotswold St
Howe St
Bernard St
Whitworth St
Anderson St
Hannah St
Broxbourne St
Fraser St
Amos St
Drew St
Houison St
Good St
Parkside Ln
Lichen Pl
Park Pde
Jessie St
Helen St
Caroline St
Queens Rd
Ashley Ln
Central Ave
Alfred St
Railway Pde
Bailey St
Priddle St
Mowle St
Oakes St
Pitt Ln
O'Reilly St
King St

0 250 500 Meters

Scale: 1:7,000 at A4
Coordinate system: GDA2020 MGA Zone 56

Date drawn: 23-Dec-2021
Project number: 610.30390

SLR

Worst-case Change in Road Traffic Noise Levels All Periods

APPENDIX E

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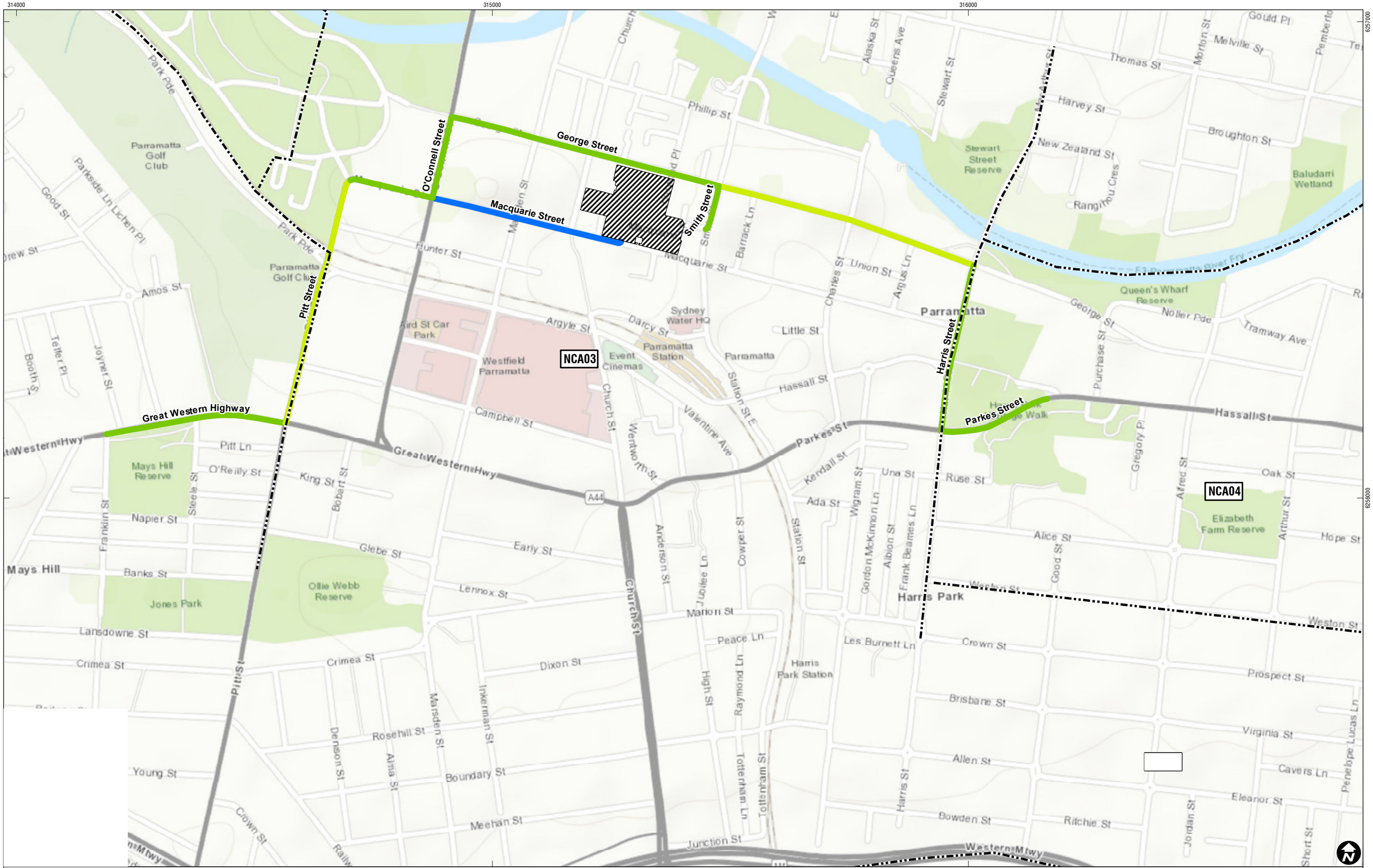

