Pitt Town Bypass

Review of Environmental Factors

Roads and Maritime Services | Novermber 2018

Volume 3 of 3 - Technical reports, Appendix G to Appendix J



NSW GOVERNMENT

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Pitt Town Bypass

Review of Environmental Factors

Roads and Maritime Services | November 2018

Volume 3 of 3 - Technical reports, Appendix G to Appendix J

Prepared by Arcadis and Roads and Maritime Services

Publication Number: 18.1083

ISBN: 978-1-925093-92-6

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Document controls

Approval and authorisation

Title	Pitt Town Bypass review of environmental factors
Accepted on behalf of NSW Roads and Maritime Services by:	Ankur Arora Project Development Manager
Signed:	
Dated:	6 November 2018

Document status

Document status	Date	Prepared by	Reviewed by
Draft 1	21 June 2018	Danielle Haynes	Javier Valderrama
Draft 2	18 August 2018	Danielle Haynes	Javier Valderrama
Draft 3	9 October 2018	Danielle Haynes	Javier Valderrama
Draft 4	16 October 2018	Danielle Haynes	Javier Valderrama
Final for public display	6 November 2018	Danielle Haynes	Javier Valderrama

Contents

Appendices

Appendix G	Noise and Vibration Assessment
Appendix H	Hydrology and Hydraulic Investigation
Appendix I	Non-Aboriginal Statement of Heritage Impact
Appendix J	Traffic and Transport Assessment

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Appendix G

Noise and Vibration Assessment

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Resonate

Pitt Town Bypass

Review of Environmental Factors
Noise and Vibration Assessment

S17876RP1 Revision E

Tuesday, 9 October 18

Resonate

Document Information

Project	Pitt Town Bypass	
Client	Arcadis Australia Pacific Pty Ltd	
Report title	Pitt Town Bypass Review of Environmental Factors Noise and Vibration Assessment	
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Revision Table

Report revision	Date	Comments
0	1 March 2018	Draft for comment
A	18 May 2018	Draft for comment
B	11 July 2018	Draft for comment
C	30 July 2018	Draft for comment
D	29 August 2018	Draft for comment
E	9 October 2018	Final version

Glossary

'A' Weighted	A spectrum adaption that is applied to measured noise levels to approximate human hearing. A-weighted levels are used as human hearing does not respond equally at all frequencies.
dB	Decibel—a unit of measurement used to express sound level. It is based on a logarithmic scale which means a sound that is 3 dB higher has twice as much energy. We typically perceive a 10 dB increase in sound as a doubling of that sound level.
dB(A)	'A' Weighted sound level in dB.
Feasible and reasonable	Consideration of best practice noise and vibration mitigation measures f taking into account the benefit of proposed measures and their technological and associated operational application in the NSW and Australian context. Feasible relates to engineering considerations and what is practical to build. Reasonable relates to the application of judgement in arriving at a decision, taking into account mitigation benefits and cost of mitigation versus benefits provided, community views and nature and extent of potential improvements.
Frequency	The number of times a vibrating object oscillates (moves back and forth) in one second. Fast movements produce high frequency sound (high pitch/tone), but slow movements mean the frequency (pitch/tone) is low.
Hz	Hertz—units of frequency.
L_{eq}	Equivalent Noise Level—energy averaged noise level over the measurement time.
$L_{eq,\ (15\ min)}$	A-weighted energy averaged noise level over a 15-minute period. Used in the EPA Interim Construction Noise Guideline (ICNG).
$L_{eq,\ (15\ hour)}$	A-weighted energy averaged noise level over the 15-hour daytime period from 7 am to 10 pm. Used in the EPA Road Noise Policy (RNP).
$L_{eq,\ (9\ hour)}$	A-weighted energy averaged noise level over the 9-hour night-time period from 10 pm to 7 am. Used in the EPA Road Noise Policy (RNP).
mm/s	Millimetres per second—unit of vibration velocity.
$m/s^{1.75}$	Units of VDV.
Noise Management Level (NML)	Construction noise management level. Where the construction noise levels are above the NML, additional consideration of feasible and reasonable noise mitigation is required.
Peak Particle Velocity (PPV)	The maximum speed of a particle in a particular component direction due to vibration during a measurement.
Rating Background Level (RBL)	The Rating Background Level for each period is the median value of the average background values for the period over all of the days measured. There is an RBL value for each period (day, evening and night).
Vibration	Refers to the oscillation of an object back and forth, normally the ground.
Vibration Dose Value (VDV)	A measure used to assess the level of vibration over a defined time period, such as a day, evening or night. Often used for the assessment of intermittent construction vibration that may rise and fall across a day.

Resonate

Table of Contents

1 Introduction 1

1.1 Assessment objectives 1

1.2 Project description 1

1.3 Proposed road design objectives and criteria 3

1.4 Construction 5

1.4.1 Ancillary facilities 7

1.4.2 Construction hours and duration 7

2 Existing ambient noise environment 8

2.1 Noise monitoring 8

2.1.1 Unattended noise monitoring 8

2.1.2 Weather conditions 8

2.2 Unattended noise monitoring results 9

2.2.1 Attended noise monitoring 10

2.3 Noise catchment areas 10

3 Operational road traffic noise 13

3.1 Operational road traffic noise criteria 13

3.1.1 Residential receivers 13

3.1.2 Relative increase criterion 14

3.1.3 Cumulative limit 14

3.1.4 Acute 14

3.1.5 Non-residential land uses 15

3.1.6 Assessing eligibility for consideration of noise mitigation measures 18

3.2 Operational noise assessment 18

3.2.1 Road traffic noise modelling methodology 18

3.2.2 Road traffic noise modelling parameters 19

3.2.3 Road traffic noise model validation 20

3.2.4 Predicted noise levels 21

3.2.5 Design of noise mitigation measures 22

3.3 Assessment of maximum noise levels 24

3.3.1 Assessment basis 24

3.3.2 Assessment methodology 24

4 Construction noise and vibration 26

4.1 Construction noise criteria 26

4.1.1 Interim Construction Noise Guideline (DECC) 26

4.1.2 Construction Noise and Vibration Guideline (Roads and Maritime) 26

4.3 Noise management levels 27
4.3.1 Residential and aged care land uses 27
4.3.3 Other sensitive land uses 28
4.3.4 Commercial and industrial premises 28
4.3.5 Sleep disturbance 28
4.3.6 Ground-borne noise 28
4.4 Construction vibration criteria 29
4.4.1 Cosmetic and structural damage 29
4.4.2 Human comfort 31
4.5 Construction noise assessment 32
4.5.1 Project specific Noise Managements Levels 32
4.6 Predicted noise levels 33
4.6.1 Typical construction scenarios 33
4.6.2 Ancillary facilities 35
4.7 Discussion of predicted construction noise levels 42
4.7.1 Noise Catchment Area 1 42
4.7.2 Noise Catchment Area 2 43
4.7.3 Noise Catchment Area 3 43
4.7.4 Noise Catchment Area 4 44
4.7.5 Noise Catchment Area 5 44
4.7.6 Noise Catchment Area 6 45
4.7.7 Ancillary facilities 45
4.7.8 Construction traffic 46
4.8 Construction vibration 46
4.8.1 Minimum working distances 46
4.8.2 Vibration intensive activities 47
4.8.3 Heritage structures 48
5 Construction noise and vibration mitigation 49
5.1 Standard mitigation measures 49
5.2 Additional mitigation measures 53
5.3 Detailed description of CNVG additional mitigation measures 56
5.4 Vibration mitigation 58
6 Conclusion 59

1 Introduction

Roads and Maritime Services (Roads and Maritime) proposes to build a road bypass of Pitt Town, NSW (the proposal). The proposal is approximately one kilometre in length, extending from Pitt Town Road to Buckingham Road to the east of Pitt Town town centre. The proposal comprises of one lane in each direction with a posted speed limit of 70 km/h.

Pitt Town is located to the north west of Sydney, roughly 60 kilometres from Sydney's Central Business district. A population of approximately 5,000 currently inhabit Pitt Town in generally separated residences.

The study area of the REF includes a minimum 25-metre wide buffer either side of the centreline of the proposed new alignment and land occupied by the ancillary facilities. The approximate total area under investigation is 17.3 ha.

1.1 Assessment objectives

Resonate has been engaged by Arcadis to prepare a noise and vibration impact assessment for inclusion in a Review of Environmental Factors (REF) for the proposal. The assessment objectives are to determine:

- The existing ambient noise environment surrounding the site,
- The impact of the operational road once its built and in the future,
- The noise and vibration impact that may be generated by the construction of the road.

1.2 Project description

The proposed bypass would provide a connection between Pitt Town Road and Cattai Road to improve road connectivity and safety in the area. Presently the main thoroughfare between these two roads involves traffic going through the centre of Pitt Town. The construction of this bypass would assist to retain the local amenity and character of Pitt Town with future infrastructure and transport growth.

The key features of the proposal include:

- Extend Pitt Town Road past Bathurst Street onto Cattai Road, east of Eldon Street
- Install a new roundabout at Eldon Street and Old Pitt Town Road
- Closing a portion of Cattai Road to maintain access to Buckingham Street
- Providing new crossings of Hortons Creek at the southern and central sections of the project
- Install a new roundabout at Pitt Town Road/Bathurst Street and Glebe Road.

Figure 1-1 provides an overview of the proposed road alignment, proposed locations for ancillary and stockpile facilities and both attended and unattended noise monitoring locations.

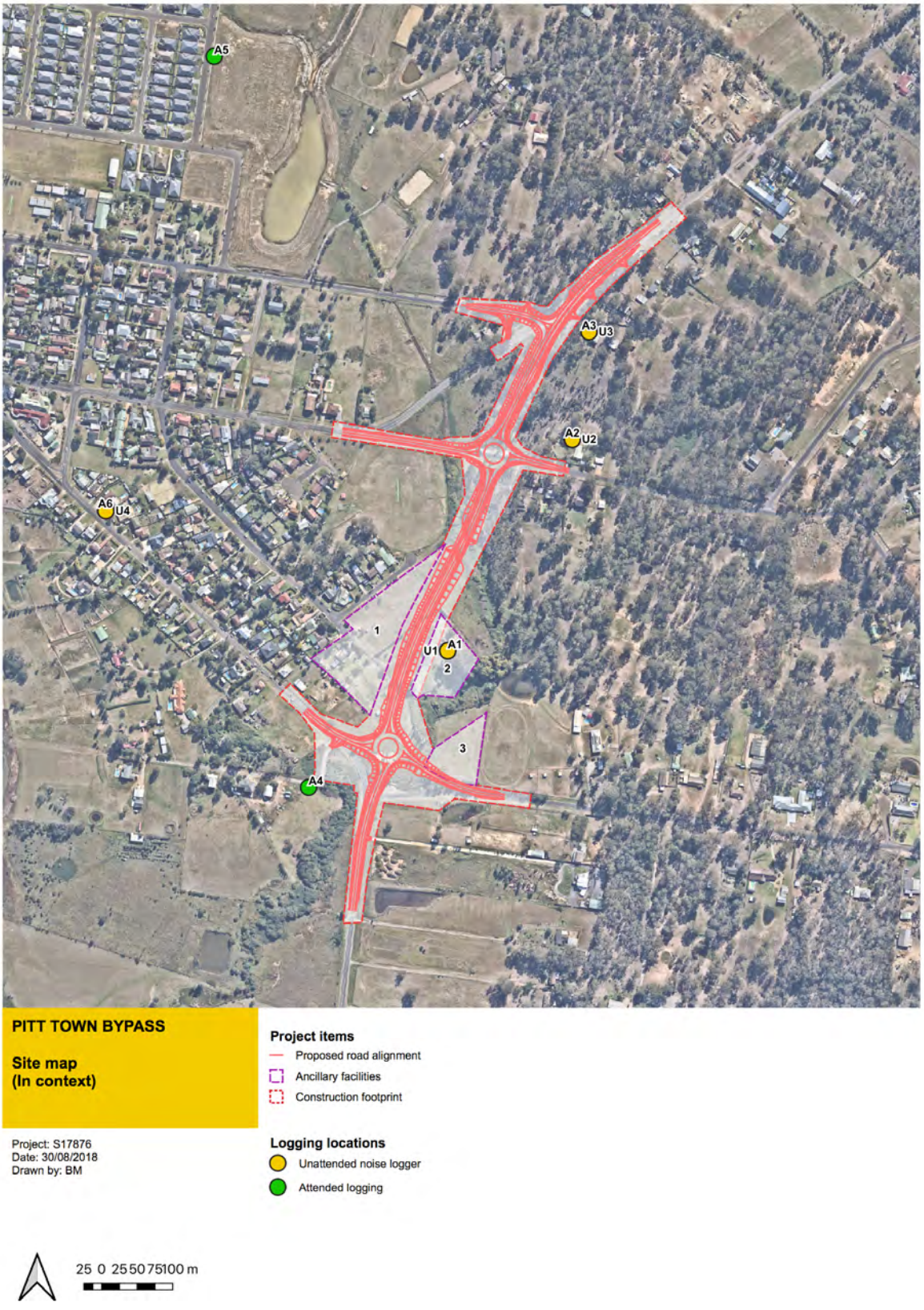


Figure 1-1 Site map in context

1.3 Proposed road design objectives and criteria

The concept design for the proposal has been prepared to achieve a compliant road geometry with a design speed of 80 km/h for the main proposal alignment and 60 km/h for other local road sections including:

- Bathurst Street
- Glebe Road
- Eldon Street
- Old Pitt Town Road
- Buckingham Street

The concept design is intended to:

- Maintain acceptable travel times and conditions for general traffic and freight through movements
- Maintain acceptable operation of intersections with sufficient separation or storage of turning traffic from through traffic
- Improve connectivity and safety for general and active transport users
- Minimise environmental impacts and maximise the quality of urban and landscape design outcomes.

The concept design is described below and will be further refined during detailed design.

The key design criteria for the proposal are listed in Table 1-1 and Table 1-2.

Table 1-1 Proposal main alignment design criteria

Design element	Minimum Criteria
Posted speed limit	70 km/h
Design speed	80 km/h
Design Vehicle	25 m B-Double
Number of lanes	One lane each way (excluding auxiliary lanes)
Typical traffic lane width	3.5 m
Shoulder width	1.0 m
Verge width	1.0 m
Batter slope	6H:1V or 4H:1V desirable, 2H:1V minimum
Pavement life	40 years for new pavement 20 years for rehabilitated pavement
Flood immunity	20 year average recurrence interval (ARI) local catchment design storm to the edge line of the through lanes.

Table 1-2 Proposal Other Local Road design criteria

Posted speed limit	60 km/h
Design speed	60 km/h
Design Vehicle	12.5m Single Unit Truck or existing design vehicle, whichever is larger
Number of lanes	One lane each way
Typical traffic lane width	3.5 m for new sections of road, tapering to existing lane widths where connecting to existing
Shoulder width	1 m for new sections of road or match existing
Median width	NIL
Verge width	1 m
Batter slope	4:1 or 6:1 desirable
Pavement life	40 years for new pavement 20 years for rehabilitated pavement
Flood immunity	As per existing road immunity

1.4 Construction

Subject to planning approval, construction of the proposal is anticipated to start in June 2020 and be completed by January 2022. The overall duration of the proposal would depend on timing and outcomes of key decisions about procurement, such as early works and contract packaging, and the project delivery method.

A potential construction sequence and the main construction activities for each stage, are described in Table 1-3.

Table 1-3 Construction staging

Stage	Description	Duration
Stage 1- Greenfield Construction (Pitt Town Road to Old Pitt Town Road, Old Pitt Town Road to Cattai Road)	• Set up ancillary sites off Glebe Road and Wellesley Street • Provide property access to 54 Wellesley Street • Start constructing the greenfield sections, between Pitt Town Road and Old Pitt Town Road, and Old Pitt Town Road and Cattai Road • Start construction of two-span plank bridge • Works on bridge to commence including piles, abutments, headstocks etc. • Works on the sewer rising main and Telstra utilities located at the southern roundabout • Build low flow pipes and temporary access road for the construction of the plank bridge crossing • Creek diversion • Build culverts PTB3 and Bathurst Street culvert prior to culvert PTB2 and the southern roundabout. • Build temporary access road in the location of the plank bridge • Build culvert under the southern roundabout with a single western-facing headwall.	9-12 months
Stage 2- Southern Roundabout to Cattai Road	• Close Old Pitt Town Road • Divert traffic around Old Pitt Town Road closure via Cattai Road, Pitt Town Dural Road and Airstrip Road • Build the southwest retaining walls for the northern roundabout • Build culvert OPT5 and PTB5 • Build the eastern and western legs of the northern roundabout • Complete construction of bridge crossing • Move bus stop at Pitt Town Bypass south during construction • Build tie in works of the southern roundabout to Pitt Town Road, Bathurst Street and Glebe Road • Build and correct level difference between Old Pitt Town Road and Cattai Road	3-6 months
Stage 2b: Southern roundabout to Cattai Road	• Build culvert PTB 6 • Build the remaining sections of the northern roundabout	
Stage 3 -Bathurst Street and Cattai Road Tie In	• Build permanent rural fence and gate to close redundant section of Cattai Road • Remove existing section of Pitt Town Road to help with cross drainage • Close section of Buckingham Street to tie in the Pitt Town Bypass to Cattai Road • Maintain property access to the redundant section of Cattai Road • Detour via opened section of Pitt Town Bypass, Old Pitt Town Road and Liverpool Road • Remove existing redundant section of Glebe Road	2-4 months

A summary of the proposed construction activities relevant to the completion of the proposal is presented in Table 1-4.

Table 1-4 Proposed construction methodology

Construction phase	Activities	Duration
Pre-construction work	• Installation of sediment controls • Adjustment and/or relocation of utilities and farm infrastructure • Temporary relocation of bus stops to locations agree with bus service providers • Installation of boundary fencing • Surveys • Upgrade minor access roads • Vegetation clearing and grubbing • Demolition of existing drainage structures including the installation of temporary local diversions where required • Demolition of redundant existing road pavement where required • Removal of existing signage.	1-2 months
Site establishment	• Temporary removal of fencing that conflicts with the construction work zone • Set-up of stockpile sites and ancillary facilities • Temporary traffic management arrangements • Construction of access roads • Progressive installation of environmental controls including exclusion zones and erosion and sediment controls • Other activities determined by the environmental representative (construction contractor or roads and maritime) to have minimal environmental impact • Construction of diversion drains and sedimentation control measures (where required) • Clearing of vegetation and processing of materials • Temporary upgrade work for existing local roads and intersections.	1-2 months
Drainage upgrade and drainage structures construction	• Establishment of erosion and sediment controls and specific water quality controls to capture any dirty water generated during work • Establishment of construction work zones at the culvert inlet/outlet • Earthworks for creek diversion • Establishment of traffic control measures • Demolition and removal of existing structure • Construction or extension of culverts including any channel diversions • Installation of scour protection as required.	4-6 months
Earthworks and pavement	• Clearing and grubbing of topsoil; and stripping, ripping and compaction of subgrade • Construction of road formation and embankments • Select material and sub-base layers preparation and compaction • Laying of asphalt layers, including surfacing • Construction of verges and batters.	6-8 works
Bridge construction works	• Earthworks and construction of foundations • Construction of bridge abutments • Installation of two span plank bridge.	4-6 months

Construction phase	Activities	Duration
Property access amendments	• Subgrade improvements and embankment earthworks • Pavement construction including asphalt layers • Removal of existing redundant accesses.	2-3 months
Finishing work	• Installation of pavement markings, signposting and other road furniture • Progressive landscaping and tree planting • Reinstatement of fencing • Site clean-up and demobilisation, including restoration of ancillary facilities and access roads (where required).	2-3 months

1.4.1 Ancillary facilities

Details of the proposed location and usage of ancillary facilities required to construct the proposal are described in Table 1-5.

Table 1-5 Ancillary facilities

Item	Ancillary facility 1	Ancillary facility 2	Ancillary facility 3
Location	Western side of the central Pitt Town bypass section	Eastern side of the central Pitt Town bypass section	East of the southern roundabout
Access road	Via Bathurst Street	Via Wellesley Street	Via Glebe Road
Approximate area (ha)	1.36	0.62	0.48
Land ownership	NSW Government	NSW Government	NSW Government
Distance to nearest sensitive receiver (metres)	17	115	130
Batching plant, crushing plant and material processing activities?	Yes	Yes	Yes
Plant workshop	Yes	Yes	Yes
Storage of plant, equipment and parking vehicles?	Yes	Yes	Yes
Stockpile site	Yes	Yes	Yes

1.4.2 Construction hours and duration

Construction activity will be undertaken in accordance with the Roads and Maritime *Construction Noise and Vibration Guideline* (CNVG) and the *Interim Construction Noise Guideline* (DECC, 2009) (ICNG). It is proposed that construction work occur during the 'standard hours' period as follows:

- Monday to Friday: 7 am to 6 pm
- Saturday: 8 am to 1 pm
- Sunday and public holiday: No work.

Should works occur outside of these standard hours, additional noise and vibration management will be required. This is discussed in more detail in Section 4.1 and Section 5.2.

2 Existing ambient noise environment

The proposal site is located east of Pitt Town town centre connecting Cattai Road in the north and Pitt Town Road in the south. The area surrounding the proposal site contains various noise and vibration sensitive receivers, including residential and commercial buildings.

2.1 Noise monitoring

Noise monitoring was conducted in February 2018 to formulate noise criteria for construction noise management and operational road traffic verification. The locations of these monitoring sites are shown in Figure 1-1.

2.1.1 Unattended noise monitoring

The purpose of unattended noise measurements is to obtain the L_{Aeq} and L_{A90} prevailing noise levels for sensitive receivers located in close proximity to the proposed alignment. These measurements were undertaken for a minimum period of one week.

Unattended noise monitoring was conducted at four locations adjacent to the proposed alignment. Details of these locations are provided in Table 2-1 and an aerial view shown in Figure 1-1.

Table 2-1 Unattended noise monitoring locations

ID	Address	Measurement period	Position	Approx. setback distance to edge of nearest road, (m)
U1	54 Wellesley Road	Wednesday, 14 February 2018 to Tuesday, 20 February 2018	Free-field with direct line of sight to proposed bypass alignment	150
U2	23 Old Pitt Town Road	Wednesday, 14 February 2018 to Tuesday, 20 February 2018	Free-field with direct line of sight to proposed bypass alignment	42
U3	8 Cattai Road	Wednesday, 14 February 2018 to Tuesday, 20 February 2018	Free-field with direct line of sight to proposed bypass alignment	50
U4	61 Bathurst Street	Friday, 11 May 2018 to Thursday 18 May 2018	1.5 m from facade with direct line of sight to Bathurst Street	10

These locations were selected on the basis of their proximity to the proposal to best represent the existing background noise levels in the surrounding area.

The equipment used in the monitoring process were Rion NL-42 sound level meters. These meters were configured to capture L_{max}, L_{Aeq}, L_{10} and L_{A90} noise metrics for each 15-minute window over the logging period. All instruments carry current calibration certification. Calibration was checked before and after logging and the level of drift was less than 0.5 dB in all cases.

2.1.2 Weather conditions

It is a requirement that noise data is captured during periods of favourable weather conditions avoiding adverse impacts of wind and rain on background noise levels. In order to assess weather conditions for the measurement period, half-hourly weather data was obtained from the Bureau of Meteorology (BOM) weather observation station IDN067105 at Richmond RAAF Base.

Noise data has been excluded from the processed results if:

- Rain was observed during a measurement period, and/or
- Wind speed exceeded 5 m/s (18 km/h) at the measurement height of 1.5 m above ground. Wind data obtained from the BOM is presented as the value at 10 m above ground.

The BOM wind speed data obtained for this report was measured at a height of 10 m above ground level. It is therefore necessary to apply a correction factor in order to estimate the wind speed at the height of the logger (1.5 m).

The methodology to formulate a correction factor has been derived[1]. The correction multiplier for the measured wind speed at 10 m is derived by the following formula:

$$W_{1.5}=W_{10}\times\left(\frac{M_{1.5,cat}}{M_{10,cat}}\right)$$

where:

$W_{1.5}$ = Wind speed at height of 1.5 m
W_{10} = Wind speed at height of 10 m
$M_{1.5,cat}$ = AS 1170 multiplier for receiver height of 1.5 m and terrain category
$W_{10,cat}$ = AS 1170 multiplier for receiver height of 10 m and terrain category

Noise logging data that has been excluded due to adverse weather conditions is identified in the overall summary and daily noise logging graphs presented in Appendix B.

2.2 Unattended noise monitoring results

A summary of results from unattended noise surveys are presented in Table 2-2. The Rating Background Level (RBL) and overall average noise level (L_{Aeq}) are provided for each assessment period.

The RBL for each period is the median value of the average background values for the period over all the days measured. There is an RBL value for each period (day, evening and night).

The L_{Aeq} or equivalent noise level is the energy averaged noise level over the measurement period. Detailed daily noise logging graphs are provided in Appendix B.

Table 2-2 Unattended noise survey results summary

ID	Location	Noise Level, dB(A)					
		Day (7 am to 6 pm)		Evening (6 pm to 10 pm)		Night (10 pm to 7 am)	
		RBL	L_{eq}	RBL	L_{eq}	RBL	L_{eq}
U1	54 Wellesley Rd	40	54	37	55	32	43
U2	23 Old Pitt Town Rd	39	55	36	48	32	44
U3	8 Cattai Rd	40	54	37	50	31	50
U4	61 Bathurst St	44	66	33	60	30	63

[1] Gowen, T., Karantonis, P. & Rofail, T. (2004), *Converting Bureau of Meteorology wind speed data to local wind speeds at 1.5m above ground level*, Proceedings of ACOUSTICS 2004

2.2.1 Attended noise monitoring

Table 2-3 provides a summary of operator attended noise measurement locations and measured levels.

Table 2-3 Operator-attended short-term noise measurement results

ID	Location	Length (min:sec)	L_{eq} dB(A)	L_{Fmax} dB(A)	L_{10} dB(A)	L_{90} dB(A)	Observations
A1	54 Wellesley Rd	17:15	48	59	54	40	• Distant traffic noise • Typical light vehicle range within background noise levels 40 dB(A) • Typical heavy vehicle range 46-48 dB(A)
A2	23 Old Pitt Town Rd	15:03	55	83	58	45	• Measured noise levels controlled by traffic noise from Cattai Road • Typical light vehicle range 56-57 dB(A) (Old Pitt town Rd) • Typical heavy vehicle range 54-56 dB(A) (Cattai Road)
A3	8 Cattai Rd	15:00	56	68	59	49	• Measured noise levels controlled by traffic noise from Cattai Road • Typical light vehicle range 55-60 dB(A) • Typical heavy vehicle range 61-65 dB(A)
A4	397 Pitt Town Rd	15:00	54	70	58	45	• Measured noise levels controlled by traffic noise from Pitt Town Road • Typical light vehicle range 50-58 dB(A) • Typical heavy vehicle range 62-65 dB(A)
A5	15 Stables St	15:00	47	71	42	35	• Distant traffic noise from Cattai Rd • Occasional light vehicle pass-by on Stables Street
A6	61 Bathurst St	09:00	67	84	70	51	• Measured noise levels controlled by traffic noise from Bathurst street • Typical light vehicle noise range between 65-70 dB(A) • Typical heavy vehicle between 75-78 dB(A)

2.3 Noise catchment areas

Noise catchment areas (NCAs) have been derived for the purposes of the operational and construction noise assessment. The summary and location of the NCAs for the proposal are present in Table 2-4 and Figure 2-1.

Table 2-4 Noise catchments areas

ID	Number of receivers	Receiver types	Minimum distance (worst affected receiver)
NCA1	240	Low density residential with small areas of public recreation. Includes the Pitt Town town centre.	10
NCA2	245	Low density residential with pockets of large lot residential areas to the west. Includes Pitt Town Public School (educational) as well as the Scots Church and Pitt Town Anglican Community Church.	310
NCA3	26	Primary production small lots with scattered residential and other industry-type structures. Some large lot residential areas to the north.	7

ID	Number of receivers	Receiver types	Minimum distance (worst affected receiver)
NCA4	14	Primary production small lots with scattered residential and other industry-type structures. Includes areas of the Scheyville National Park.	350
NCA5	36	Primary production small lots with scattered residential and other industry-type structures. Includes areas of the Scheyville National Park and a cemetery.	11
NCA6	23	Primary production small lots with scattered residential and other industry-type structures. Includes areas of the Pitt Town Lagoon.	148

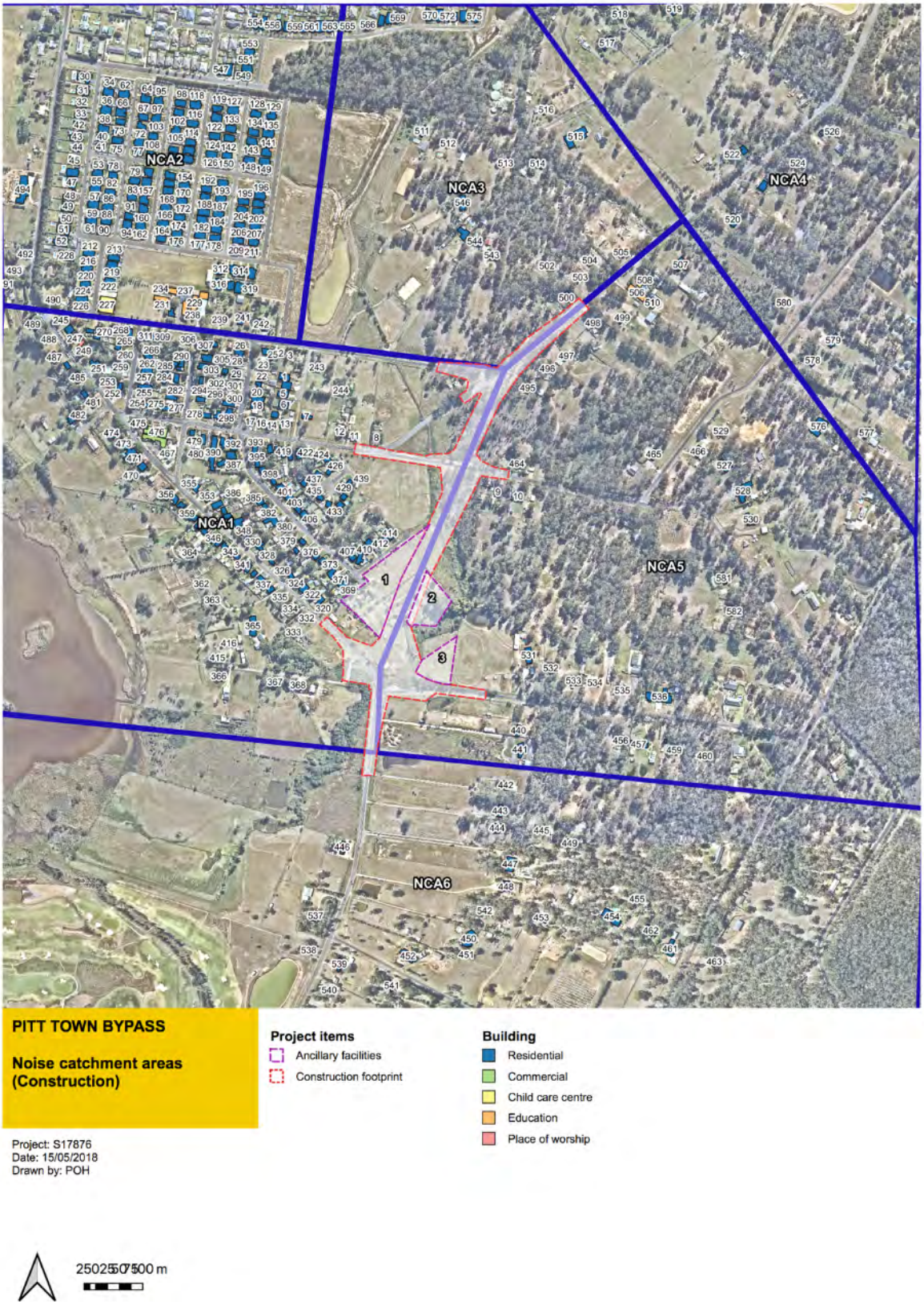


Figure 2-1 Noise catchment area map

3 Operational road traffic noise

3.1 Operational road traffic noise criteria

3.1.1 Residential receivers

Noise criteria are assigned to sensitive receivers using RMS' Noise Criteria Guideline (NCG). RMS' NCG provides guidance on how to implement the NSW Road Noise Policy. The assessment timeframe for the criteria are in the year of opening and 10 years after opening.

Residences may be assigned new, redeveloped, transition zone or relative increase criteria depending on how the proposal influences noise levels. For each façade of the residence the most stringent applicable criteria have been used in the assessment.

Criteria are based on the road development type a residence is affected by due to the proposal. In some instances, residences may be exposed to noise from both new and redeveloped roads.

The proposal consists of a combination of redeveloped and new road segments comprising sub-arterial and local roads. The main proposal roads have been classified as sub-arterial roads. Criteria have been assigned as follows:

- Pitt Town Bypass: New sub-arterial road
- Bathurst Street, Chatham Street, Eldon Street, Old Pitt Town Road and Pitt Town Road: Redeveloped sub-arterial road / roads not subject to redevelopment but influenced by the proposal.
- Glebe Road: Redeveloped local road.
- The balance of roads within the proposal: Road not subject to redevelopment but influenced by the proposal.

The intersections of new and redeveloped roads result in the requirement to assess the relative noise level contribution of the new and redeveloped roads at each receiver within the zone. This to ensure an even transition of noise assessment criteria between the two road types.

The proposal assessment area and calculated noise criterion for each residential receiver location is shown in Figure 3-1.

The criteria for residences are summarised in Table 3-1.

Table 3-1 Road traffic noise assessment criteria for residential land uses

Road category	Type of project/land use	Assessment criteria – dB	
		Day (7am–10pm)	Night (10pm–7am)
Freeway/ arterial/ sub-arterial roads	1. Existing residences affected by noise from new freeway/arterial/sub-arterial road corridors	$L_{Aeq(15hour)}$ 55 (external)	$L_{Aeq(9hour)}$ 50 (external)
	2. Existing residences affected by noise from redevelopment of existing freeway/arterial/sub-arterial roads 3. Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	$L_{Aeq(15hour)}$ 60 (external)	$L_{Aeq(9hour)}$ 55 (external)
Local roads	4. Existing residences affected by noise from new local road corridors 5. Existing residences affected by noise from redevelopment of existing local roads 6. Existing residences affected by additional traffic on existing local roads generated by land use developments	$L_{Aeq(1hour)}$ 55 (external)	$L_{Aeq(1hour)}$ 50 (external)

3.1.2 Relative increase criterion

The relative increase criterion is designed to account for large increases in traffic noise levels that may impact residential receivers that currently experience low levels of traffic noise. This is achieved by having a criterion that is set 12 dB above the existing traffic noise levels during the daytime or night-time periods. No minimum criterion is set for the relative increase criterion in order to capture residences where the existing road traffic noise level is sufficiently low that the minimum criterion from Table 3-1 would not be exceeded even with a 12 dB increase. The relative increase criteria are as shown in Table 3-2.

Table 3-2 Relative increase criteria for residential land uses

Road category	Type of project/development	Total traffic noise level increase	
		Day (7am–10pm)	Night (10pm–7am)
Freeway/arterial/ sub-arterial roads and transitways	New road corridor/ redevelopment of existing road/land use development with the potential to generate additional traffic on existing road.	Existing traffic $L_{Aeq(15hour)}$ + 12 dB (external)	Existing traffic $L_{Aeq(9hour)}$ + 12 dB (external)

3.1.3 Cumulative limit

The cumulative limit applies when the total noise level in the design build year is 5 dB(A) or more above the NCG criterion. The cumulative limit does not apply where the project roads (new road or redeveloped section of road) adds less than 2 dB(A) to the total noise level at a given façade for the design build year.

3.1.4 Acute

Noise levels are considered to be acute where $L_{Aeq(15hour)}$ and $L_{Aeq(9hour)}$ noise levels are great than or equal to 65 dB(A) and 60 dB(A) respectively.

3.1.5 Non-residential land uses

The criteria for other sensitive receivers are summarised in Table 3-3.

Table 3-3 Road traffic noise assessment criteria for non-residential land uses affected by proposed road projects and traffic generating developments

Existing sensitive land use	Assessment criteria – dB(A)		Additional considerations
	Day (7am–10pm)	Night (10pm–7am)	
1. School classrooms	$L_{Aeq(1hour)}$ 40 (internal)	–	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 2107:2016 (Standards Australia 2016).
2. Hospital wards	$L_{Aeq(1hour)}$ 35 (internal)	$L_{Aeq(1hour)}$ 35 (internal)	
3. Places of worship	$L_{Aeq(1hour)}$ 40 (internal)	$L_{Aeq(1hour)}$ 40 (internal)	The criteria are internal, i.e. 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. For example, if there is a church car park between a church and the road, compliance with the internal criteria inside the church may be sufficient. If, however, between the church and the road are areas where outdoor services may take place such as weddings and funerals, external criteria for these areas are appropriate. As issues such as speech intelligibility may be a consideration in these cases, the passive recreation criteria (see point 5) may be applied.
4. Open space (active use)	$L_{Aeq(15hour)}$ 60 (external) when in use	–	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. Passive recreation is characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, e.g. playing chess, reading. In determining whether areas are used for active or passive recreation, the type of activity that occurs in that area and its sensitivity to noise intrusion should be established. For areas where there may be a mix of passive and active recreation, e.g. school playgrounds, the more stringent criteria apply. Open space may also be used as a buffer zone for more sensitive land uses.
5. Open space (passive use)	$L_{Aeq(15hour)}$ 55 (external) when in use	–	
6. Isolated residences in commercial or industrial zones	–	–	For isolated residences in industrial or commercial zones, the external ambient noise levels can be higher than those in residential areas. Internal noise levels in such residences are likely to be more appropriate in assessing any road traffic noise impacts, and the proponent should determine suitable internal noise level targets, taking guidance from Australian Standard 2107:2000 (Standards Australia 2000).

Existing sensitive land use	Assessment criteria – dB(A)		Additional considerations
	Day (7am–10pm)	Night (10pm–7am)	
7. Mixed use development	–	–	Each component of use in a mixed use development should be considered separately. For example, in a mixed use development containing residences and a child care facility, the residential component should be assessed against the appropriate criteria for residences and the child care component should be assessed against the appropriate criteria for child care facilities.
8. Child care facilities	Sleeping rooms $L_{Aeq(1hour)}$, 35 (internal) Indoor play areas $L_{Aeq(1hour)}$, 40 (internal) Outdoor play areas $L_{Aeq(1hour)}$ 55 (external)	–	Multipurpose spaces, e.g. 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.
9. Aged care facilities	–	–	Residential land use noise assessment criteria should be applied to these facilities, see Table 3.

Note: Land use developers must meet internal noise goals set for sensitive developments alongside busy roads as identified in the Infrastructure SEPP.

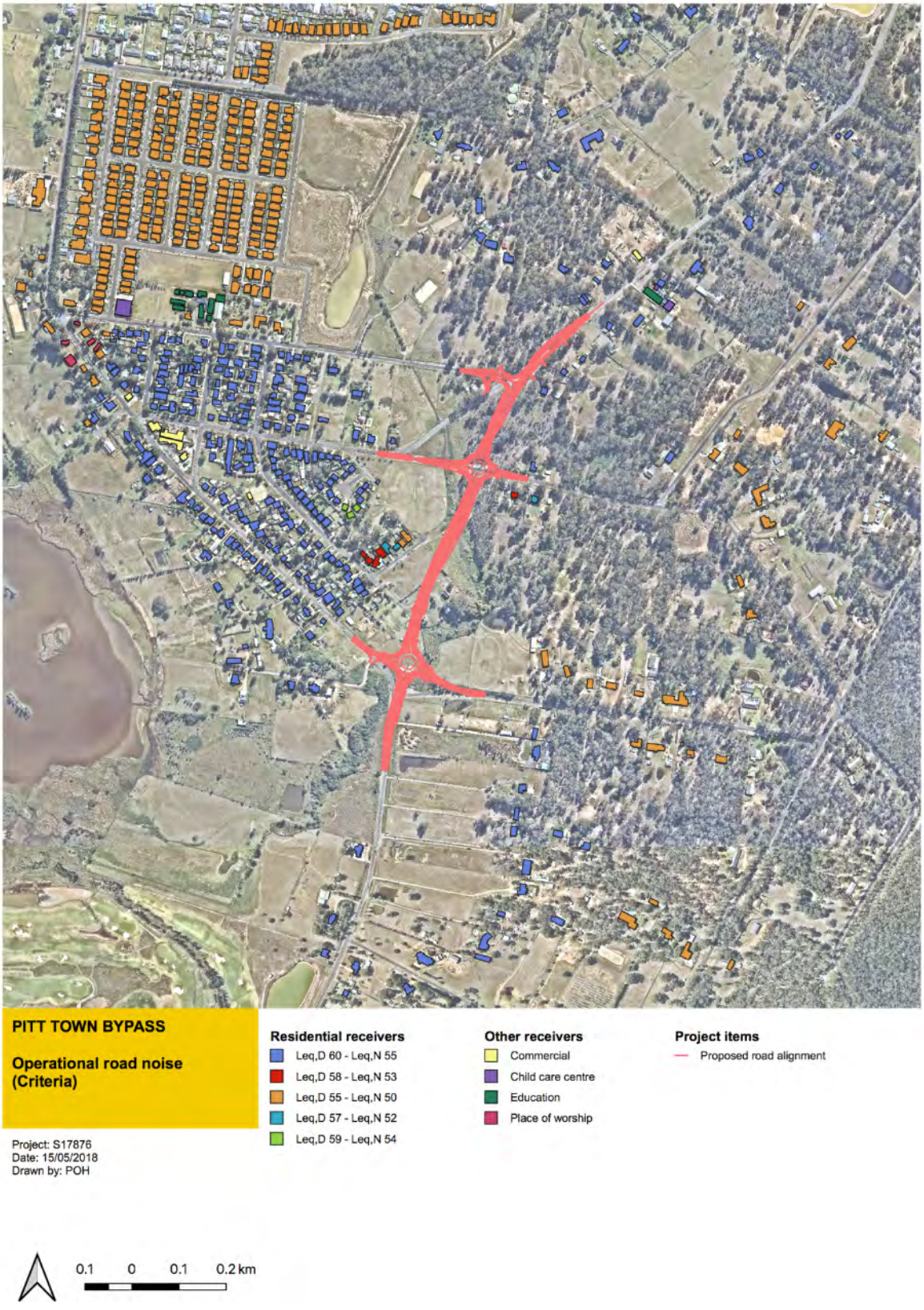


Figure 3-1 Operational road noise criteria

3.1.6 Assessing eligibility for consideration of noise mitigation measures

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

The NMG notes that the most effective way of minimising noise from vehicles and traffic is to control vehicle noise at the source. Where source measures are not practical, or do not provide sufficient noise reduction, additional methods are required to reduce levels to within acceptable margins. Such additional methods may include the use of quieter pavement surfaces, noise barriers and/or consideration of at-property treatment.

The NMG provides three triggers where a receiver may qualify for consideration of noise mitigation (beyond the adoption of road design and traffic management measures). These are:

- The predicted Build noise level exceeds the NCG controlling criterion and the noise level increase due to the proposal (i.e. the noise predictions for the Build minus the No Build) is greater than 2 dB(A),or;
- The predicted Build noise level is 5 dB(A) or more above the criteria (exceeds the cumulative limit) and the receiver is significantly influenced by proposal road noise, regardless of the incremental impact of the proposal, or;
- The noise level contribution from the proposal is acute (daytime $L_{Aeq(15hour)}$ 65 dB(A) or higher, or night-time $L_{Aeq(9hour)}$ 60 dB(A) or higher) then it qualifies for consideration of noise mitigation even if noise levels are dominated by another road.

The eligibility of receivers for consideration of additional noise mitigation is determined before the benefit of additional noise mitigation (quieter pavement and noise barriers) is included. The requirement for the proposal is to provide reasonable and feasible additional mitigation for these eligible receivers to meet the NCG controlling criterion. If the NCG criterion cannot be satisfied with quieter pavement and noise barriers, then the receiver may be eligible for consideration of at-property treatment.

The Road Noise Policy includes a review of internal sleep arousal research but does not provide noise goals. The RNP concludes that there appears to be insufficient evidence to set new indicators for potential sleep disturbance due to road traffic noise. Guidance for considering sleep disturbance due to maximum noise levels is provided in Practice Note iii of the Environmental Noise Management Manual (RTA 2001). The sleep disturbance assessment (guided by Practice Note iii of the Environmental Noise Management Manual (RTA 2001)) does not influence the degree of mitigation required but is used to rank and prioritise design options and noise mitigation strategies.

3.2 Operational noise assessment

3.2.1 Road traffic noise modelling methodology

A computer noise model of the existing scenario and the proposed upgraded road was developed using SoundPLAN V7.4 noise prediction software. SoundPLAN implements the UK Calculation of Road Traffic Noise (CoRTN) algorithms for the prediction of road traffic noise. The CoRTN methodology is an accepted road traffic noise prediction method in NSW.