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Coordinate system: GDA2020 MGA Zone 56

Date drawn: 23-Dec-2021
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Worst-case Change in Road Traffic Noise Levels All Periods

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Scale: 1:6,000 at A4
Coordinate system: GDA2020 MGA Zone 56

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Worst-case Change in Road Traffic Noise Levels All Periods

APPENDIX E

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322000
323000
324000
6252000
6251000

NCA10
NCA11

Underwood Road
Pomeroy Street
Queen Street
Wellbank Street
Concord Road
Gipps Street

Bressington Park
Mason Park
JB Hi Fi DFO Homebush
Direct Factory Outlets Homebush
Central Park
Henley Park
North Strathfield
Homebush
North Strathfield Station

0 250 500 Meters

Scale: 1:6,000 at A4
Coordinate system: GDA2020 MGA Zone 56

Date drawn: 23-Dec-2021
Project number: 610.30390

SLR

Worst-case Change in Road Traffic Noise Levels All Periods

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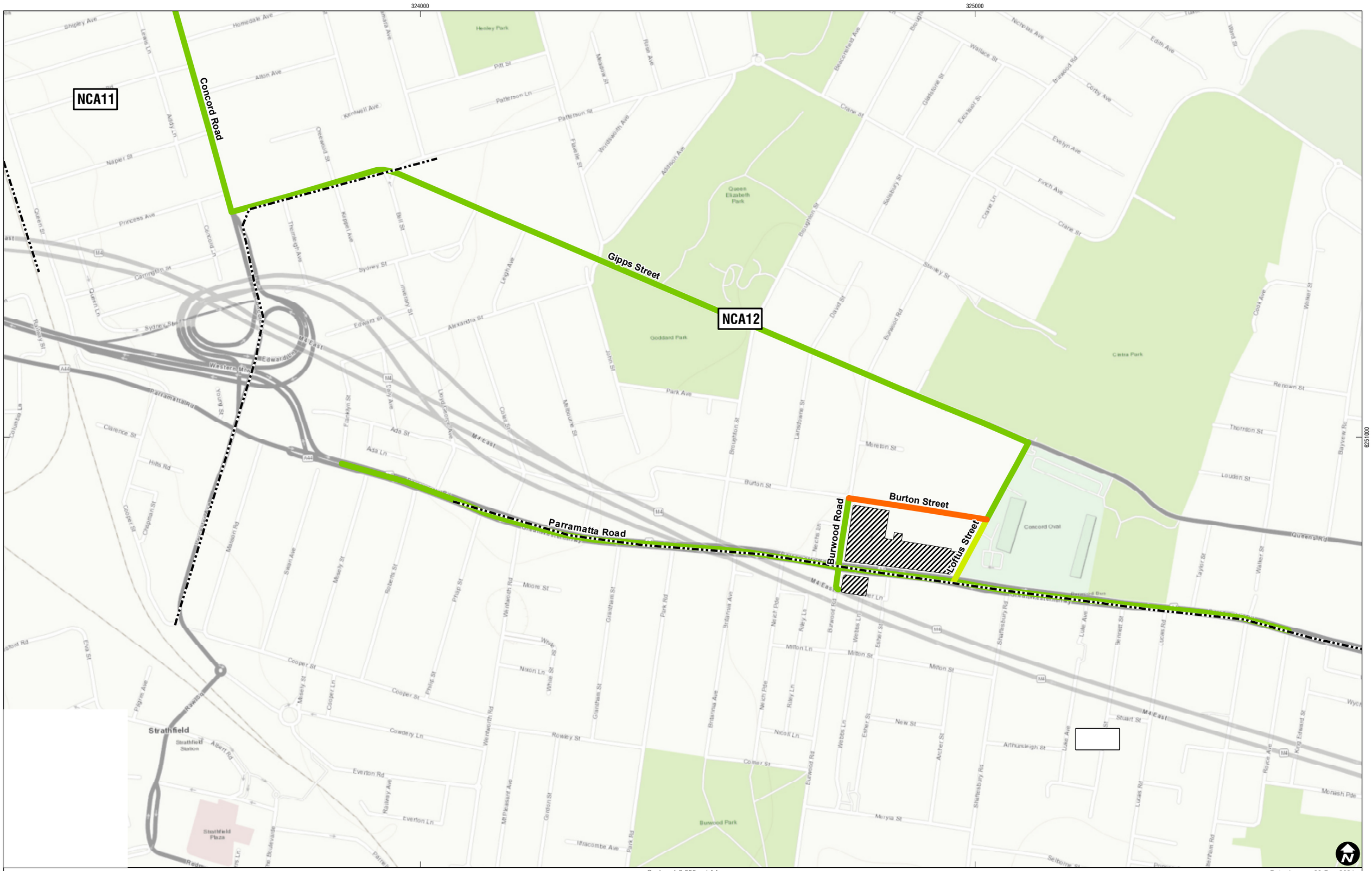