The NCG requires the following operational road traffic noise scenarios to be modelled in order to assess the potential noise impact from the proposal:

- Existing Scenario based on current (measured) road traffic flows, current (measured) noise levels and road alignments. The purpose of this scenario is to validate the noise model is predicting accurate noise levels within the proposal area.
- Future Year of Project Opening Scenario (2021) – Build Scenario incorporating traffic flow predictions for the year of project opening and the proposed road design.
- Future Year of Project Opening Scenario (2021) – No Build Scenario incorporating traffic flow predictions for the year of project opening assuming that the road project did not proceed. The Year 2021 Build and No-Build scenarios may be used for noise mitigation design if the noise levels for this year control the potential criteria exceedances. The Build and No-Build noise level predictions will be compared to determine changes in noise levels at sensitive receiver locations. These predictions would also form the basis for a post-construction compliance assessment.

- Future 10 Years after Project Opening Scenario (2031) – Build Scenario incorporating traffic flow predictions for a time horizon ten years after project opening and the proposed road design.
- Future 10 Years after Project Opening Scenario (2031) – No Build Scenario incorporating traffic flow predictions for a time horizon ten years after project opening assuming that the road project did not proceed. The Year 2031 Build and No-Build scenarios may be used for noise mitigation design if the noise levels for this year control the potential criteria exceedances. The Build and No-Build noise level predictions will be compared to determine changes in noise levels at sensitive receiver locations.
- Existing residential properties located within the construction footprint (including ancillary sites) have not been assessed as noise sensitive receiver locations.

3.2.2 Road traffic noise modelling parameters

The road traffic noise modelling parameters assumed for each scenario are presented in Table 3-4.

Table 3-4 Road traffic noise modelling parameters

Parameter	REF noise model
Vehicle speeds	• Refer to Appendix C. • For the design year, the bypass will have a posted speed of 70 km/h and all existing roads were modelled per the posted speeds. • The validation scenario used the measured speeds as presented in Appendix C.
Traffic volumes	• Refer to Appendix C.
Road traffic noise prediction algorithm	• Calculation of Road Traffic Noise (CoRTN) 1988
'Appropriate adjustments for NSW noise descriptors'	• The 15 hour and 9 hour traffic flows have been divided by 15 and 9 respectively. • The CoRTN $L_{10,1hr}$ predictions have been converted to $L_{eq,15h}$ and $L_{eq,9h}$ by subtracting 3 dB from the result for each period. • A 3 dB difference between L_{10} and L_{eq} levels is widely accepted.
Three source heights	• 0.5 m above ground for car exhausts, car engines, car tyres (single source string) • 0.5 m above ground for truck tyres • 1.5 m above ground for truck engines • 3.6 m above ground truck exhausts
Source corrections	• -0.6 dB for truck engines • -8.6 dB for truck exhausts
Pavement corrections	• 0 dB(A) for Densely Graded Asphalt (DGA) applied to the car and truck tyre string for the new and upgraded sections of road. • 3 dB(A) for 10/14mm Chip Seal on existing roads.
Receiver heights	• 1.5 m above ground for ground floor receiver • 4.5 m above ground for first floor receiver • or as adjusted for elevated ground floor situations based on site observations
Ground absorption factor	• 75% for grassed land and • 50% over built up areas
Search radius	• 3 km
Grid spacing and height above ground	• 20 m grid • 1.5 m above ground
Model validation	• Refer to validation against measured data in Section 3.2.3.
Safety factor	• N/A

Parameter	REF noise model
Façade reflection correction	• + 2.5 dB(A) at 1 m from facade (single point receiver calculations) • Noise contour plots (grid noise maps) are presented as free field noise levels (i.e. with no + 2.5 dB(A) façade reflection correction
Standard Australian condition correction based on ARRB	• -1.7 dB(A) for standard correction at 1 m from façade • -0.7 dB(A) for free field measurements

3.2.3 Road traffic noise model validation

A noise model of the proposal area was developed and was based on the existing road alignments and the existing traffic volumes and speeds that were measured as part of the traffic counting survey. The parameters used for the validation model are presented in Table 3-5.

Table 3-5 Validation model parameters

Correction	Comment	Correction
Road surface Old Pitt Town Rd	10mm or 14/7mm chip seal	+ 4 dB[1]
Road surface Cattai Rd	Dense graded asphalt or equivalent	+ 0 dB
Road surface Bathurst St	Dense graded asphalt or equivalent	+ 0 dB
Truck Engine		-0.6 dB
Truck Exhaust		-8.6 dB
ARRB Correction	1m from façade	-1.7 dB
ARRB Correction	Free Field	-0.7 dB
Façade Correction	For predictions at 1 m from building façade	+ 2.5 dB
Vehicle speeds	Refer to Appendix C.	
Traffic volumes	Refer to Appendix C.	

The predicted noise levels were compared to measured noise levels at unattended noise monitoring locations as presented in Table 3-6.

Table 3-6 Road traffic noise model validation

Ref	Location	Daytime road noise level, dB(A)			Night-time road noise level, dB(A)		
		Measured	Predicted	Difference	Measured	Predicted	Difference
U1	Wellesley Street	50.4	49.5	-0.9	44.6	44.1	-0.5
U2	Old Pitt Town Road	53.3	52.9	-0.4	45.0	46.5	1.5
U3	Cattai Road	54.0	56	2.0	50.4	50.7	0.3
U4	Bathurst St	65.9	66.7	0.8	60.8	60.9	0.1
Median difference				0.2			0.2

A comparison of the modelled versus measured noise levels showed the following:

- A median over prediction of 0.2 dB during the daytime period.
- A median over prediction of 0.2 dB during the night-time period.

The predicted and measured road traffic noise levels agree within a median tolerance of ±0.2 dB, which is considered a suitable level of accuracy for road traffic noise projects.

Due to the good correlation between the measured and predicted noise levels, no additional calibration factors were required.

3.2.4 Predicted noise levels

Noise levels have been predicted in the form of noise contours assessed at 1.5 m above ground level for each assessment scenario. The noise contours are presented in Appendix D.

Noise levels have been predicted for every façade at every floor of each potentially affected noise sensitive receiver. The predicted noise levels for each location are tabulated in detail in Appendix E. Appendix E presents the following:

- Build and No-Build Predicted noise levels for the year of opening and the design year.
- Noise levels changes for each scenario.
- An assessment of noise sensitive receiver locations at which additional noise mitigation should be considered.
- Predicted noise levels are presented for every building façade down to the night-time residential NCG criterion.

A summary of the outcomes of the noise level predictions is provided below for the design year.

Year 2031: (Design Year)

- Compliance with the established criteria has been predicted at the majority of noise sensitive receiver locations across the proposal area with the exception of the following location:
  - 22 Old Pitt Town Road is predicted to exceed the daytime and night-time NCG transition zone criterion of 58 dB(A) and 53 dB(A) respectively at the worst affected facades. This receiver is located directly to the south-east of the new roundabout at the intersection of the bypass and Old Pitt Town Road. The predicted increase in noise level relative to the no-build scenario is approximately 3 dB. The increase in noise levels at this location results from the proximity of the bypass to the receiver location.
- The proposal does not in itself generate higher traffic flows over and above the no-build scenario. However, the action of diverting approximately 30% of traffic flows from Bathurst Street and Eldon Street on to the bypass results in noise level reductions on these streets in the order of 1 dB to 2 dB. Consequently, noise levels are predicted to increase by a similar margin at receiver locations located directly to the east and west of the bypass.
- Compliance with the NCG criteria has been predicted at all non-residential noise sensitive receivers.

3.2.5 Design of noise mitigation measures

The RMS Noise Mitigation Guideline (NMG) provides guidance on how to determine whether a noise sensitive receiver qualifies for the consideration of mitigation and the type of mitigation that would be suitable.

The NMG requires that mitigation measures be investigated in order of preference as follows:

- Road design and traffic management
- Quieter pavement surfaces
- Noise mounds and walls
- At-property treatments.

Low noise pavement

The bypass has been modelled assuming DGA will be used as the wearing surface for the new or upgraded roads of the proposal. DGA is a quieter pavement when compared to standard spray seal variants.

Quieter pavement surfaces are to be considered where groups of four or more receivers are predicted to exceed the criteria. As there is only one exceedance predicted to occur for the design year, it is not considered reasonable to implement a lower noise pavement.

Noise mounds and walls

The current design incorporates solid jersey kerb barriers along sections of the bypass. They do not currently extend all the way up to Old Pitt Town Road on the eastern side of the bypass or south of the intersection with Bathurst Street.

Consideration of the feasibility of extending the jersey kerb barriers to extend from the bypass onto Old Pitt Town Road and further south on the western verge may assist in mitigating the exceedance on Old Pitt Town Road and provide an additional benefit to residential receivers located on Buckridge Street.

At-property treatments

The exceedance location is an isolated residence and would qualify for at-property treatments subject to the feasibility review of implementing additional jersey kerb barriers as described above. At-property treatments are generally limited to acoustic treatment of the building elements and the installation of acoustic screen walls close to the receiver where they also protect outdoor living spaces.

The following location qualifies for at-property treatment:

- 22 Old Pitt town Road – This receiver qualifies for at-property treatment on the basis that the NCG transition zone criteria are exceeded. The location of this receiver is shown on Figure 3-2.



Figure 3-2 Graphical location of the predicted exceedance at 22 Old Pitt Town Road

3.3 Assessment of maximum noise levels

3.3.1 Assessment basis

The RNP includes discussion of current knowledge regarding sleep disturbance due to road traffic noise, and states 'despite intensive research, the triggers for and effects of sleep disturbance have not yet been conclusively determined.' Current research does indicate that the main acoustic characteristic that influences sleep disturbance is the emergence (e.g. magnitude) and number of noisy events heard distinctly above the background level. The RNP suggests that intermittent noisy events, such as truck pass-bys, could be assessed on the basis of emergence events determined as the difference between L_{Amax} levels and the steadier L_{Aeq} or L_{A90} levels.

The RNP makes reference to Practice Note iii of the ENMM[2] which suggests that the $L_{eq,9h}$ road traffic noise guidelines should sufficiently account for sleep disturbance impacts except where both of the following conditions are met:

- the L_{Amax} emergence over the ambient $L_{Aeq,1hour}$ is greater than 15 dB(A) and
- the L_{Amax} level is greater than 65 dB(A).

Section 5.4 of the RNP further states that:

- maximum internal noise levels below 50-55 dB(A) are unlikely to awaken people from sleep
- one or two noise events per night, with maximum internal noise levels of 65-70 dB(A), are not likely to affect health and wellbeing significantly.

3.3.2 Assessment methodology

A conservative reference level of 90 dB(A) L_{Amax} at a distance of 20 m from an accelerating truck was used to predict L_{Amax} levels along the proposed bypass in order to identify residences potentially affected by sleep disturbance based on the noise measurement results for the REF and Resonate's noise source database. Table 3-7 shows residences which have a predicted night-time period noise impact of L_{Amax} - $L_{Aeq,1hour}$ ≥ 15 dB(A) and L_{Amax} level greater than 65 dB(A).

Table 3-7 Maximum night-time noise levels in the proposal area.

Potentially affected residences	Noise levels at receiver location, dB				
	Predicted L_{Amax} for noisy truck pass-by	Year 2021		Year 2031	
		Typical $L_{Aeq(1hour)}$ at night[1]	L_{Amax} - $L_{Aeq(1hour)}$	Typical $L_{Aeq(1hour)}$ at night[1]	L_{Amax} – $L_{Aeq(1hour)}$
1 Cattai Road, Pitt Town	70	51	19	53	17
22 Old Pitt Town Road, Pitt Town	68	49	19	50	18
28 Old Pitt Town Road, Pitt Town	67	44	23	47	20
4 Eldon Street, Pitt Town	69	47	22	53	16
23 Old Pitt Town Road, Pitt Town	72	47	24	48	24
46 Cattai Road, Pitt Town	67	50	17	52	15
29 Cattai Road, Pitt Town	72	54	18	56	16

1 The provided traffic data and unattended traffic noise logging have been used to calculate the typical $L_{Aeq,1h}$ noise levels from the predicted $L_{Aeq,\ 9h}$ noise levels. A 2 dB(A) reduction has been applied to account for a typical $L_{Aeq,1h}$ level lower traffic volumes during the 10pm-5am period.

A total of seven residences in the proposal area were identified as having the potential for sleep disturbance due to road traffic during the night-time period. It is noted that four properties on the existing Cattai Road and Eldon Street

[2] RTA Environmental Noise Management Manual

already have L_{Amax} noise levels that may result in sleep disturbance. There are three properties on Old Pitt Town Road that may experience an increase in L_{Amax} noise levels due to the proposal.

The predicted heavy vehicle traffic flows have been used to determine the potential number of maximum noise level events at sensitive receivers adjacent to the bypass. The predictions suggest that up to nine events may occur on average in a typical hour assuming all heavy vehicles produce maximum noise event that exceeds the established assessment thresholds.

4 Construction noise and vibration

4.1 Construction noise criteria

4.1.1 Interim Construction Noise Guideline (DECC)

The *Interim Construction Noise Guideline* (ICNG), prepared by the NSW Department of Environment & Climate Change (DECC) and released in 2009, details construction noise assessment criteria and calls for the application of feasible and reasonable measures to mitigate construction noise and vibration. For the purpose of this assessment, the ICNG has been used for the assessment of construction noise and vibration.

The ICNG defines various working hours for which different construction noise assessment procedures apply. Standard working hours, during which the majority of construction work will occur, are:

- 7 am to 6 pm, Monday to Friday
- 8 am to 1 pm, Saturday
- No work on Sundays or public holidays.

Any works outside of these hours would be classified as Out of Hours Works (OoHW).

The ICNG also prescribes noise management levels (NMLs) depending on the time that construction work is to be carried out. These NMLs should be achieved at noise sensitive locations where it is feasible and reasonable to do so.

4.1.2 Construction Noise and Vibration Guideline (Roads and Maritime)

The Roads and Maritime *Construction Noise and Vibration Guideline* (CNVG) defines time periods to which construction activity should be limited, where feasible and reasonable to do so. These working hours are set out in Table 4-1.

Table 4-1 CNVG construction hours

Activity	Working hours		
	Monday to Friday	Saturday	Sunday & Public Holiday
Standard construction	7 am to 6 pm	8 am to 1 pm	No work
Construction activities with impulsive or tonal noise emissions	8 am to 5 pm	9 am to 1 pm	No work
Blasting	9 am to 5 pm	9 am to 1 pm	No blasting

The CNVG also outlines the method for identification of all feasible and reasonable mitigation measures. The CNVG provides the mitigation measures most relevant to the proposal.

4.3 Noise management levels

The CNVG outlines methodology for determining Noise Management Levels (NMLs) for construction work based on classification of potentially noise affected receiver land use type.

4.3.1 Residential and aged care land uses

Table 4-2 presents the NMLs for residential and aged care receivers for both standard working hours and periods outside of the standard working hours. The NMLs apply at the property boundary most exposed to construction noise. If the residence is more than 30 metres from the boundary, the NML applies to the most noise affected position within 30 metres of the residence.

Table 4-2 Noise Management Levels for residential land uses (ICNG)

Time of day	Noise Management Level, $L_{Aeq(15\text{-}minute)}$	
Standard hours: 7 am to 6 pm, Monday to Friday 8 am to 1 pm, Saturday	**Noise affected** RBL +10 dB(A)	May be some community reaction to noise. Actions: Where the predicted or measured construction noise level exceeds the noise-affected level, all feasible and reasonable work practices should be applied to meet the noise affected level. All residents potentially impacted by the works should be informed of the nature of the works, the expected noise levels and duration, and provided with site contact details.
	Highly noise affected >= 75 dB(A)	May be strong community reaction to noise. Actions: Where construction noise is predicted or measured to be above this level, the relevant authority may require respite periods that restrict the hours that the very noisy activities can occur. Respite activities would be determined taking into account times identified by the community when they are less sensitive to noise, and if the community is prepared to accept a longer period of construction to accommodate respite periods.
Out of Hours Work (OoHW)	**Noise affected** RBL +5 dB(A)	Actions: Strong justification typically required for these works. All feasible and reasonable work practices should be adopted. Where all feasible and reasonable work practices have been adopted and noise level is more than 5 dB(A) above the NML, negotiation should be undertaken with the community.

4.3.3 Other sensitive land uses

The ICNG also establishes NMLs for other sensitive land uses.

Table 4-3 summarises the NMLs for those other sensitive land uses identified for the proposal.

Table 4-3 Noise Management Levels for other land uses (ICNG)

Land use	Noise Management Level, $L_{Aeq(15\text{-}minute)}$ [1]
Classrooms at schools and other educational institutions	Internal noise level – 45 dB(A)
Places of worship	Internal noise level – 45 dB(A)
Active recreation areas (characterised by sporting activities and activities that generate their own noise or focus for participants, making them less sensitive to external noise intrusion).	External noise level – 65 dB(A)
Passive recreation areas (characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion (i.e. reading and meditation).	External noise level – 60 dB(A)
Community centres	Dependent on the intended use. Refer to the recommended 'maximum' internal levels in AS/NZS 2107.

(1) Applies when premises are in use.

The ICNG recommends internal NMLs for certain receiver types. It is considered more practical from an assessment perspective to establish external NMLs for all receivers. Due to the low measured ambient background noise levels in the area, it has been assumed that most receivers would have open windows in order to maximise natural ventilation. Typically, a facade insertion loss performance of 10 dB may be achieved where windows are open. For this reason, a NML of $L_{Aeq(15\text{-}minute)}$ 55 dB has been established for educational and place of worship land uses.

4.3.4 Commercial and industrial premises

The ICNG recommends NMLs for commercial and industrial land uses that are applicable during the time of day for which they are occupied. The external noise levels recommended are:

- industrial premises – external $L_{Aeq(15\text{-}minute)}$ 75 dB
- commercial premises – external $L_{Aeq(15\text{-}minute)}$ 70 dB
- other businesses that may be very sensitive to noise where the noise level is project specific.

Other noise sensitive commercial premises, such as cafes and restaurants, should be assessed on a project-by-project basis in consideration of the recommended maximum internal noise levels provided by AS 2107 *Acoustics – Recommended design sound levels and reverberation times for building interiors.*

4.3.5 Sleep disturbance

The CNVG considers night works exceeding an external L_{Amax} sound pressure level at a receiver of 65 dB to impact upon occupant sleep amenity. This criterion has not been assessed due to the assumptions that construction works will be conducted during standard hours.

4.3.6 Ground-borne noise

Ground-borne noise will not be a controlling factor with respect to construction noise impacts. No underground works will occur and therefore air-borne noise levels will exceed the ground-borne noise levels. As such a detailed ground-borne noise assessment is not required for the proposal.

4.4 Construction vibration criteria

Ground vibration generated by construction can have a range of effects on buildings and building occupants, with the main effects generally classified as:

- Human disturbance – disturbance to building occupants: vibration which inconveniences or interferes with the activities of the occupants or users of the building
- Effects on building structures – vibration that may compromise the condition of the building structure itself.

In general, vibration criteria for human disturbance are more stringent than vibration criteria for effects on building contents and structural damage. Building occupants will normally feel vibration readily at levels well below those that may cause a risk of cosmetic or structural damage to a structure. However, it may not always be practical to achieve the human comfort criteria. Furthermore, unnecessary restriction of construction activities can prolong construction works longer than necessary, potentially resulting in other undesirable effects for the local community.

Construction vibration criteria have been adopted from the following sources:

- Cosmetic and structural damage to buildings: German Standard DIN 4150-3[3]
- British Standard BS 7385 Part 2-1993 *Evaluation and Measurement for Vibration in Buildings*
- NSW Environmental Protection Agency's Human comfort: Assessing Vibration – a technical guideline (the Guideline)

4.4.1 Cosmetic and structural damage

The DIN 4150-3 structural and cosmetic damage assessment criteria for different types of buildings are presented in Table 4-4. The criteria are specified as Peak Particle Velocity (PPV) levels measured in any direction at or adjacent to the building foundation.

DIN 4150-3 states that exposing buildings to vibration levels higher than that recommended in Table 4-4 would not necessarily result in damage. Rather it recommends these values as maximum levels of short-term construction vibration at which experience has shown that damage that reduces the serviceability of structures will not occur due to vibration effects.

DIN 4150-3 is considered to be suitable for the assessment of both structural and cosmetic damage as the standard considers a reduction in serviceability of the structure is deemed to have occurred if:

- Cracks form in plastered surfaces of walls.
- Existing cracks in the building are enlarged.
- Partitions become detached from loadbearing walls or floors.

[3] German Standard DIN 4150-3, 1999, *Structural Vibration – Part 3: Effects of vibration on structures*.

Table 4-4 DIN 4150-3 vibration cosmetic and structural damage criteria

Structure type	Peak Particle Velocity (PPV) mm/s			
	Foundation of structure			Vibration at horizontal plane of highest floor at all frequencies
	< 10 Hz	10-50 Hz	50-100 Hz	
Buildings used for commercial, industrial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
Dwelling and buildings of similar design and/or use	5	5 to 15	15 to 20	15
Structures that, because of their particular sensitivity to vibration, do not correspond to those listed in rows 1 and 2, and are of great intrinsic value (e.g. heritage-listed buildings)	3	3 to 8	8 to 10	8

The guideline values from BS7385 relating to cosmetic damage from transient vibration are reproduced in Table 4-5.

Table 4-5 Transient vibration guide values for cosmetic damage (BS7385)

Line	Type of building	Peak component particle velocity in frequency range of predominant pulse	
		Frequency range	
		4-15 Hz	15 Hz and above
1	Reinforced or framed structures Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	
2	Unreinforced or light framed structures Residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above
(1) Values referred to are at the base of the building. (2) For line 2, at frequencies below 4 Hz, a maximum displacement of 0.6 mm (zero to peak) should not be exceeded.			

DIN4150 and BS7385 state that exceedances of the guidance values do not necessarily mean that damage will occur, but that more detailed analysis may be required in order to quantify the site specific relationship between vibration levels, strain and the potential for damage. If required, the additional analysis may include more detailed vibration, strain or displacement measurements combined with engineering analysis.

BS7385 also states that *a building of historical value should not (unless it is structural unsound) be assumed to be more vibration sensitive*.

4.4.2 Human comfort

The ICNG recommends that vibration from construction works be assessed under the EPA's *Assessing Vibration – a technical guideline* (the Guideline). The vibration assessment criteria defined in this guideline are for human comfort and represent goals that, where predicted or measured to be exceeded, require the application of all feasible and reasonable mitigation measures. Where the maximum value cannot be feasibly and reasonably achieved, the operator would need to negotiate directly with the affected community.

The Guideline defines vibration assessment criteria for continuous, impulsive and intermittent vibration. Vibration can be classified according to the following definitions:

- Continuous vibration: continues uninterrupted for a defined period. Applies to continuous construction activity such as tunnel boring machinery.
- Impulsive vibration: rapid build-up to a vibration peak followed by a damped decay or the sudden application of several cycles of vibration at approximately the same magnitude providing that the duration is short. Applies to very occasional construction activities that create distinct events such as the occasional dropping of heavy equipment.
- Intermittent vibration: interrupted periods of continuous vibration (such as a drill) or repeated periods of impulsive vibration (such as a pile driver).
- The majority of construction works as part of the proposal would be expected to be intermittent in nature with the potential for some impulsive activities (e.g. demolition works).

Table 4-6 presents the management levels for continuous and impulsive vibration at different land uses. The management levels specified are as overall unweighted Root-Mean-Square vibration velocity levels (V_{rms}). The Guideline specifies the management levels as suitable for vibration sources predominantly in the frequency range 8-80 Hz as would be expected for construction vibration.

Table 4-6 Daytime V_{rms} management levels for continuous and impulsive vibration

Receiver	Continuous vibration V_{rms}, mm/s		Impulsive vibration V_{rms}, mm/s	
	Preferred	Maximum	Preferred	Maximum
Residences – daytime	0.2	0.4	6	12
Residences – night-time	0.14	0.28	2	4
Offices, schools, place of worship	0.4	0.8	13	26
Workshops	0.8	1.6	13	26

For intermittent vibration, the Vibration Dose Value (VDV) is used as the metric for assessment as it accounts for the duration of the source, which will occur intermittently over the assessment period. The VDV management levels at different land uses for intermittent vibration sources are presented in Table 4-7.

Table 4-7 VDV management levels for intermittent vibration

Receiver	VDV – Intermittent vibration, $m/s^{1.75}$	
	Preferred	Maximum
Residences – daytime	0.2	0.4
Residences – night-time	0.13	0.26
Offices, schools, places of worship	0.4	0.8
Workshops	0.8	1.6

4.5 Construction noise assessment

In order to quantify noise emissions from the proposed construction works, noise modelling software (SoundPLAN v7.4) has been utilised to predict the $L_{Aeq(15\text{-}minute)}$ noise levels at nearby receivers. The calculations include: the source noise levels of the anticipated equipment, the location of selection of nearby sensitive receivers, the number of plant items likely to be operating at any given time and the distance between the equipment and the receivers.

Construction noise source levels for typical road construction plant and equipment expected to be used as part of the proposal are shown in Appendix F. Total sound power levels (SWLs) are then provided for each major stage of the works. The typical noise levels are based on previous measurements conducted by Resonate and on data from Roads and Maritime's *Construction Noise and Vibration Guideline*. The predicted noise level results are presented as a summary of the potential noise impacts for each NCA when the work is located at the nearest position within the proposal area to the sensitive receiver in question.

In practice, the noise levels will vary because plant will move around the worksites and will not all be operating concurrently. As such, noise levels are likely to be lower than the worst-case noise levels presented for notable periods of time during the works.

The ICNG states that where construction works are planned to extend over more than two consecutive nights, the impact assessment should cover the maximum noise level from the proposed works.

- Sound power levels (SWLs) for each proposed stage of work have been calculated. Refer Table 4-9 for a summary of the overall SWLs and Appendix F for a detailed description of the plant and equipment included within each stage.
- The various construction stages and associated work activities have been categorised based on the estimated SWLs resulting in either a low, medium or high noise intensity activity. Table 4-9 provides a summary of the categorisation values for the noise intensity descriptors used for the purposes of the construction noise assessment.
- Existing residential properties located within the construction footprint (including ancillary sites) have not been assessed as noise sensitive receiver locations.

4.5.1 Project specific Noise Managements Levels

NMLs for the identified sensitive receivers have been determined based on the measured RBLs summarised in Section 2.1 and the ICNG methodology in Table 4-2. The NMLs relevant to this assessment are presented in Table 4-8.

Table 4-8 NMLs for sensitive land uses

Land use	Noise Catchment Area (NCA)	Noise Management Level, $L_{Aeq(15\text{-}minute)}$			
		Day (Standard Hours)	Day (OoHW)	Evening	Night
Residential	1	50	45	42	37
	2	50	45	42	37
	3	50	45	42	37
	4	50	45	42	37
	5	50	45	42	37
	6	50	45	42	37
Classrooms	-	55 (external - when in use)			
Places of worship	-	55 (external - when in use)			
Active recreation	-	65 (external - when in use)			

Land use	Noise Catchment Area (NCA)	Noise Management Level, $L_{Aeq(15\text{-}minute)}$			
		Day (Standard Hours)	Day (OoHW)	Evening	Night
Passive recreation	-	60 (external - when in use)			
Commercial	70				
Industrial	75				
Other	Applicable on a case-by-case basis				

4.6 Predicted noise levels

4.6.1 Typical construction scenarios

To present the potential construction noise impacts that may result from the works during standard construction hours, the following figures and tables have been developed:

- Site maps showing NML exceedances for the noise intensity descriptors provided in Table 4-9 are presented in Figure 4-2, Figure 4-3, Figure 4-4 and Figure 4-5.
- Predicted noise levels for each noise sensitive receiver are presented in Appendix G.

It is noted:

- On a representative day, construction noise levels would vary depending on the location and operation of individual plant items. Therefore, the overall noise level experienced at a particular receiver location would vary with time and would typically be less than the maximum presented values.
- The NML exceedances are categorised based on the requirements of the CNVG noise mitigation categories such that the range of noise mitigation measures that may be applicable to each receiver can be identified by cross referencing with Table 5-1, Table 5-2 and Table 5-4.
- Buildings/structures that have been classified as 'Other' have been included in the model but are not required for assessment.

Table 4-9 SWLs per construction phase

Phase	Sub-stage	Description	Total sound power level, L_w dB(A)	Noise intensity descriptor
1	a)	Installation of sediment controls	111	Medium
	b)	Adjustment of utilities and farm infrastructure	112	Medium
	c)	Temporary relocation of bus stops	107	Low
	d)	Installation of boundary fencing	112	Medium
	e)	Site surveys	104	Low
	f)	Upgrade of minor access roads	113	Medium
	g)	Vegetation clearing and grubbing	120	High
	h)	Demolition of existing drainage structures	121	High
	i)	Demolition of redundant existing roads	121	High
	j)	Removal of existing signage	112	High
2	a)	Temporary removal of fencing	113	Medium
	b)	Set up of stockpile and ancillary facilities	118	High
	c)	Temporary traffic management	106	Low

Phase	Sub-stage	Description	Total sound power level, L_w dB(A)	Noise intensity descriptor
	d)	Construction of access roads	116	High
	e)	Progressive installation of environmental controls	104	Low
	f)	Other activities determined at a later date	N/A	N/A
	g)	Construction of diversion drains and sedimentation controls	110	Medium
	h)	Clearing of vegetation and processing materials	120	High
	i)	Temporary upgrade work for existing local roads and intersections	116	High
3	a)	Establishment of erosion and sediment controls and specific water quality controls	113	Medium
	b)	Establishment of construction work zones	117	High
	c)	Earthworks for creek diversion	115	Medium
	d)	Establishment of traffic control measures	105	Low
	e)	Demolition and removal of existing structures	121	High
	f)	Construction of extension of culverts, including channel diversions	117	High
	g)	Installation of scour protection, as required	114	Medium
4	a)	Clearing and grubbing of topsoil, stripping, ripping and compaction of subgrade	118	High
	b)	Construction of road formation and embankments	119	High
	c)	Select material and sub-base layers preparation and compaction	115	Medium
	d)	Laying of asphalt layers, including surfacing	119	High
	e)	Construction of verges and batters	117	High
5	a)	Earthworks and construction of foundations	120	High
	b)	Construction of bridge and abutments	121	High
	c)	Installation of two-span plank bridge	119	High
6	a)	Subgrade improvements and embankment earthworks	117	High
	b)	Pavement construction, including asphalt layers	122	High
	c)	Removal of existing redundant accesses	119	High
7	a)	Installation of pavement markings, signposting and other road furniture	109	Medium
	b)	Progressive landscaping and tree planting	116	High
	c)	Reinstatement of fencing	107	Low
	d)	Site clean-up and demobilisation, including restoration of ancillary facilities and access roads, where required	114	Medium

Table 4-10 SWL noise intensity categorisation

Noise intensity descriptor	Representative sound power level range, L_w dB(A)		Assessment sound power level, L_w dB(A)	Corresponding figure
	Lower	Upper		
Low	103	107	**107**	Figure 4-2
Medium	108	115	**115**	Figure 4-3
High	116	122	**122**	Figure 4-4
Highly noise affected	-	122	**122**	Figure 4-5

4.6.2 Ancillary facilities

In order to complete the proposal, the use of ancillary facilities is required for the storage and processing of materials, housing and maintenance of plant and equipment and site amenities for work crews. A detailed view of the proposed ancillary facilities is provided in Figure 4-1.

The construction activities classed as ancillary works are summarised as the following:

- Scenario 1: batching plant, crushing plant and material processing activities
- Scenario 2: plant workshop
- Scenario 3: storage of plant, equipment and parking vehicles
- Scenario 4: stockpile site.

Table 4-11 provides a summary of the minimum and nominal distances to nearby sensitive receivers as well as the proposed usage for each of the three ancillary facilities.

Table 4-11 Ancillary facility usage summary

Item	Ancillary facility 1	Ancillary facility 2	Ancillary facility 3
Minimum distance to sensitive receiver (metres)	4	115	130
Nominal distance to sensitive receiver (metres)	50	155	190
Scenario 1 activities (Yes/No)	Yes	Yes	Yes
Scenario 2 activities (Yes/No)	Yes	Yes	Yes
Scenario 3 activities (Yes/No)	Yes	Yes	Yes
Scenario 4 activities (Yes/No)	Yes	Yes	Yes

Based on the above, Table 4-12 provides a summary of the likely plant and equipment to be utilised within the ancillary facilities for each proposed usage scenario.

Table 4-12 Ancillary facilities construction SWLs

Plant item	Sound power level, dB(A)	Plant per scenario			
		Scenario 1	Scenario 2	Scenario 3	Scenario 4
Dump truck	110	Yes			Yes
Excavator	110	Yes		Yes	
Bulldozer	116	Yes			
Rock crusher	118	Yes			
Generator	103		Yes	Yes	

Plant item	Sound power level, dB(A)	Plant per scenario			
		Scenario 1	Scenario 2	Scenario 3	Scenario 4
Road truck	108		Yes	Yes	
Light vehicle	103		Yes		
Front end loader	112				Yes
Total sound power level per scenario, $L_{eq(15min)}$ dB(A)		**121**	**110**	**113**	**114**

Based on the information provided above, the predicted noise levels for each usage scenario at the minimum and nominal distances (approximate mid-point of construction footprint to nearest sensitive receiver) between the proposed ancillary facilities and noise sensitive receivers are presented in Table 4-13.

Table 4-13 Ancillary facilities predicted noise levels

Item	Predicted noise level (Scenario 1), $L_{eq(15min)}$ dB(A)		Predicted noise level (Scenario 2), $L_{eq(15min)}$ dB(A)		Predicted noise level (Scenario 3), $L_{eq(15min)}$ dB(A)		Predicted noise level (Scenario 4), $L_{eq(15min)}$ dB(A)	
	Minimum distance	Nominal distance	Minimum distance	Nominal distance	Minimum distance	Nominal distance	Minimum distance	Nominal distance
Ancillary facility 1	101	79	90	68	93	71	94	72
Ancillary facility 2	72	69	61	58	63	61	65	62
Ancillary facility 3	71	67	60	57	62	59	64	61

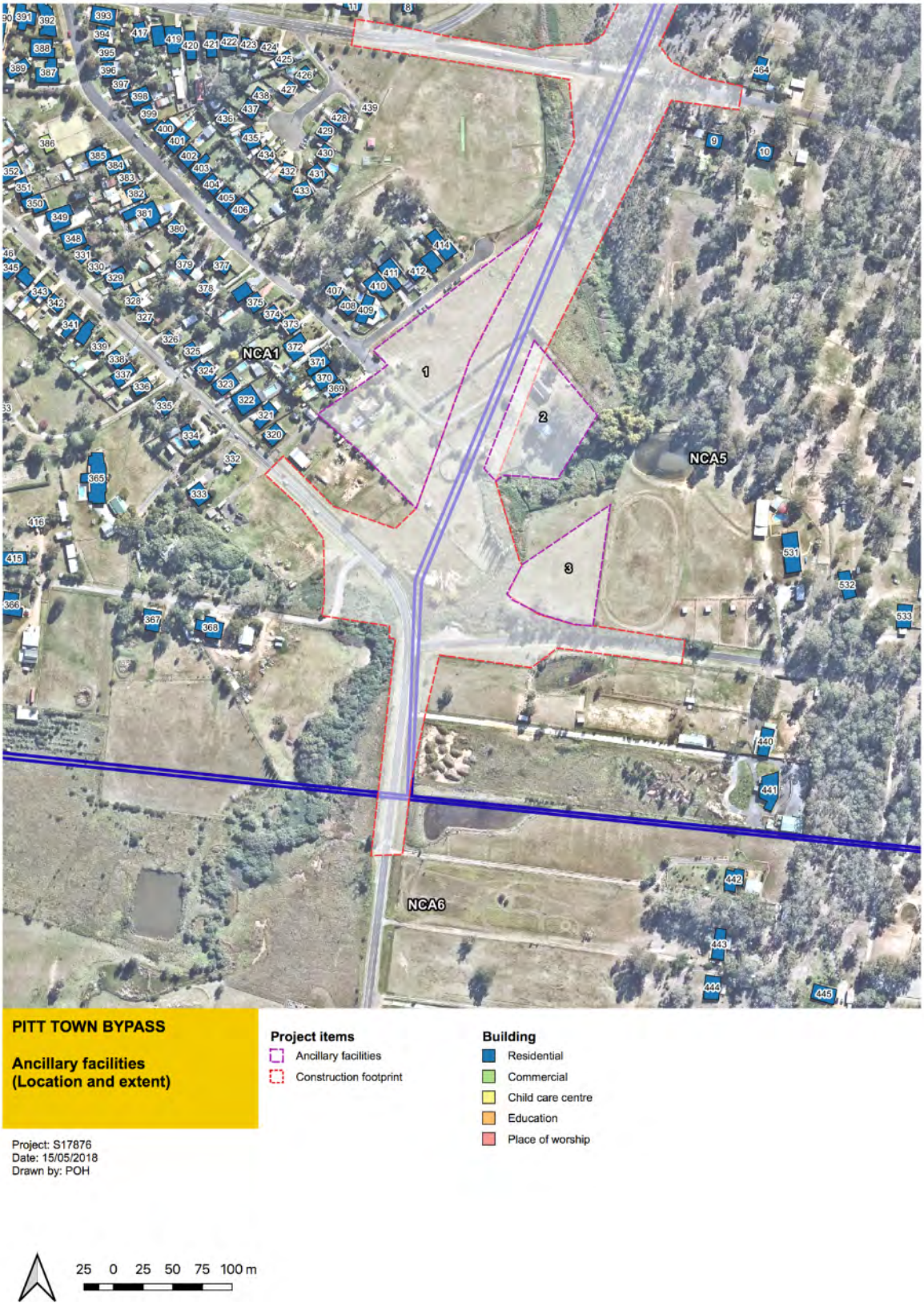


Figure 4-1 Ancillary facilities

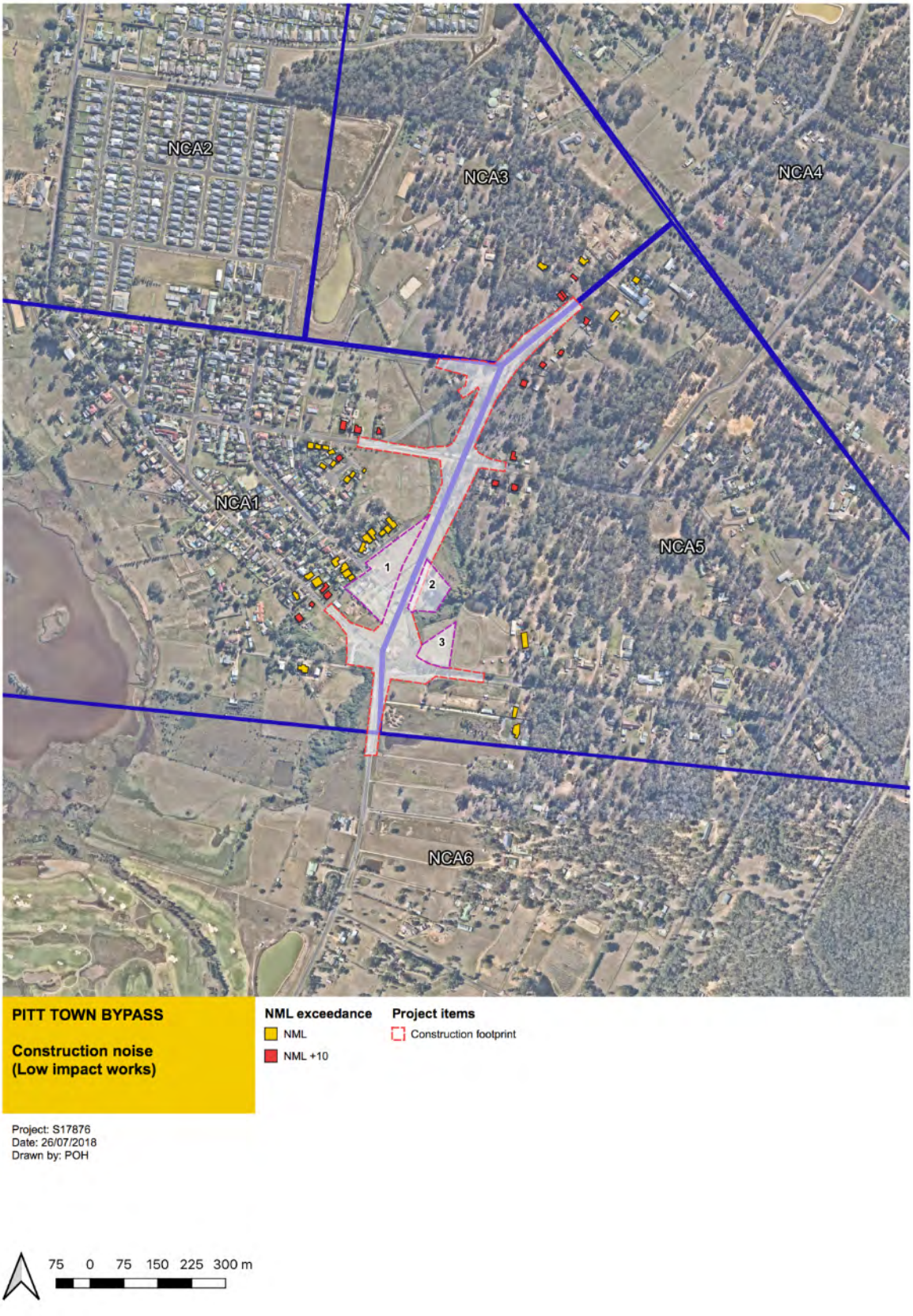


Figure 4-2 Predicted NML exceedances (low noise intensity construction work)

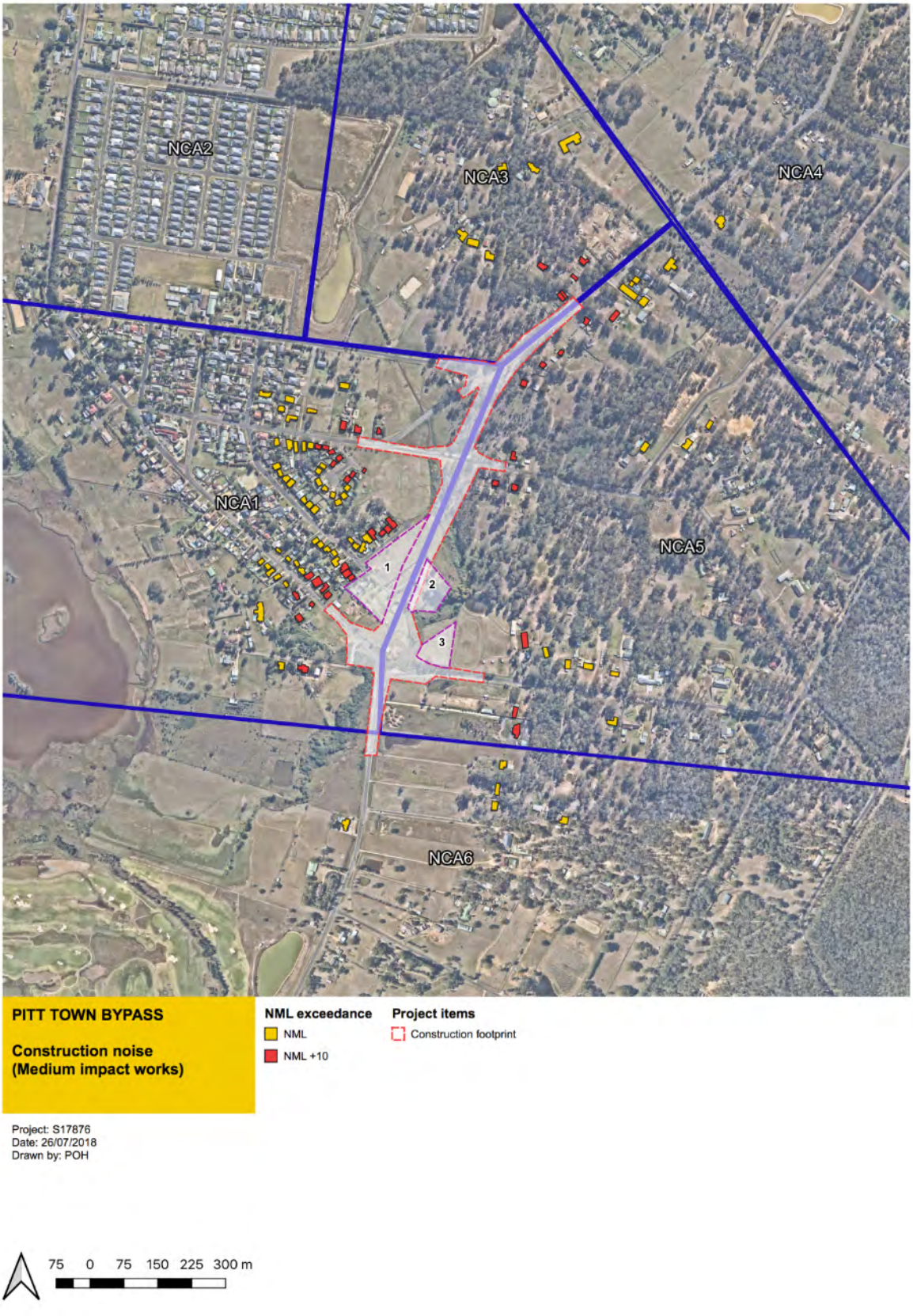


Figure 4-3 Predicted NML exceedances (medium noise intensity construction work)