0 250 500 Meters

Scale: 1:6,000 at A4
Coordinate system: GDA2020 MGA Zone 56

Date drawn: 23-Dec-2021
Project number: 610.30390

SLR

Worst-case Change in Road Traffic Noise Levels All Periods

APPENDIX E

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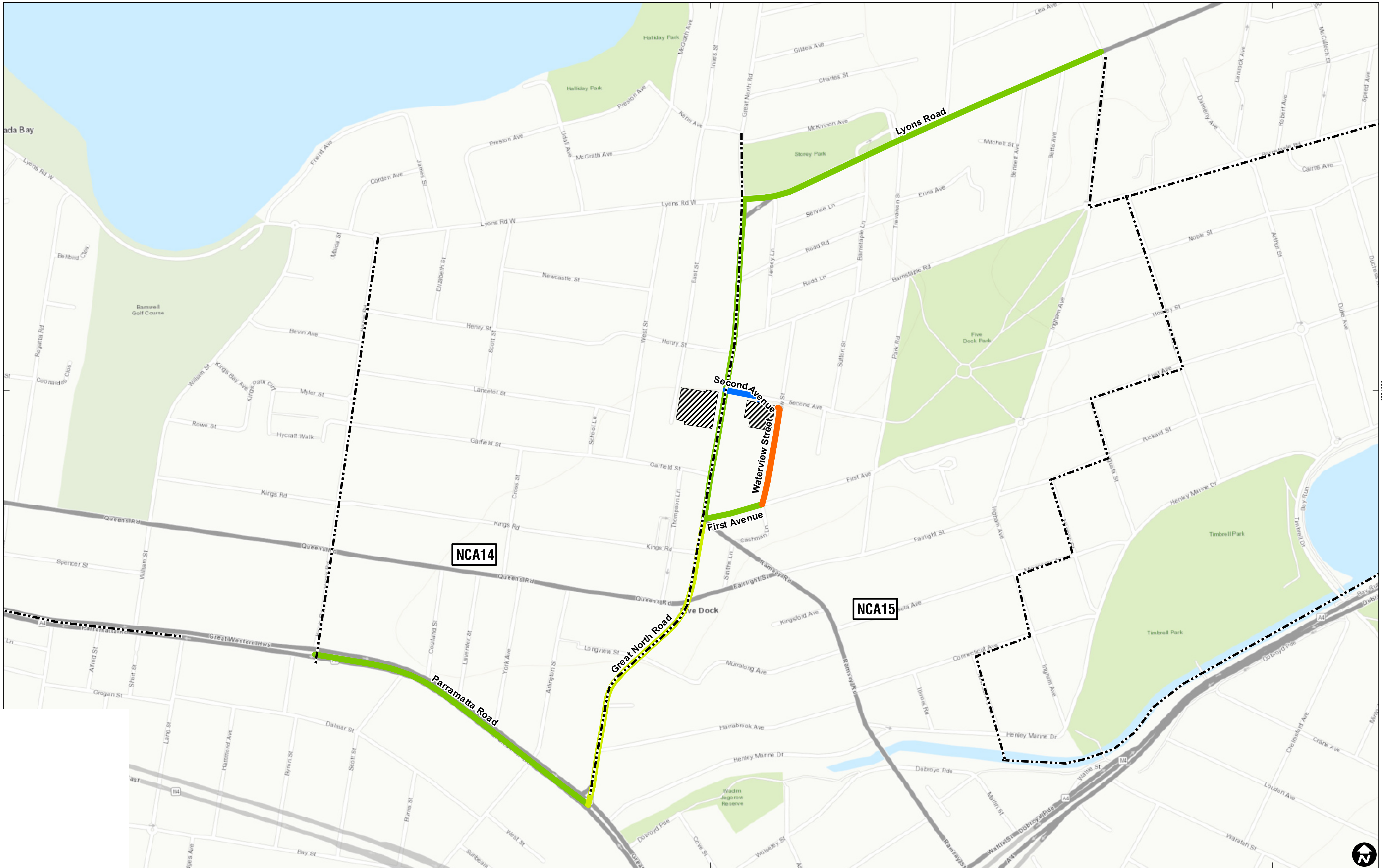