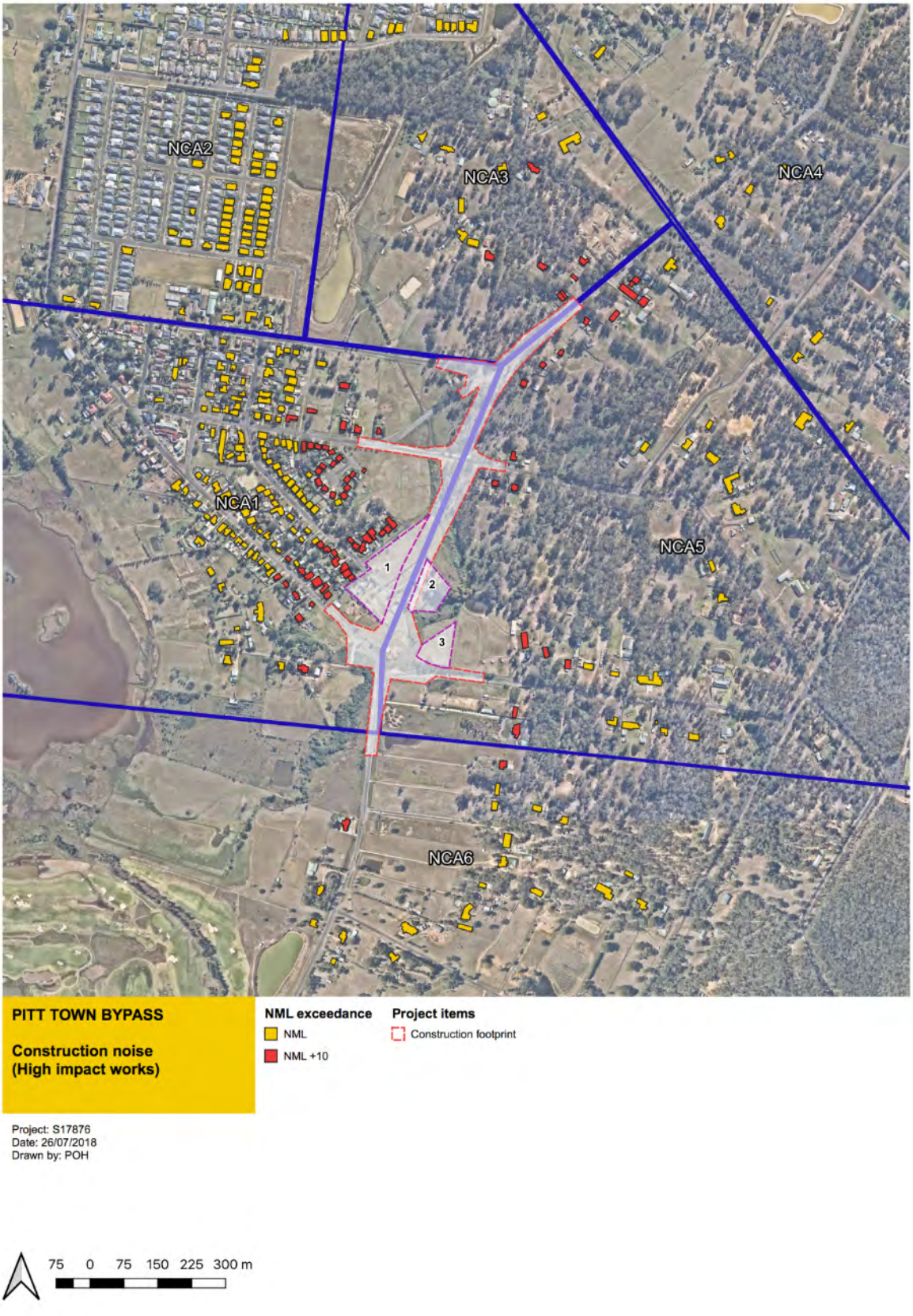


Figure 4-4 Predicted NML exceedances (high noise intensity construction work)

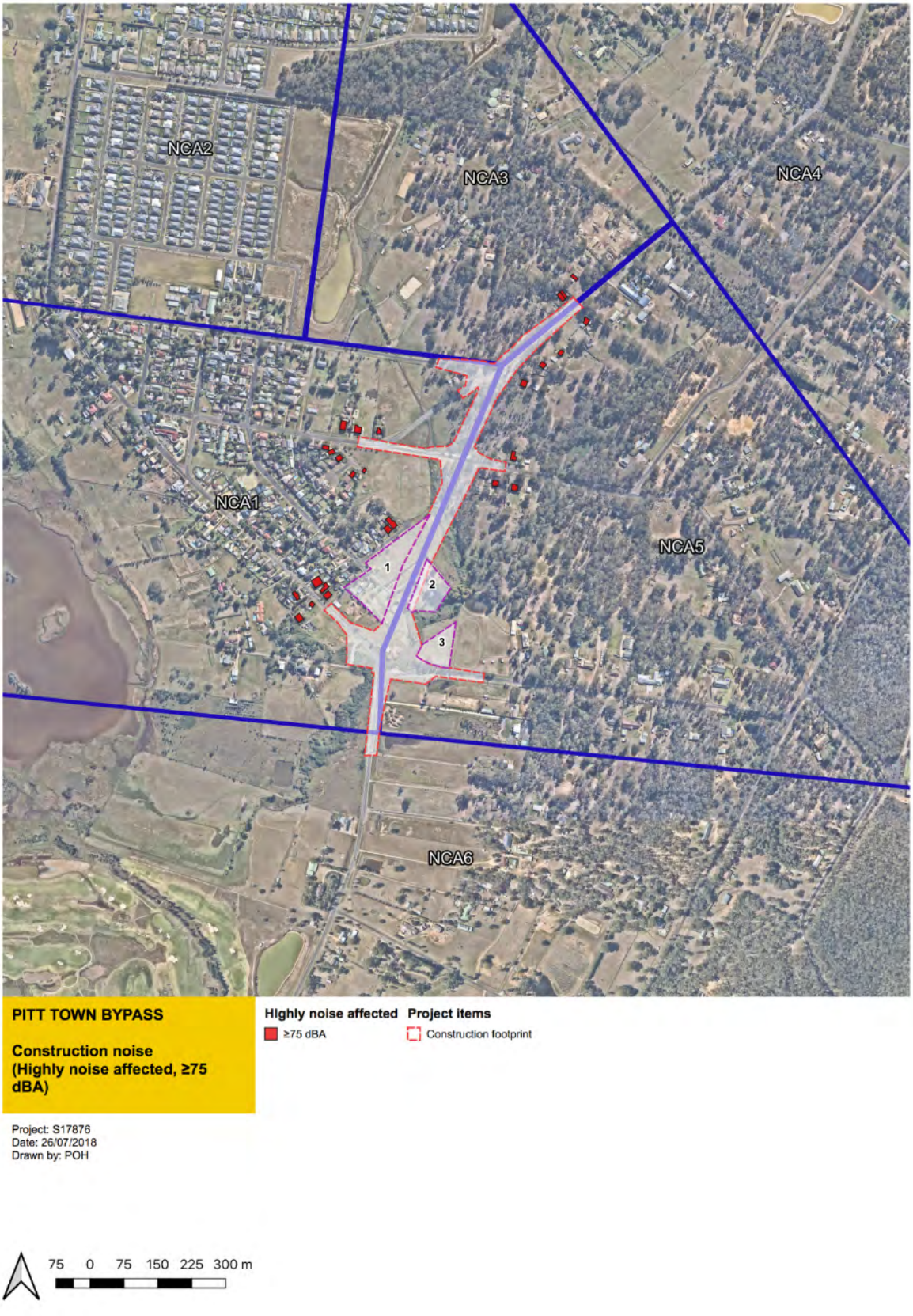


Figure 4-5 Predicted worst-case scenario highly noise affected (>=75 dB(A))

4.7 Discussion of predicted construction noise levels

For construction works that occur during standard hours, the CNVG calls for additional noise mitigation measures in the following circumstances:

- Moderately intrusive construction noise levels:
  - Noise levels are predicted to be greater than or equal 10 dB above the NML (60 dB(A) in the case of the Pitt Town Bypass Project).
  - Notifications and verification noise measurements are recommended at locations exceeding this noise level.
- Highly intrusive construction noise levels:
  - Noise levels are predicted to be greater than or equal to 75 dB(A).
  - Notifications, verification noise measurements, phone calls and respite offers are recommended at locations exceeding this noise level.

Table 4-14 provides the ranges of predicted noise levels per NCA for the categorised construction work. See Appendix G for a detailed table of predicted noise levels per noise sensitive receiver.

Moderately or highly intrusive noise levels are shown in **bold** and daytime NML exceedances are *italicised*. Moderately and highly intrusive noise levels are predicted for NCA 1, NCA 3 and NCA 5 for low, medium and high impact works.

- Moderately intrusive noise levels are predicted to occur at receiver locations at distances up to approximately 200 m from the construction footprint depending of the intensity of the construction activity in question.
- Highly intrusive noise levels are predicted to occur receiver locations at distances up to approximately 60 m from the construction footprint depending of the intensity of the construction activity in question.

Table 4-14 Predicted noise impacts per NCA summary

NCA	NML, $L_{eq(15\text{-}minute)}$ dB(A)				Predicted range of noise levels per works grouping, $L_{eq(15\text{-}minute)}$ dB(A)			Minimum distance (receiver – works), (m)
	Day	Day OoHW	Evening	Night	Low	Medium	High	
1	50	45	42	37	31-***79***	39-***87***	46-***94***	10
2	50	45	42	37	24-41	32-49	39-*56*	310
3	50	45	42	37	32-***81***	40-***89***	47-***96***	7
4	50	45	42	37	33-42	41-*50*	48-*57*	350
5	50	45	42	37	36-***75***	44-***83***	51-***90***	11
6	50	45	42	37	32-49	40-*57*	47-*64*	148

The following is a summary discussion of the predicted noise levels described per NCA. Locations at which moderately or highly intrusive noise levels have been predicated are described with reference to the worst case 'high noise impact' scenario.

4.7.1 Noise Catchment Area 1

Residential receivers

- The predicted construction noise levels within this NCA range between 31 dB(A) and 94 dB(A) with NML exceedances ranging between 0 dB(A) and 44 dB(A) for the daytime period.
- Locations at which highly intrusive noise levels are predicted include locations on Eldon Street, Somerset Street, Mawson Place, Buckridge Street and Bathurst Street up to 60 m from the construction footprint (refer to Figure 4-5).

- Locations at which moderately intrusive noise levels are predicted include locations on Eldon Street, Somerset Street, Mawson Place, Buckridge Street, Lagoon Road and Bathurst Street up to 200 m from the construction footprint (refer to Figure 4-4).
- It should be noted that NML exceedances (noise levels exceeding 50 dB(A) are predicted at receiver locations up to 800m from the construction footprint for high impact works. Standard construction mitigation measures would apply for these locations.
- The majority of construction activities would occur at most locations within the construction footprint.
- Almost all construction activities described in Table 4-9 have the potential to result in moderately or highly intrusive noise levels when conducted at the minimum identified distances from the nearest noise sensitive receivers.
- Activities requiring the use of highly noise intensive plant items would result in the highest noise levels at sensitive receiver locations. High noise intensity plant items are planned for use in all stages of project construction. Typical construction activities and associated plant items likely to result in the highest NML exceedances at sensitive receiver locations are listed below:
    - Demolition of existing road infrastructure including the use of concrete saws, excavators, dump trucks and jackhammers.
    - Vegetation clearing and grubbing including the use of chain saws and mulchers.
    - Pavement construction including the use of pavement laying machines and asphalt profilers.
    - Bridge construction including the use of concrete paving machines, concrete pumps and concrete agitators.

Other sensitive land uses

Other sensitive land uses within NCA 1 include places of worship and commercial receivers. Exceedances of the respective NMLs are not predicted at these locations for any construction activity.

4.7.2 Noise Catchment Area 2

Residential receivers

- The predicted construction noise levels within this NCA range between 24 dB(A) and 56 dB(A) with NML exceedances ranging between 0 dB(A) and 6 dB(A) for the daytime.
- The minimum distance of 310 m between the nearest receiver locations and the construction works means that there are no noise levels predicted to be in the moderately or highly intrusive category.
- NML exceedances are predicted at sensitive receivers located on Buckingham Street, Fernadell Drive, Stables Street, Moorhen Street, Oakes Street, Pittsmoor Street and Velmont Avenue. Standard construction mitigation measures would apply for these locations.
- Typical construction activities and associated plant items likely to result in the highest NML exceedances at sensitive receiver locations are listed below:
    - Demolition of existing road infrastructure including the use of concrete saws, excavators, dump trucks and jackhammers.
    - Vegetation clearing and grubbing including the use of chain saws and mulchers.
    - Pavement construction including the use of pavement laying machines and asphalt profilers.

Other sensitive land uses

Other sensitive land uses within NCA 2 include educational facilities and child care centres. Exceedances of the respective NMLs are not predicted at these locations for any construction activity.

4.7.3 Noise Catchment Area 3

Residential receivers

- The predicted construction noise levels within this NCA range between 32 dB(A) and 96 dB(A) with NML exceedances ranging between 0 dB(A) and 46 dB(A) for the daytime period.
- Locations at which highly intrusive noise levels are predicted include locations on Cattai Road up to 60 m from the construction footprint (refer to Figure 4-5).
- Locations at which moderately intrusive noise levels are predicted include locations on Cattai Road, Bootles Lane, Redfern Place and Buckingham Street up to 200 m from the construction footprint (refer to Figure 4-4).

- Almost all construction activities described in Table 4-9 have the potential to result in moderately intrusive noise levels when conducted at the minimum identified distances from the nearest noise sensitive receivers.
- It should be noted that NML exceedances (noise levels exceeding 50 dB(A) are predicted at receiver locations up to 800m from the construction footprint for high impact works. Standard construction mitigation measures would apply for these locations.
- The majority of construction activities would occur at most locations within the construction footprint.
- Activities requiring the use of highly noise intensive plant items would result in the highest noise levels at sensitive receiver locations. High noise intensity plant items are planned for use in all stages of project construction. Typical construction activities and associated plant items likely to result in the highest NML exceedances at sensitive receiver locations are listed below:
    - Demolition of existing road infrastructure including the use of concrete saws, excavators, dump trucks and jackhammers.
    - Vegetation clearing and grubbing including the use of chain saws and mulchers.
    - Pavement construction including the use of pavement laying machines and asphalt profilers.

Other sensitive land uses

Other sensitive land uses within NCA 3 include light industrial receivers on Cattai Road. Exceedances of the 70 dB(A) NML for commercial receivers may occur at these locations when works are occurring at the minimum offset distances.

4.7.4 Noise Catchment Area 4

Residential receivers

- The predicted construction noise levels within this NCA range between 33 dB(A) and 57 dB(A) with NML exceedances ranging between 0 dB(A) and 7 dB(A) for the daytime.
- The minimum distance of 350 m between the nearest receiver locations and the construction works means that there are no noise levels predicted to be in the moderately or highly intrusive category.
- NML exceedances are predicted at sensitive receivers located on Cattai Road, Airstrip Road and Old Stock Route Road. Standard construction mitigation measures would apply for these locations.
- Typical construction activities and associated plant items likely to result in the highest NML exceedances at sensitive receiver locations are listed below:
    - Demolition of existing road infrastructure including the use of concrete saws, excavators, dump trucks and jackhammers.
    - Vegetation clearing and grubbing including the use of chain saws and mulchers.
    - Pavement construction including the use of pavement laying machines and asphalt profilers.

Other sensitive land uses

Exceedances of NMLs for other sensitive land uses are not predicted are not predicted within NCA 4.

4.7.5 Noise Catchment Area 5

Residential receivers

- The predicted construction noise levels within this NCA range between 36 dB(A) and 90 dB(A) with NML exceedances ranging between 0 dB(A) and 40 dB(A) for the daytime period.
- Locations at which highly intrusive noise levels are predicted include locations on Eldon Street, Somerset Street, Mawson Place, Buckridge Street and Bathurst Street up to 60 m from the construction footprint (refer to Figure 4-5).
- Locations at which moderately intrusive noise levels are predicted include locations on Eldon Street, Somerset Street, Mawson Place, Buckridge Street, Lagoon Road and Bathurst Street up to 200 m from the construction footprint (refer to Figure 4-4).
- It should be noted that NML exceedances (noise levels exceeding 50 dB(A) are predicted at receiver locations up to 800m from the construction footprint for high impact works. Standard construction mitigation measures would apply for these locations.
- The majority of construction activities would occur at most locations within the construction footprint.

- Almost all construction activities described in Table 4-9 have the potential to result in moderately or highly intrusive noise levels when conducted at the minimum identified distances from the nearest noise sensitive receivers.
- Activities requiring the use of highly noise intensive plant items would result in the highest noise levels at sensitive receiver locations. High noise intensity plant items are planned for use in all stages of project construction. Typical construction activities and associated plant items likely to result in the highest NML exceedances at sensitive receiver locations are listed below:
    - Demolition of existing road infrastructure including the use of concrete saws, excavators, dump trucks and jackhammers.
    - Vegetation clearing and grubbing including the use of chain saws and mulchers.
    - Pavement construction including the use of pavement laying machines and asphalt profilers.
    - Bridge construction including the use of concrete paving machines, concrete pumps and concrete agitators.

Other sensitive land uses

Other sensitive land uses within NCA 5 include an educational and child care centre on Cattai Road to the north of the project. Exceedance of the 55 dB(A) NML is predicted at these locations for medium and high impact works occurring at the minimum source-receiver offset distances.

4.7.6 Noise Catchment Area 6

Residential receivers

- The predicted construction noise levels within this NCA range between 32 dB(A) and 64 dB(A) with NML exceedances ranging between 0 dB(A) and 14 dB(A) for the daytime.
- The minimum distance of 148 m between the nearest receiver locations and the construction works means that there are no noise levels predicted to be in the highly intrusive category.
- Noise levels are predicted to be moderately intrusive at one location on Pitt Town Road and one location on Glebe Road.
- NML exceedances are predicted at sensitive receivers located on Pitt Town Road, Schofield Road and Glebe Road. Standard construction mitigation measures would apply for these locations.
- Typical construction activities and associated plant items likely to result in the highest NML exceedances at sensitive receiver locations are listed below:
    - Demolition of existing road infrastructure including the use of concrete saws, excavators, dump trucks and jackhammers.
    - Vegetation clearing and grubbing including the use of chain saws and mulchers.
    - Pavement construction including the use of pavement laying machines and asphalt profilers.

Other sensitive land uses

Exceedances of NMLs for other sensitive land uses are not predicted are not predicted within NCA 6.

4.7.7 Ancillary facilities

The predicted construction noise levels associated with the proposed operation of the three ancillary facilities range between 57 dB(A) and 101 dB(A) at the nearest noise sensitive receiver locations. The predicted maximum levels are as a result of high-impact works resulting from the proposed Scenario 1 construction work, such as the operation of rock crushing and batching plant and equipment. The predicted maximum levels also indicate the potential for sleep disturbance if the ancillary facilities were to operate outside of standard construction hours. This is particularly relevant for Ancillary Facility 1 where minimum distances of 4 m would be possible. It is noted that the large size of this ancillary site is likely to allow for strategic placement of high-noise generating equipment and utilisation of noise barriers both in the form of temporary hoarding and other ancillary items such as site sheds.

It is recommended that all standard mitigation measures as well as additional project specific mitigation measures be implemented in order to minimise the potential noise impacts from the operation of the ancillary facilities.

4.7.8 Construction traffic

Access to the ancillary sites and the general construction zone is likely to require the use of local roads. This would represent a temporary, but noticeable, change in road traffic noise levels at directly affected receivers. Common construction traffic includes light vehicles, including utes and heavy construction vehicles such as dump trucks and concrete agitators.

Based upon Section 7.6.1 of the *Traffic and Transport Assessment* (Arcadis, 2018) for the proposal, it has been calculated that there would be an approximate maximum number of 64 construction truck movements over the course of each working day.

Cattai Road and Bathurst Street have daily traffic volumes of 4,280 and 9,280 vehicles respectively as per the traffic volumes presented in Appendix C. This equates to an approximated 1% to 2% increase in total traffic numbers on main project access roads such as Bathurst Street, Eldon Street, Cattai Road and Pitt Town Road. This increase in traffic volume due to construction traffic would result in an increase in construction traffic related noise levels of less than 1 dB. This increase was calculated based upon a logarithmic ratio of the increased traffic with construction traffic compared to the current traffic volume. The CNVG does not require further assessment of construction traffic noise if the increase is less than or equal to 2 dB.

However, there may be a more localised increase in noise levels at construction access points and should be further assessed during the detailed construction planning phase.

It is recommended that all standard mitigation measures as well as additional project specific mitigation measures be implemented in order to minimise the potential noise impacts from construction traffic on local roads.

4.8 Construction vibration

4.8.1 Minimum working distances

The CNVG provides guidelines for minimum working distances for vibration-intensive activities with respect to the stated standards and guidelines. The minimum working distances for building damage should be complied with at all times. The distances are noted as being indicative and are likely to vary depending on the particular item of plant and local geotechnical conditions. The minimum working distances apply to addressing the risk of cosmetic (minor – easily reparable) damage of typical buildings under typical geotechnical conditions.

Where vibration intensive works are required to be undertaken within the specified minimum working distances, vibration monitoring should be undertaken to ensure acceptable levels of vibration are satisfied.
In relation to human comfort, the minimum working distances relate to continuous vibration. For most construction activities, vibration emissions would be intermittent in nature and for this reason, higher vibration levels, occurring over shorter periods may be allowed.

Table 4-15 presents the recommended minimum working distances for vibration intensive plant.

Table 4-15 Recommended safe working distances for vibration intensive plant

Plant Item	Rating/Description	Minimum Working Distance – Cosmetic Damage[1] (BS7385)	Minimum Working Distance – Human Response (OH&E Guideline)
Vibratory Roller	< 50 kN (Typically 1-2 tonnes)	5 m	15 m to 20 m
	< 100 kN (Typically 2-4 tonnes)	6 m	20 m
	< 200 kN (Typically 4-6 tonnes)	12 m	40 m
	< 300 kN (Typically 7-13 tonnes)	15 m	100 m
	> 300 kN (Typically 13-18 tonnes)	20 m	100 m

Plant Item	Rating/Description	Minimum Working Distance – Cosmetic Damage[1] (BS7385)	Minimum Working Distance – Human Response (OH&E Guideline)
	> 300 kN (> 18 tonnes)	25 m	100 m
Small Hydraulic Hammer	(300 kg - 5 to 12t excavator)	2 m	7 m
Medium Hydraulic Hammer	(900 kg – 12 to 18t excavator)	7 m	23 m
Large Hydraulic Hammer	(1600 kg – 18 to 34t excavator)	22 m	73 m
Vibratory Pile Driver	Sheet piles	2 m to 20 m	20 m
Pile Boring	≤ 800 mm	2 m (nominal)	4 m
Jackhammer	Hand held	1 m (nominal)	2 m

4.8.2 Vibration intensive activities

Generally, the separation distance from the nearest receivers is sufficient to mitigate the potential impacts. As such it is considered that structural or cosmetic damage impacts from vibration intensive works are generally unlikely for most the adjacent receivers.

Where work is proposed within the safe working distances the mitigation measures outlined in Section 5.1 should be implemented to reduce the impacts as far as practicable.

4.8.3 Heritage structures

The proposal alignment is located adjacent to one buildings/structure that has been identified as being heritage listed or of significance from a heritage perspective. This structure is described in Table 4-16 together with an estimate of the minimum distance to the proposal.

Table 4-16 Heritage-listed items

Name	Address	Description	Minimum distance to works, m
The Cottage	22 Bathurst Street	Lot 1, DP 986055	24

BS7385 states that a building of historical value should not (unless it is structurally unsound) be assumed to be more vibration sensitive, and therefore, compliance with the minimum distances provided in Table 4-15, is likely to result in low risk of cosmetic damage to the nominated structure in this category.

Notwithstanding the above, large vibration intensive plant items such as large vibratory rollers and hydraulic hammers have the potential to exceed the most stringent DIN4150 criterion of 3 mm/s for vibration sensitive structures.
It is recommended that a review of the vibration sensitivity of this structure be completed as part of the detailed design or pre-construction planning phases in order to confirm the appropriateness of the minimum working distance assessment and apply management protocols if required.

Management protocols may include:

- Conduct a pre-construction dilapidation survey and monitor the condition of the structure throughout construction.
- Conduct vibration monitoring during construction applying the revised vibration targets determined as part of the pre-construction assessment.
- Conduct a vibration measurement investigation in order to determine the sensitivity of the structure in question to ground-borne vibration. This would only be required if the structure was deemed to have a particular sensitivity to vibration.

5 Construction noise and vibration mitigation

5.1 Standard mitigation measures

Exceedances are predicted at several identified sensitive receivers for various construction activities involved in the proposal. Therefore, efforts should be made to implement all feasible and reasonable mitigation measures in order to minimise the impacts of construction noise and vibration.

Appendix B of the CNVG presents a detailed table of standard mitigation measures. The CNVG states that the standard mitigation measures should be implemented on all construction projects. The standard mitigation measures include items such as:

- Community consultation or notification
- Site inductions and staff training
- Preparation of work specific construction noise and vibration management plans
- Validation noise and vibration measurements
- Selection of the quietest available plant and equipment
- Scheduling of noise and vibration intensive work
- Use of temporary noise barrier / enclosure and/or planning work to use natural topographical shielding
- Dilapidation surveys and vibration monitoring.

Table 5-1 Standard noise mitigation measures applicable to the proposal (CNVG)

Action required	Applies to:	Details
Management measures		
Implementation of any project specific mitigation measures required.	Airborne noise.	Implementation of any project specific mitigation measures required. These specific mitigation measures will centre around all construction activities and work areas, including ancillary facilities. These will need to be further detailed as part of the construction noise and vibration management plan that will be developed for the proposal.
Implement community consultation or notification measures.	Airborne noise. Ground-borne noise & vibration.	Notification detailing work activities, dates and hours, impacts and mitigation measures, indication of work schedule over the night time period, any operational noise benefits from the works (where applicable) and contact telephone number. Notification should be a minimum of 7 calendar days prior to the start of works. For projects other than maintenance works more advanced consultation or notification may be required. Please contact Roads and Maritime Communication and Stakeholder Engagement for guidance. Website (If required). Contact telephone number for community. Email distribution list (if required). Community drop in session (if required by approval conditions).

Action required	Applies to:	Details
Site inductions	Airborne noise. Ground-borne noise & vibration.	All employees, contractors and subcontractors are to receive an environmental induction. The induction must at least include: • all project specific and relevant standard noise and vibration mitigation measures • relevant licence and approval conditions • permissible hours of work • any limitations on high noise generating activities • location of nearest sensitive receivers • construction employee parking areas • designated loading/unloading areas and procedures • site opening/closing times (including deliveries) • environmental incident procedures.
Behavioural practices	Airborne noise.	No swearing or unnecessary shouting or loud stereos/radios on site. No dropping of materials from height, throwing of metal items and slamming of doors.
Verification	Airborne noise Ground-borne noise and vibration.	Where specified under Appendix C of the CNVG, a noise verification program is to be carried out for the duration of the works in accordance with the Construction Noise and Vibration Management Plan and any approval and licence conditions.
Attended vibration measurements	Ground-borne vibration	Where required, attended vibration measurements should be undertaken at the commencement of vibration generating activities to confirm that vibration levels are within the acceptable range to prevent cosmetic building damage.
Update Construction Environmental Management Plans	Airborne noise. Ground-borne noise and vibration.	The CEMP must be regularly updated to account for changes in noise and vibration management issues and strategies.
Building condition surveys	Vibration	Undertake building dilapidation surveys on all buildings located within the buffer zone prior to commencement of activities with the potential to cause property damage.
Source controls		
Construction hours and scheduling	Airborne noise. Ground-borne noise and vibration.	Where feasible and reasonable, construction should be carried out during the standard daytime working hours. Work generating high noise and/or vibration levels should be scheduled during less sensitive time periods.
Construction respite period during normal hours and out-of-hours works	Airborne noise. Ground-borne noise and vibration.	Please refer to Table 5-4 for more details on the following respite measures: • Respite Offers (RO) • Respite Period 1 (R1) • Respite Period 2 (R2) • Duration Respite (DR)
Equipment selection	Airborne noise. Ground-borne noise and vibration.	Use quieter and less vibration emitting construction methods where feasible and reasonable. For example, when piling is required, bored piles rather than impact-driven piles will minimise noise and vibration impacts. Similarly, diaphragm wall construction techniques, in lieu of sheet piling, will have significant noise and vibration benefits. Ensure plant including the silencer is well maintained.

Action required	Applies to:	Details
Plant noise levels	Airborne noise.	The noise levels of plants and equipment must have operating Sound Power or Sound Pressure Levels compliant with the criteria in Appendix H of the CNVG.
Rental plant and equipment	Airborne noise.	The noise levels of plant and equipment items are to be considered in rental decisions and, in any case, cannot be used on site unless compliant with the criteria in Table 2 of the CNVG.
Use and siting of plant	Airborne noise.	The offset distance between noisy plant and adjacent sensitive receivers is to be maximised. Plant used intermittently to be throttled down or shut down. Noise-emitting plant to be directed away from sensitive receivers. Only have necessary equipment on site.
Plan worksites and activities to minimise noise and vibration	Airborne noise. Ground-borne vibration.	Locate compounds away from sensitive receivers and discourage access from local roads. Plan traffic flows, parking and loading/unloading areas to minimise reversing movements within the site. Where additional activities or plant may only result in a marginal noise increase and speed up works, consider limiting duration of impact by concentrating noisy activities at one location and move to another as quickly as possible. Very noisy activities should be scheduled for normal working hours. If the work cannot be undertaken during the day, it should be completed before 11.00 pm. Where practicable, work should be scheduled to avoid major student examination periods when students are studying for examinations, whether at an institution or within a residence, such as before or during Higher School Certificate and at the end of higher education semesters.
Reduced equipment power	Airborne noise. Ground-borne vibration.	Use only the necessary size and power.
Non-tonal and ambient sensitive reversing alarms	Airborne noise.	Non-tonal reversing beepers (or an equivalent mechanism) must be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out of hours work. Consider the use of ambient sensitive alarms that adjust output to the ambient noise level.
Minimise disturbance arising from delivery of goods to construction sites	Airborne noise.	Loading and unloading of materials/deliveries is to occur as far as possible from sensitive receivers. Select site access points and roads as far as possible from sensitive receivers. Dedicated loading/unloading areas to be shielded if close to sensitive receivers. Delivery vehicles to be fitted with straps rather than chains for unloading, wherever possible. Avoid or minimise these out of hours movements where possible.

Action required	Applies to:	Details
Engine compression brakes	Construction vehicles.	Limit the use of engine compression brakes at night and in residential areas. Ensure vehicles are fitted with a maintained Original Equipment Manufacturer exhaust silencer or a silencer that complies with the National Transport Commission's 'In-service test procedure' and standard.
Path controls		
Shield stationary noise sources such as pumps, compressors, fans, etc.	Airborne noise.	Stationary noise sources should be enclosed or shielded where feasible and reasonable whilst ensuring that the occupational health and safety of workers is maintained. Appendix D of AS 2436:2010 lists materials suitable for shielding.
Shield sensitive receivers from noisy activities	Airborne noise.	Use of structures to shield residential receivers from noise such as site shed placement; earth bunds; fencing; erection of operational stage noise barriers (where practicable) and consideration of site topography when situating plant.
Receptor controls		
Structural surveys and vibration monitoring	Ground-borne vibration.	Pre-construction surveys of the structural integrity of vibration sensitive buildings may be warranted. At locations where there are high-risk receptors, vibration monitoring should be conducted during the activities causing vibration.

5.2 Additional mitigation measures

The CNVG recommends additional mitigation measures where all feasible and reasonable efforts cannot achieve the NMLs and maximum vibration levels for the proposed works.

Detailed construction noise and vibration impact assessments will be prepared during the construction phase based on detailed programming information. The detailed assessments will identify the specific additional mitigation measures required for the work in question based on the requirements of the CNVG.

A review of the predicted noise levels as presented in Figure 4-2, Figure 4-3, Figure 4-4, Figure 4-5 and tables below indicate the potential locations at which additional mitigation measures may be required.

The additional mitigation measures include controls such as:

- Widespread community consultation via letterbox drops, phone calls and one-on-one briefings,
- Respite offers which involves scheduling of work to provide specific receivers with a break from continuous construction work,

Guidelines to the additional mitigation measures are described in detail as follows:

- Table 5-2 details the additional mitigation measures for airborne noise impacts,
- Table 5-3 details the additional mitigation measures for ground-borne vibration impacts.

Table 5-2 Additional air-borne noise mitigation measures (CNVG)

Construction hours	dB(A) above RBL	dB(A) above NML	Additional mitigation measure type		Mitigation Levels
All periods >75 dB(A)			Notification Verification	Phone calls Respite offer	> 75 dB(A)
Standard: Mon-Fri (7am – 6pm), Sat (8am – 1pm) Sun/Public Holiday (Nil)					
Noticeable	5 to 10	0	-		NML
Clearly Audible	10 to 20	<10	-		NML
Moderately Intrusive	20 to 30	10 to 20	Notification Verification		NML+10
Highly Intrusive	>30	>20	Notification Verification		NML+20
OoHW Period 1: Mon-Fri (6pm – 10pm), Sat (7am – 8am & 1pm – 10pm), Sun/Public Holiday (8am – 6pm)					
Noticeable	5 to 10	< 5	-		NML
Clearly Audible	10 to 20	5 to 15	Notification Respite Period 1	Duration Respite	NML+5
Moderately Intrusive	20 to 30	15 to 25	Verification Notification	Respite Period 1 Duration Respite	NML+15
Highly Intrusive	> 30	> 25	Verification Individual briefings Notification Respite Period 1	Duration Respite Phone calls Specific notifications	NML+25
OoHW Period 2: Mon-Fri (10pm – 7am) Sat (10 pm – 8am) Sun/Public Holiday (6pm – 7am)					
Noticeable	5 to 10	< 5	Notification		NML
Clearly Audible	10 to 20	5 to 15	Verification Notification	Respite Period 2 Duration Respite	NML+5
Moderately Intrusive	20 to 30	15 to 25	Verification Individual briefings Notification Phone calls	Specific notifications Respite Period 2 Duration Respite	NML+15
Highly Intrusive	> 30	> 25	Alternative Accommodation Verification Individual Briefings Notification	Phone calls Specific notifications Respite Period 2 Duration Respite	NML+25

Table 5-3 Additional vibration mitigation measures

Construction hours	Additional mitigation measure type		Apply to:
Standard: Mon-Fri (7am – 6pm), Sat (8am – 1pm) Sun/Public Holiday (Nil)			
Predicted vibration levels exceeds maximum levels	Verification Notification	Respite Offer	All
OoHW Period 1: Mon-Fri (6pm – 10pm), Sat (7am – 8am & 1pm – 10pm), Sun/Public Holiday (8am – 6pm)			
Predicted vibration levels exceeds maximum levels	Verification Individual Briefings Notification Respite Offer	Phone calls Respite Offer Specific notifications	All
OoHW Period 2: Mon-Fri (10pm – 7am) Sat (10 pm – 8am) Sun/Public Holiday (6pm – 7am)			
Predicted vibration levels exceeds maximum levels	Alternative Accommodation Verification Individual Briefings Notification	Phone calls Respite Offer Specific notifications	All

5.3 Detailed description of CNVG additional mitigation measures

Table 5-4 Description of CNVG additional mitigation measures

Mitigation measure	Abbreviation	Description
Notification	N	Advanced warning of works and potential disruptors can assist in reducing the impact on the community. The notification may consist of a letterbox drop (or equivalent) detailing work activities, time periods over which these will occur, impacts and mitigation measures. Notification should be a minimum of 5 working days prior to the start of works. The approval conditions for projects may also specify requirements for notification to the community about works that may impact on them.
Specific Notifications	SN	Specific notifications are letterbox dropped (or equivalent) to identified stakeholders no later than seven calendar days ahead of construction activities that are likely to exceed the noise objectives. The specific notification provides additional information when relevant and informative to more highly affected receivers than covered in general letterbox drops. The exact conditions under which specific notifications would proceed are defined in the relevant Additional Mitigation Measures (Table 5-2 and Table 5-3). This form of communication is used to support periodic notifications, or to advertise unscheduled works.
Phone Calls	PC	Phone calls detailing relevant information made to identified/affected stakeholders within seven calendar days of proposed work. Phone calls provide affected stakeholders with personalised contact and tailored advice, with the opportunity to provide comments on the proposed work and specific needs. Where the resident cannot be telephoned then an alternative form of engagement should be used.
Individual Briefings	IB	Individual briefings are used to inform stakeholders about the impacts of high noise activities and mitigation measures that will be implemented. Project representatives would visit identified stakeholders at least 48 hours ahead of potentially disturbing construction activities. Individual briefings provide affected stakeholders with personalised contact and tailored advice, with the opportunity to comment on the project. Where the resident cannot be met with individually then an alternative form of engagement should be used.
Respite Offers	RO	Respite Offers should be considered made where there are high noise and vibration generating activities near receivers. As a guide work should be carried out in continuous blocks that do not exceed 3 hours each, with a minimum respite period of one hour between each block. The actual duration of each block of work and respite should be flexible to accommodate the usage of and amenity at nearby receivers. The purpose of such an offer is to provide residents with respite from an ongoing impact. This measure is evaluated on a project-by-project basis, and may not be applicable to all projects.
Respite Period 1	R1	Out-of-hours construction noise in out of hours period 1 shall be limited to no more than three consecutive evenings per week except where there is a Duration Respite. For night work these periods of work should be separated by not less than one week and no more than 6 evenings per month.

Mitigation measure	Abbreviation	Description
Respite Period 2	R2	Night time construction noise in out-of-hours period 2 shall be limited to two consecutive nights except for where there is a Duration Respite. For night work these periods of work should be separated by not less than one week and 6 nights per month. Where possible, high noise generating works shall be completed before 11 pm.
Duration Respite	DR	Respite offers and respite periods 1 and 2 may be counterproductive in reducing the impact on the community for longer duration projects. In this instance and where it can be strongly justified it may be beneficial to increase the work duration, number of evenings or nights worked through Duration Respite so that the project can be completed more quickly. The project team should engage with the community where noise levels are expected to exceed the NML to demonstrate support for Duration Respite. Where there are few receivers above the NML each of these receivers should be visited to discuss the project to gain support for Duration Respite.
Alternative Accommodation	AA	Alternative accommodation options may be offered to residents living in close proximity to construction works that are likely to experience highly intrusive noise levels (Tables C1-C3). The specifics of the offer will be identified on a project-by-project basis. Additional aspects for consideration shall include whether the highly intrusive activities occur throughout the night or before midnight.
Verification	V	This verification should include measurement of the background noise level and construction noise. Note this is not required for projects less than three weeks unless to assist in managing complaints.

5.4 Vibration mitigation

The potential impacts from vibration are to be considered in the site-specific Construction Noise and Vibration Management Plans, to be developed during the detailed design phase when more information is available on the schedule for the works and the equipment to be used.

The safe working distances should be maintained as per Table 4-15 and Section 4.8.3, with distances between works and sensitive receivers maximised wherever possible. The following should be implemented where reasonable and feasible to do so:

- All plant should be properly maintained.
- Low vibration alternatives for plant should be implemented where possible.
- Plant that have high and low vibration operating settings should be run on the lowest effective vibration setting.
- Vehicle movements along uneven surfaces should be restricted to minimum speed adjacent to vibration sensitive receivers.
- Pre-construction vibration monitoring and a dilapidation survey are recommended at the heritage listed location (22 Bathurst Street – The Cottage).

6 Conclusion

Resonate Consultants has been engaged by Arcadis Australia Pacific to prepare a noise and vibration impact assessment for a Review of Environmental Factors for the proposal.

Due to the location of the newly proposed road alignment, several potentially affected noise and vibration sensitive receivers have been identified. Unattended noise surveys and operator-attended noise measurements were undertaken to properly characterise the prevailing ambient and road traffic noise within the investigation area. Both operational road traffic and construction noise and vibration impacts have been assessed based upon criteria derived from the existing noise environment and the proposed road design and construction methodology.

Operational road traffic noise levels have been assessed in accordance with the requirements of the NCG. Compliance with the established criteria has been predicted at the majority of noise sensitive receiver locations across the proposal area with the exception of 22 Old Pitt Town Road. The increase in noise levels at this location results from the proximity of the bypass to the receiver location.

The proposal does not in itself generate higher traffic flows over and above the no-build scenario. However, the action of diverting traffic flows on to the bypass results in noise level reductions in the order of 1 dB to 2 dB. Consequently, noise levels are predicted to increase by a similar margin at receiver locations located directly to the east and west of the bypass. Compliance with the NCG criteria has been predicted at all non-residential noise sensitive receivers. Noise mitigation measures include the following:

- Lower noise pavement in the form of DGA has been assumed for use on the bypass
- Jersey kerb barriers are being utilised as noise barriers on some parts of the alignment
- At-property treatments would be considered at the exceedance location.

Predicted worst-case exceedances of the established NMLs and vibration criteria for nearby sensitive receivers indicate that feasible and reasonable mitigation measures are likely to be required during the construction phase of the proposal. The ranges of NML exceedances indicates preference should be given to conducting work during standard construction hours where feasible and reasonable to do so. Should work be required outside of standard hours, the scheduling of high-intensity construction work during this work should be avoided.

The proposal alignment is located adjacent to one buildings/structure that has been identified as being heritage listed or of significance from a heritage perspective. It is recommended that a review of the vibration sensitivity of this structure be completed as part of the detailed design or pre-construction planning phases in order to confirm the appropriateness of the minimum working distance assessment and apply management protocols if required.