0 250 500 Meters

Scale: 1:6,000 at A4
Coordinate system: GDA2020 MGA Zone 56

Date drawn: 23-Dec-2021
Project number: 610.30390

SLR

Worst-case Change in Road Traffic Noise Levels All Periods

APPENDIX E

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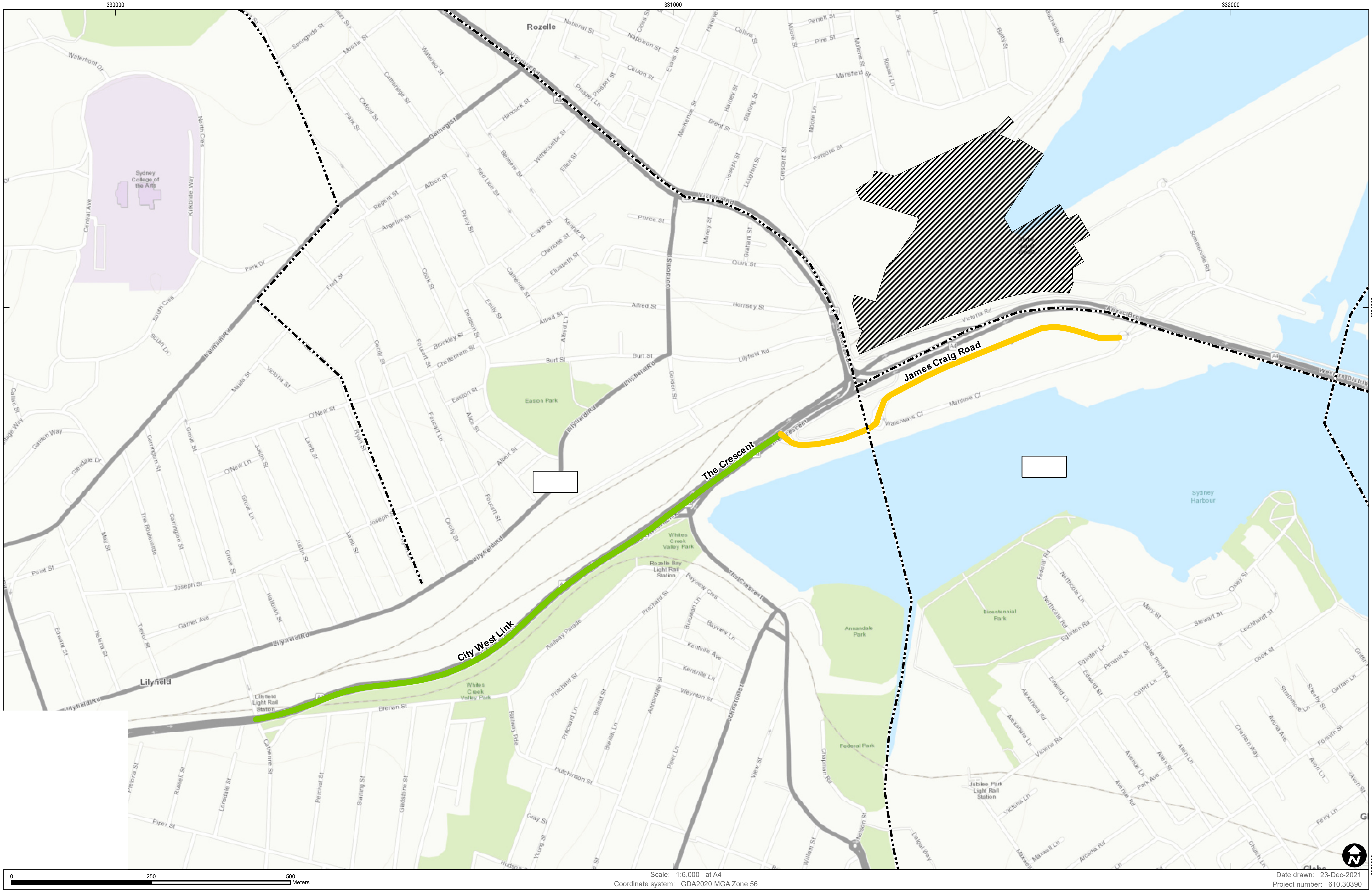

Scale: 1:6,000 at A4
Coordinate system: GDA2020 MGA Zone 56

Date drawn: 23-Dec-2021
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Worst-case Change in Road Traffic Noise Levels All Periods

APPENDIX E

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332000 333000 334000

6251000

6250000

NCA 23

NCA 24

Union Street

Pyrmont Street

Bank Street

Pyrmont Bridge Road

Darling Drive

Harris Street

Glebe Point

Darling Harbour

0 250 500 Meters

Scale: 1:5,000 at A4
Coordinate system: GDA2020 MGA Zone 56

Date drawn: 23-Dec-2021
Project number: 610.30390

SLR

Worst-case Change in Road Traffic Noise Levels All Periods

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334000

335000

6251000

Bridge Street

Clarence Street

Margaret Street

George Street

O'Connell Street

Bent Street

Macquarie Street

Hunter Street

NCA 25

NCA 26

Wynyard

Sydney

Circular Quay

Woolloomooloo

Potts

0 250 500 Meters

Scale: 1:5,000 at A4
Coordinate system: GDA2020 MGA Zone 56

Date drawn: 23-Dec-2021
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Worst-case Change in Road Traffic Noise Levels All Periods

APPENDIX E

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316000
317000
318000
319000
6256000
6255000
6254000
NCA04
NCA 06
Elizabeth Farm Reserve
Rosehill Gardens Racecourse
Camellia
Rosehill
Grand Ave
Harris Park
Harris Park Station
Granville
Granville Station
Granville Memorial Park
Clyde Station
Duck River
Duck Creek
Silverwater
Parramatta Road
Wentworth Street
Martha Street
Carnarvon Street
Western Mtwy
Parramatta Rd
Unwin St
Devon St
Colquhoun St
Durham St
Weston St
Crown St
Prospect St
Brisbane St
Virginia St
Allen St
Bowden St
Ritchie St
Eleanor St
A'Beckett St
Prince St
Victoria St
Gray St
Cowper St
East St
Russell St
Railway Pde
Memorial Dr
William St
First St
Second St
Third St
Fourth St
New York St
Archibald St
Queen St
Millennium Ct
Fisher St
Derby St
Asquith St
Carnarvon St
Beaconsfield St
Deakin St
Short St
Duck St
Junction St
Sutherland St
Harbord St
Kendall St
Shirley St
M4
A44

0 250 500 Meters

Scale: 1:9,000 at A4
Coordinate system: GDA2020 MGA Zone 56

Date drawn: 23-Dec-2021
Project number: 610.30390

SLR

Worst-case Change in Road Traffic Noise Levels All Periods

APPENDIX E

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