Appendix A

Receiver identification maps


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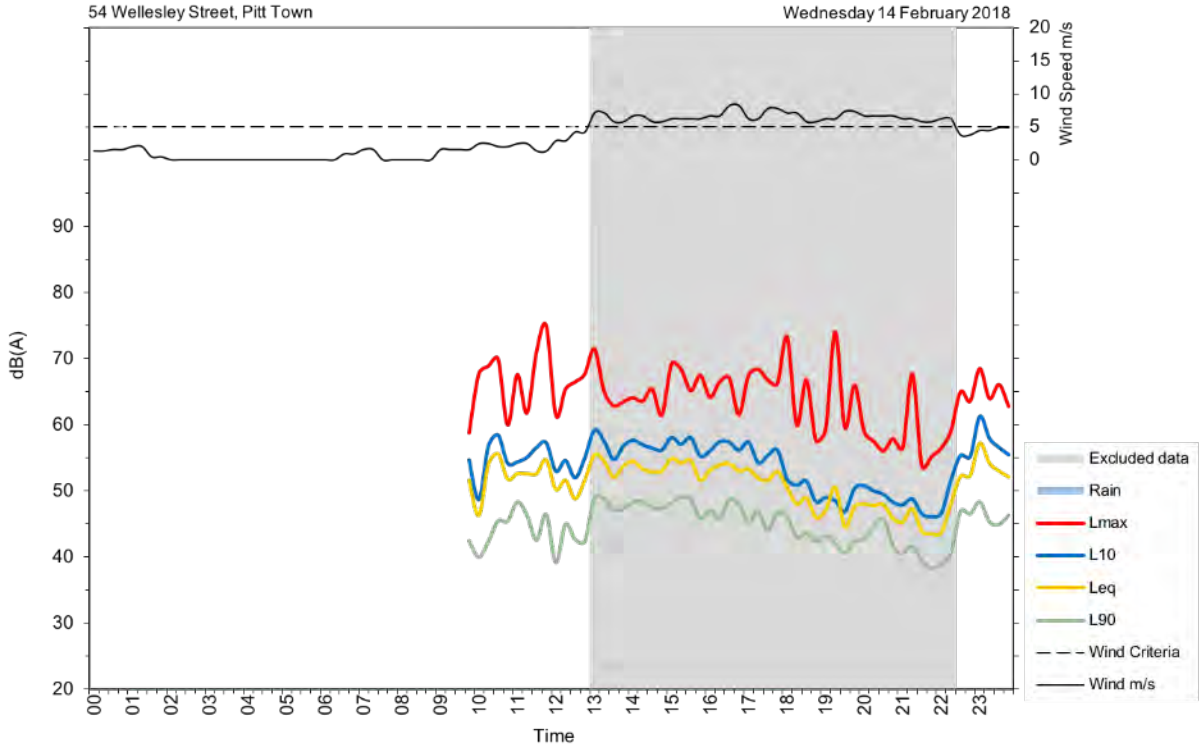
Appendix B

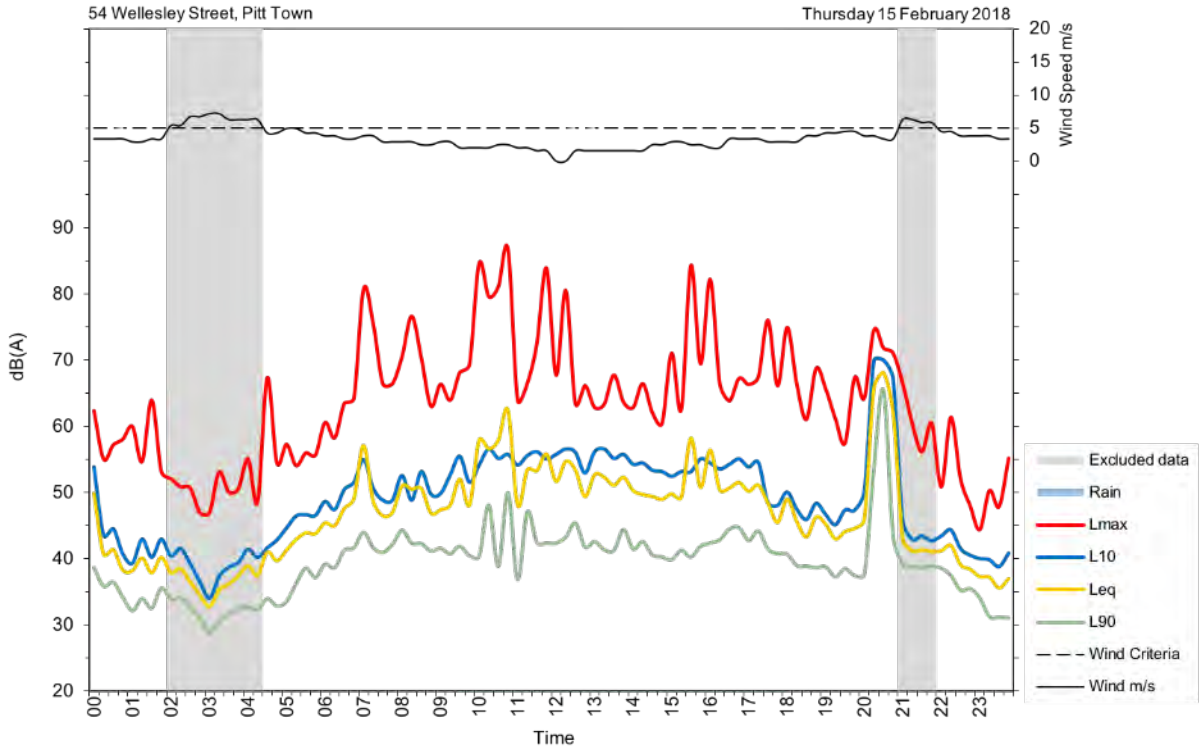
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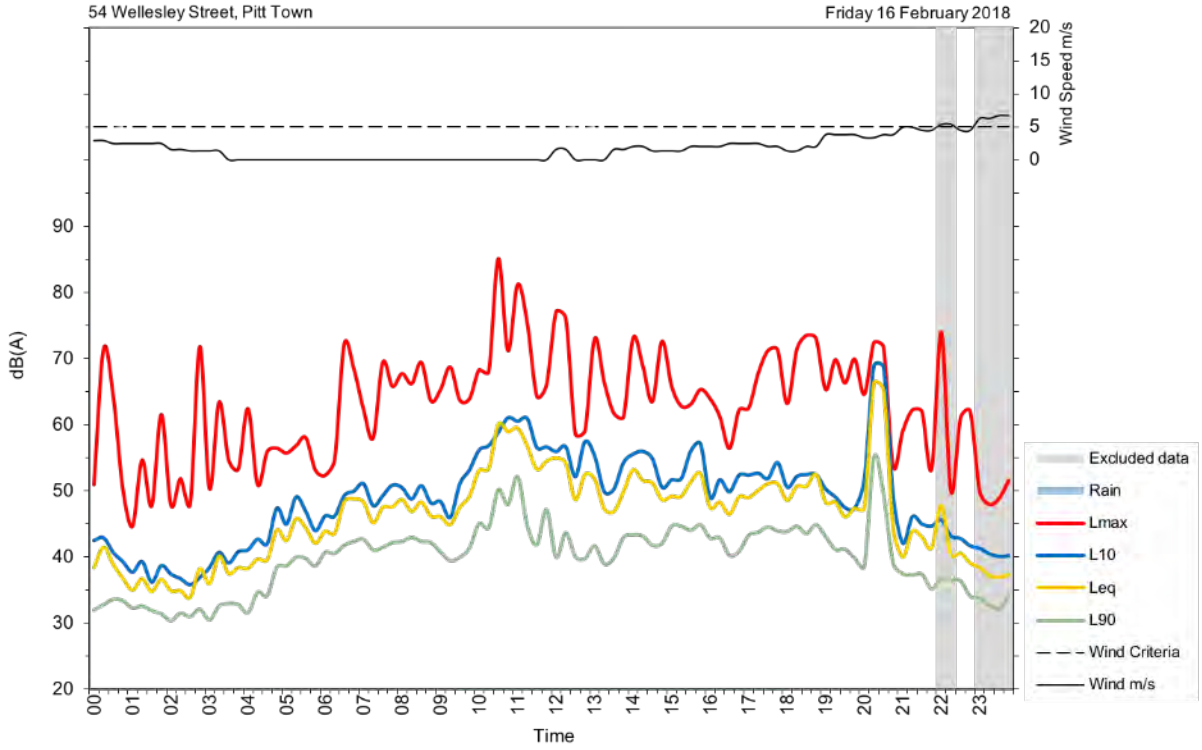
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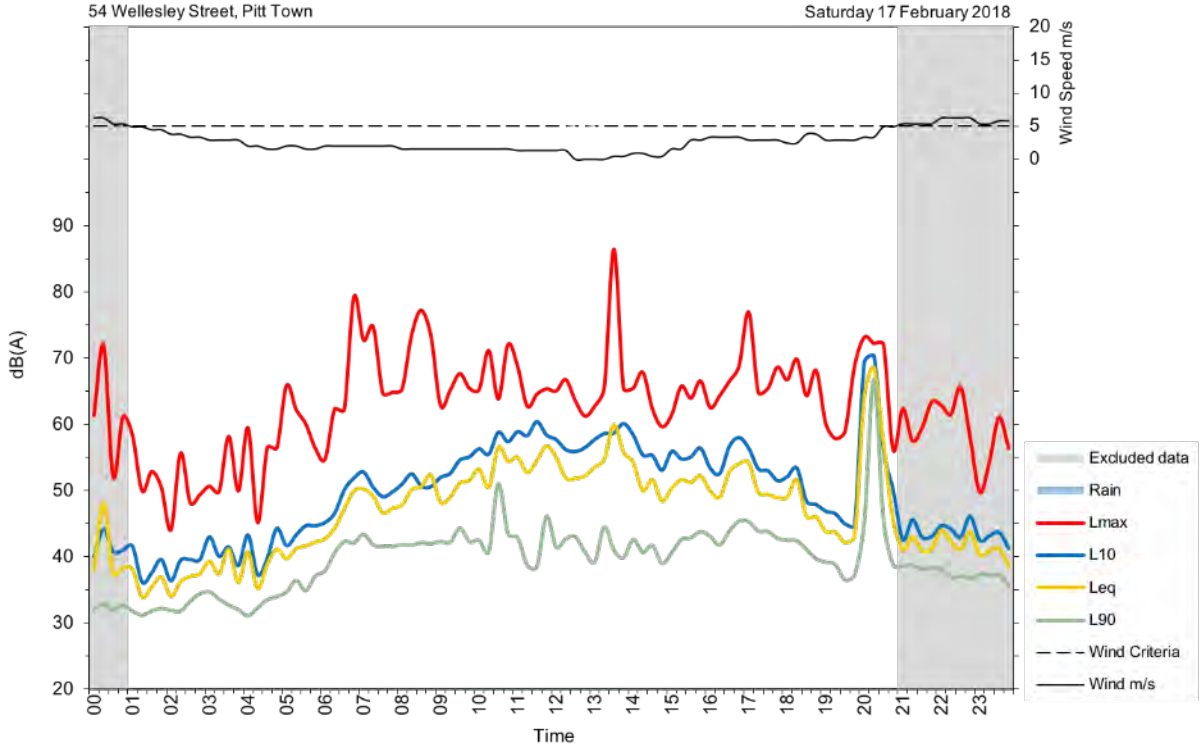
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Measurement location	Free-field
Measurement details	L_{Amax}, L_{Aeq}, L_{A90}
Logging period	Wednesday, 14 February 2018 to Tuesday, 20 February 2018

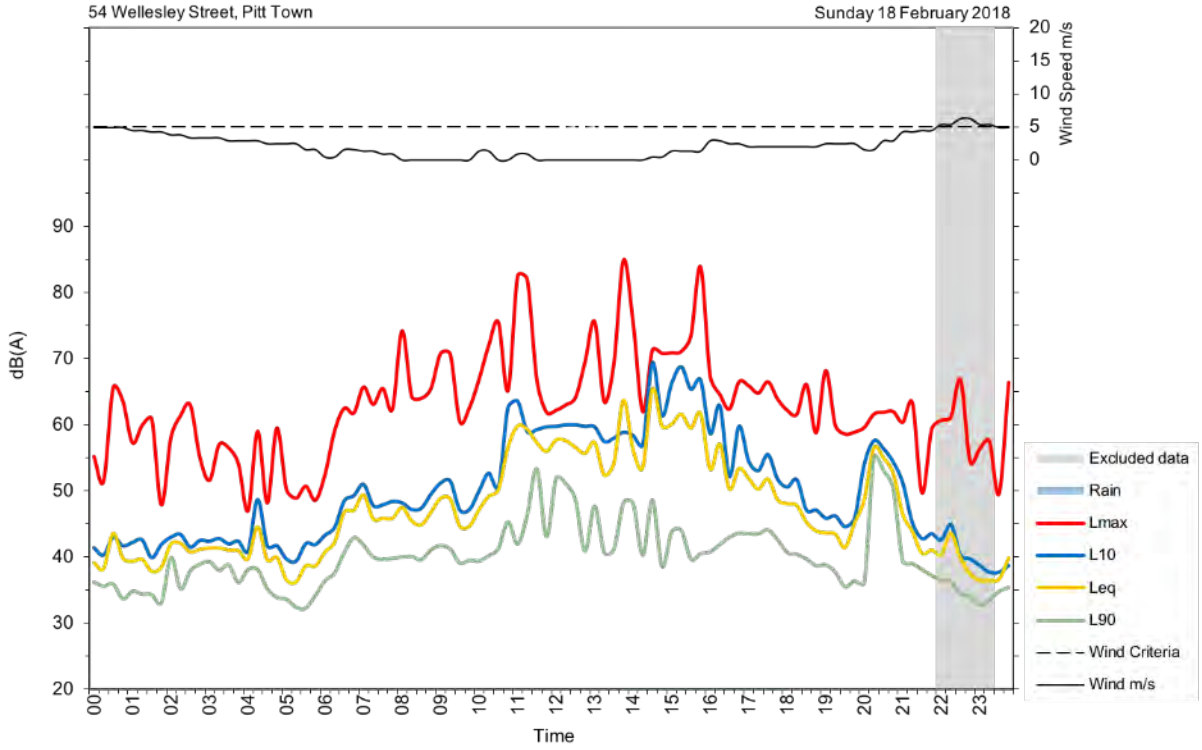


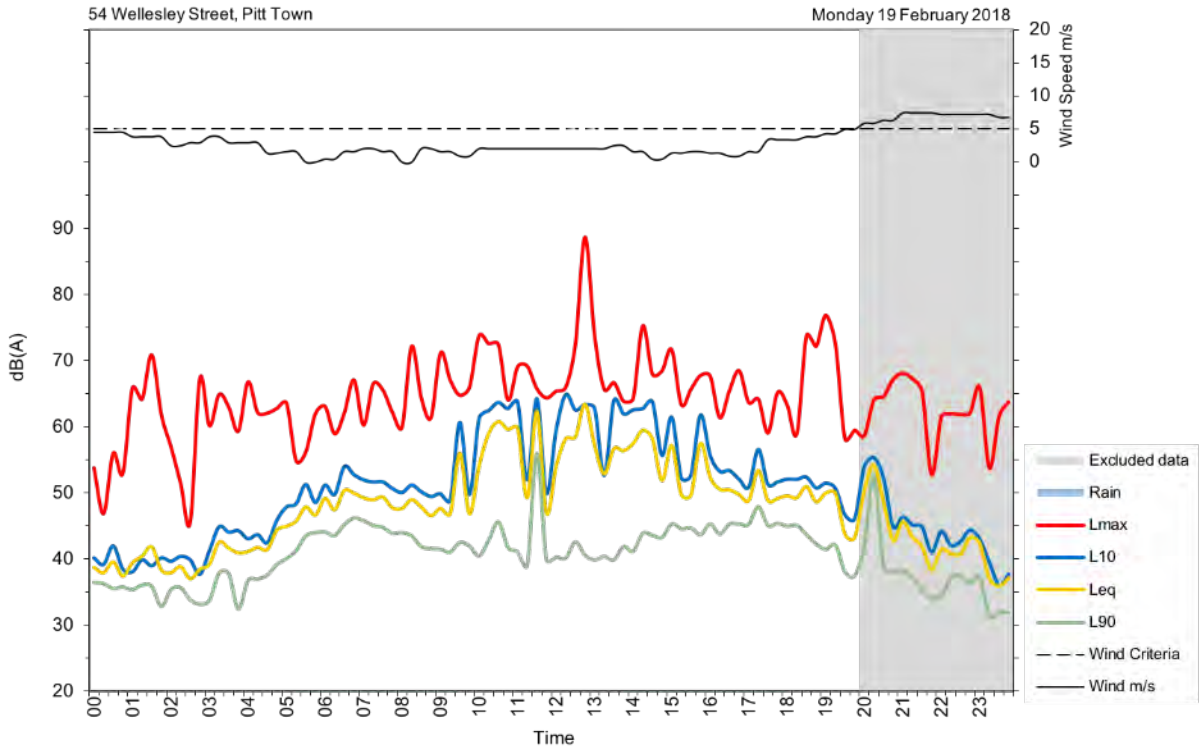

54 Wellesley Street, Pitt Town
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Wind Speed m/s
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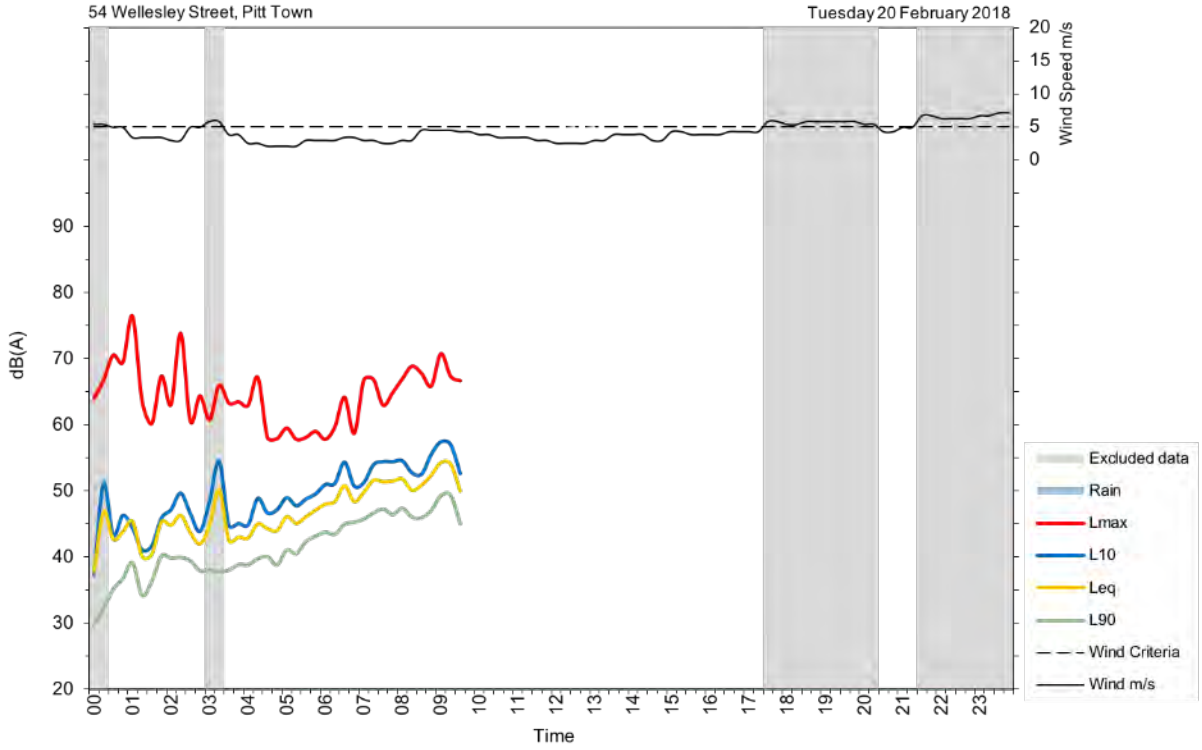

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Wind Speed m/s
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Wind Criteria
Wind m/s


54 Wellesley Street, Pitt Town
Friday 16 February 2018
Wind Speed m/s
dB(A)
Time
Excluded data
Rain
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Wind Criteria
Wind m/s


54 Wellesley Street, Pitt Town
Saturday 17 February 2018
Wind Speed m/s
dB(A)
Time
Excluded data
Rain
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Wind Criteria
Wind m/s


54 Wellesley Street, Pitt Town
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Wind Criteria
Wind m/s

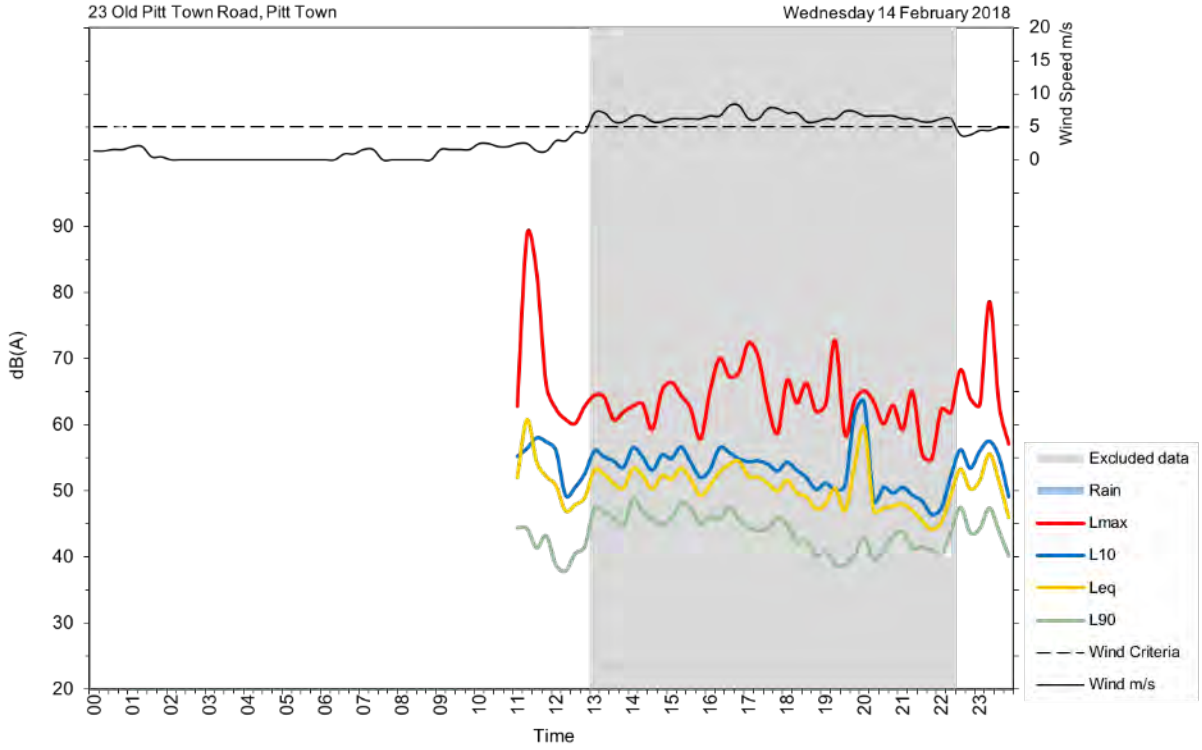

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Wind Speed m/s
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Time
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Rain
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Wind Criteria
Wind m/s

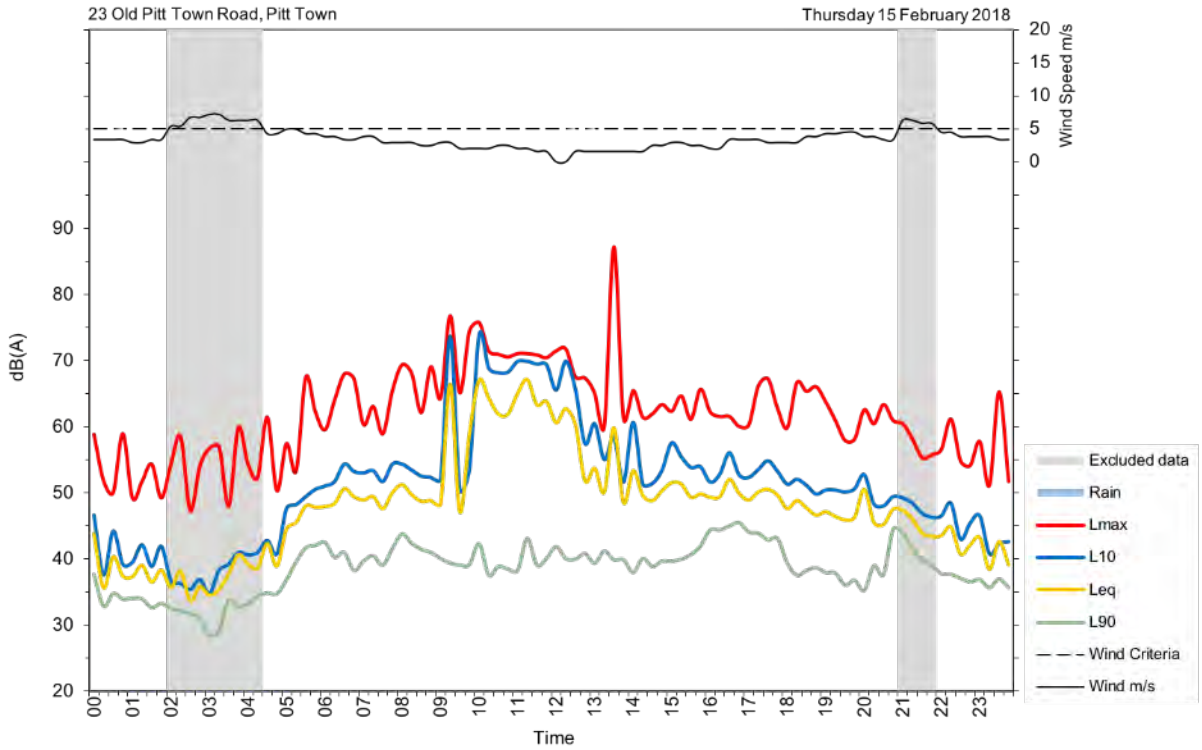

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dB(A)
Wind Speed m/s
Time
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Wind Criteria
Wind m/s

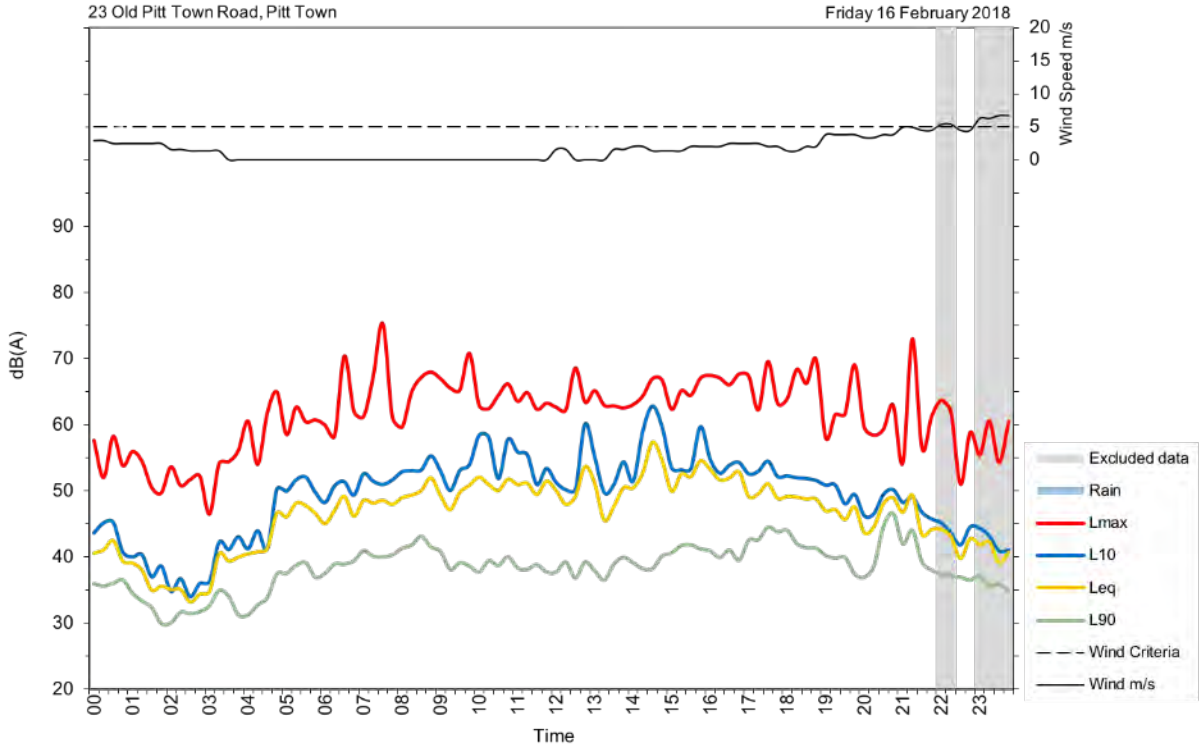
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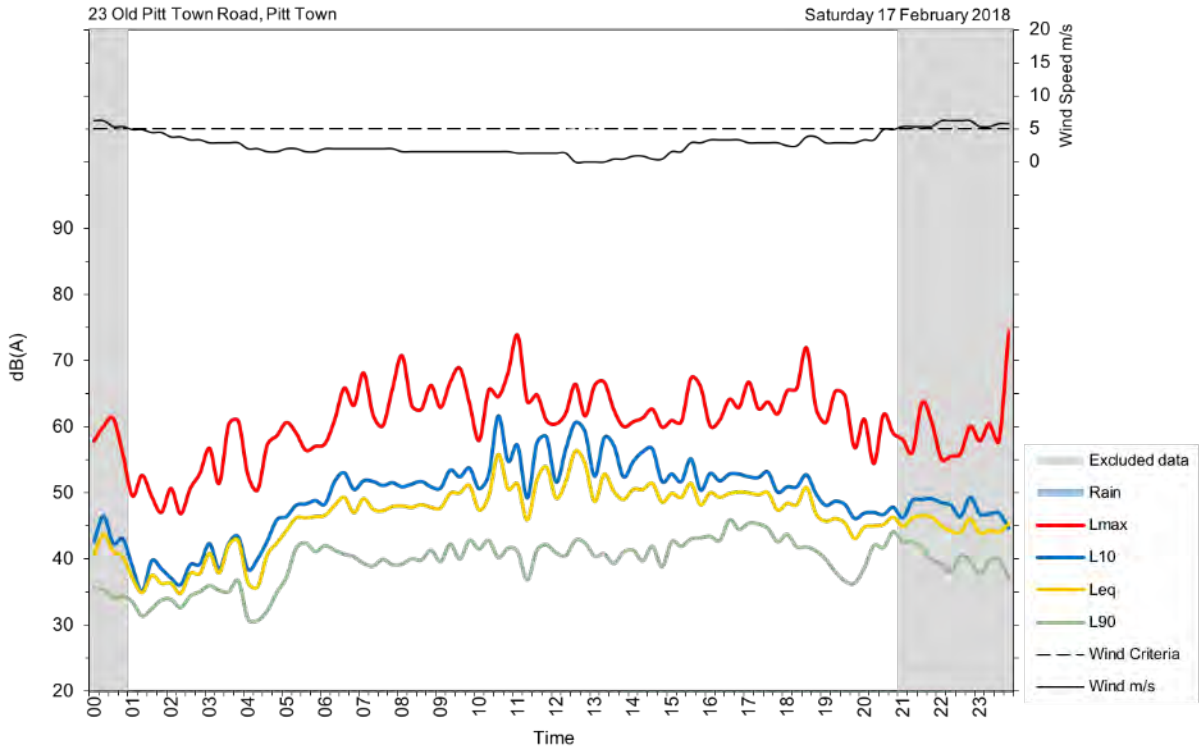
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Measurement location	Free-field
Measurement details	L_{Amax}, L_{Aeq}, L_{A90}
Logging period	Wednesday, 14 February 2018 to Tuesday, 20 February 2018

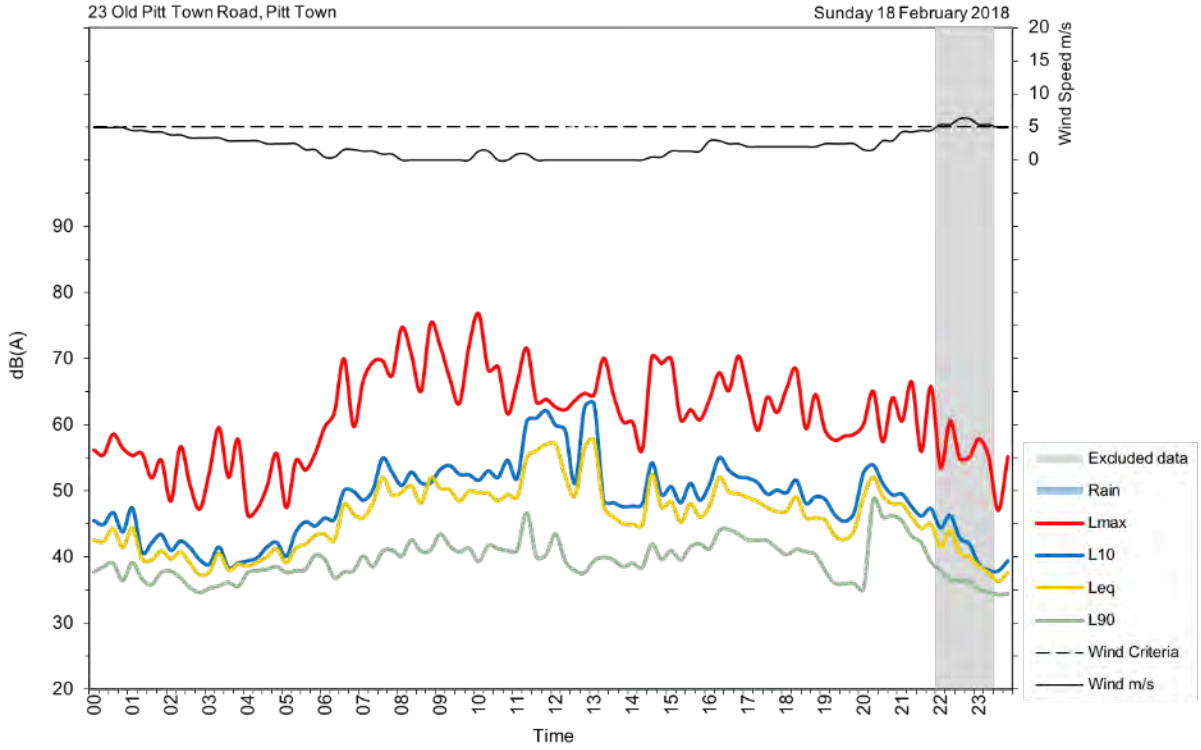


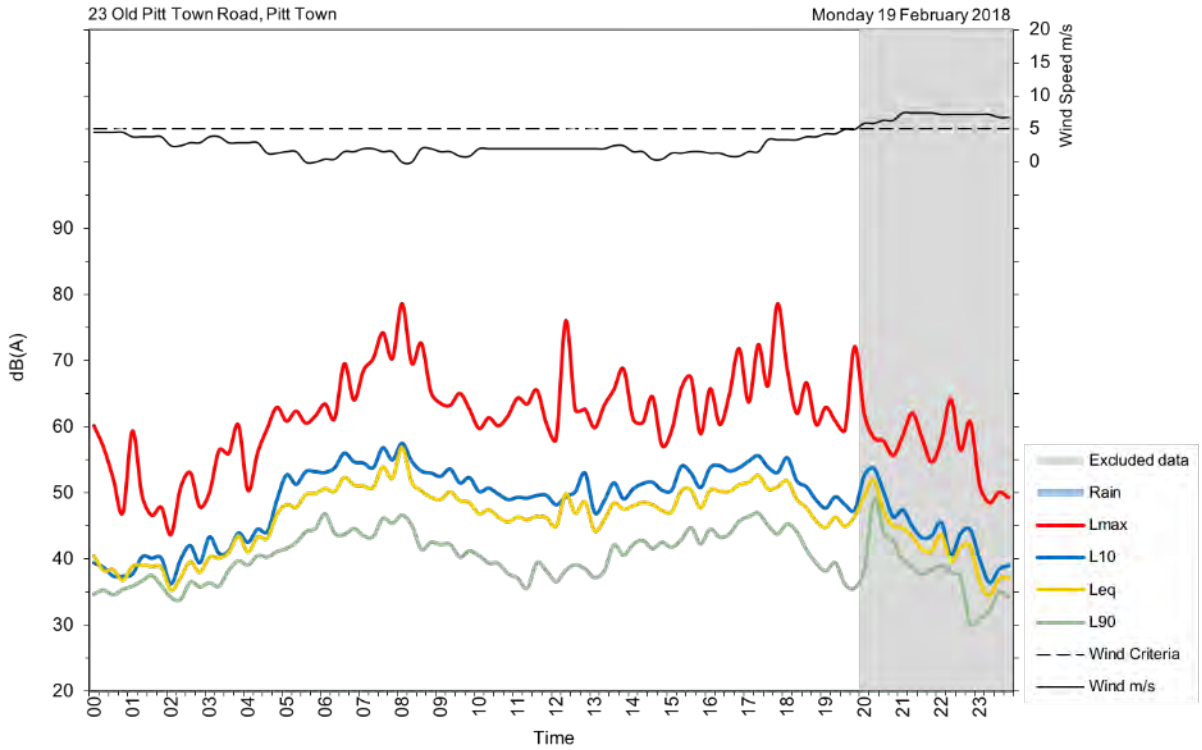

23 Old Pitt Town Road, Pitt Town
Wednesday 14 February 2018
Wind Speed m/s
dB(A)
Time
Excluded data
Rain
Lmax
L10
Leq
L90
Wind Criteria
Wind m/s

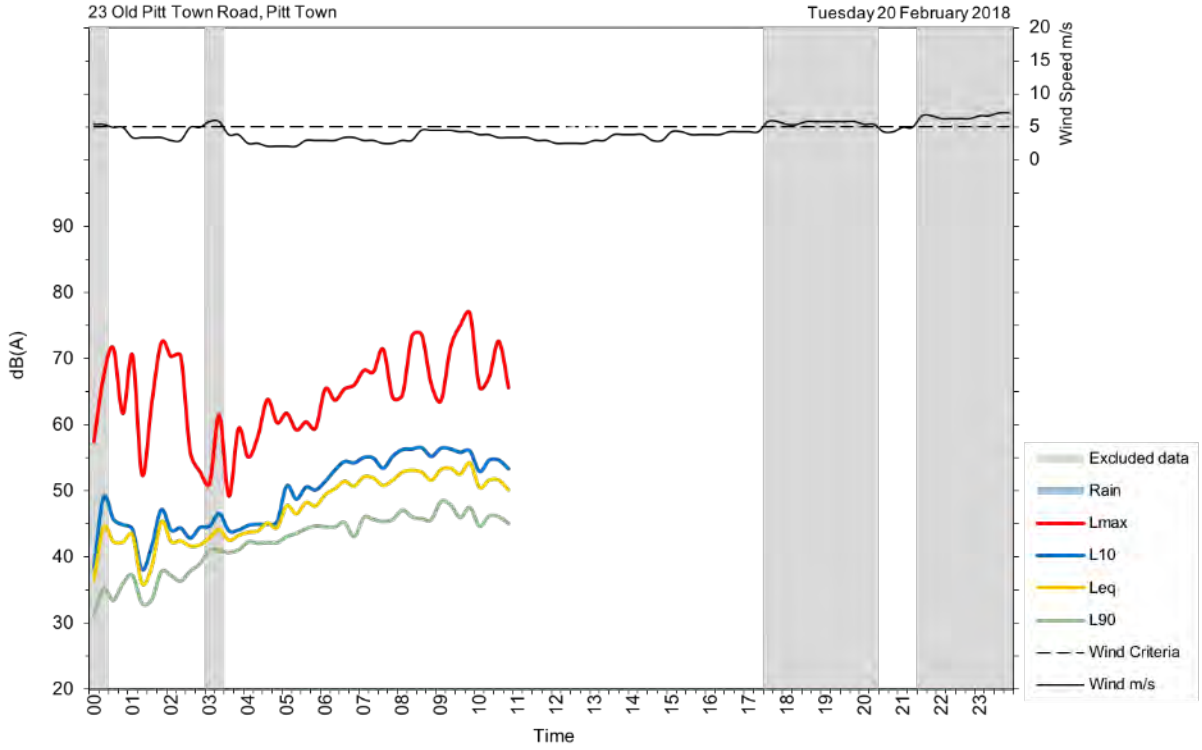

23 Old Pitt Town Road, Pitt Town
Thursday 15 February 2018
Wind Speed m/s
dB(A)
Time
Excluded data
Rain
Lmax
L10
Leq
L90
Wind Criteria
Wind m/s


23 Old Pitt Town Road, Pitt Town
Friday 16 February 2018
Wind Speed m/s
dB(A)
Time
Excluded data
Rain
Lmax
L10
Leq
L90
Wind Criteria
Wind m/s


23 Old Pitt Town Road, Pitt Town
Saturday 17 February 2018
Wind Speed m/s
dB(A)
Time
Excluded data
Rain
Lmax
L10
Leq
L90
Wind Criteria
Wind m/s


23 Old Pitt Town Road, Pitt Town
Sunday 18 February 2018
Wind Speed m/s
dB(A)
Time
Excluded data
Rain
Lmax
L10
Leq
L90
Wind Criteria
Wind m/s

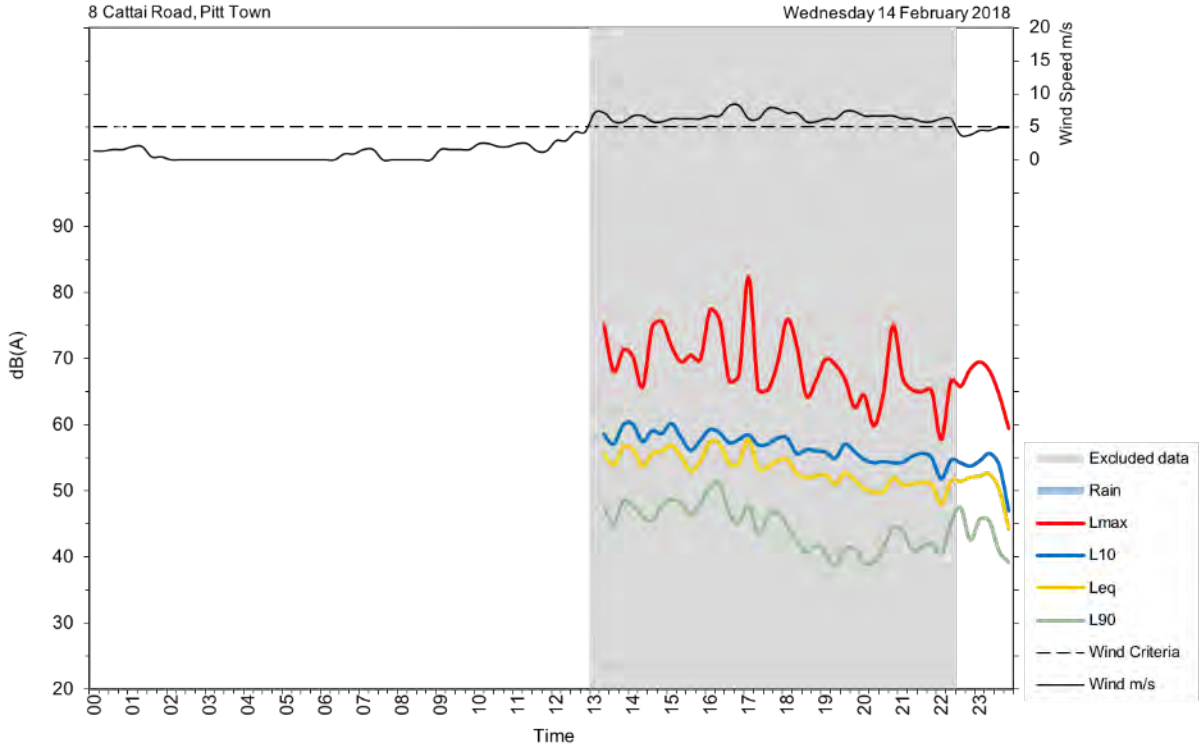

23 Old Pitt Town Road, Pitt Town
Monday 19 February 2018
Wind Speed m/s
dB(A)
Time
Excluded data
Rain
Lmax
L10
Leq
L90
Wind Criteria
Wind m/s

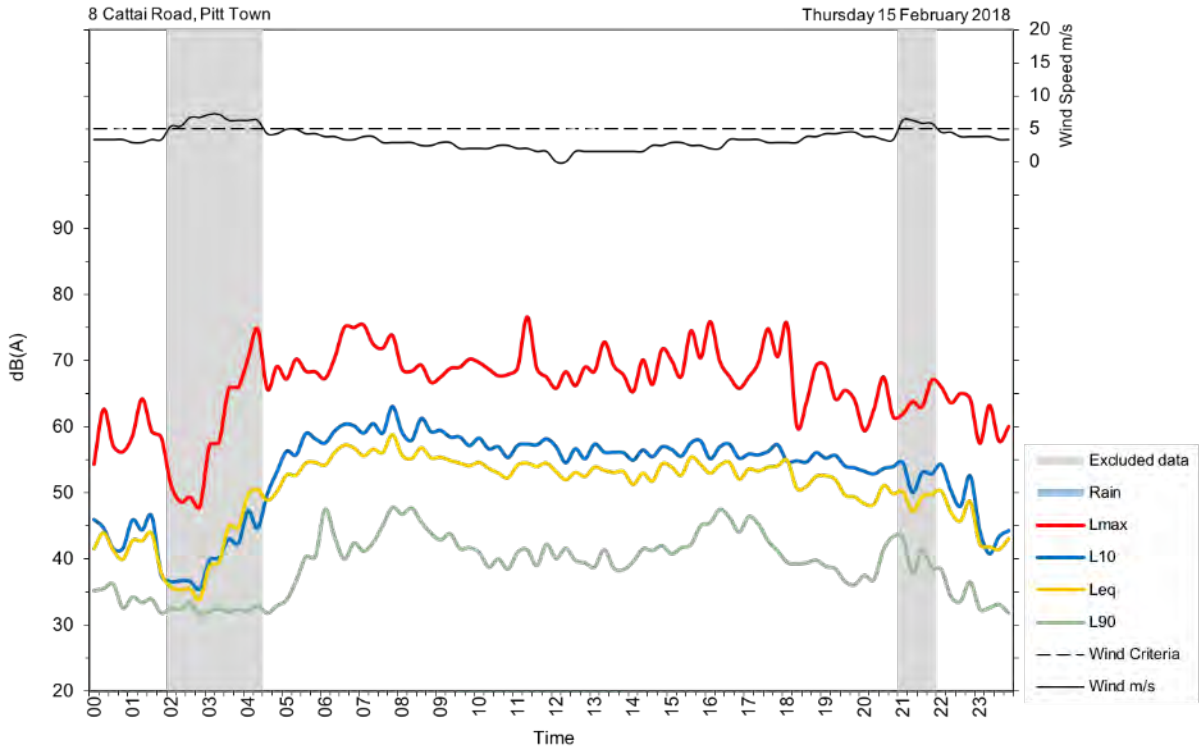

23 Old Pitt Town Road, Pitt Town
Tuesday 20 February 2018
dB(A)
Wind Speed m/s
Time
Excluded data
Rain
Lmax
L10
Leq
L90
Wind Criteria
Wind m/s

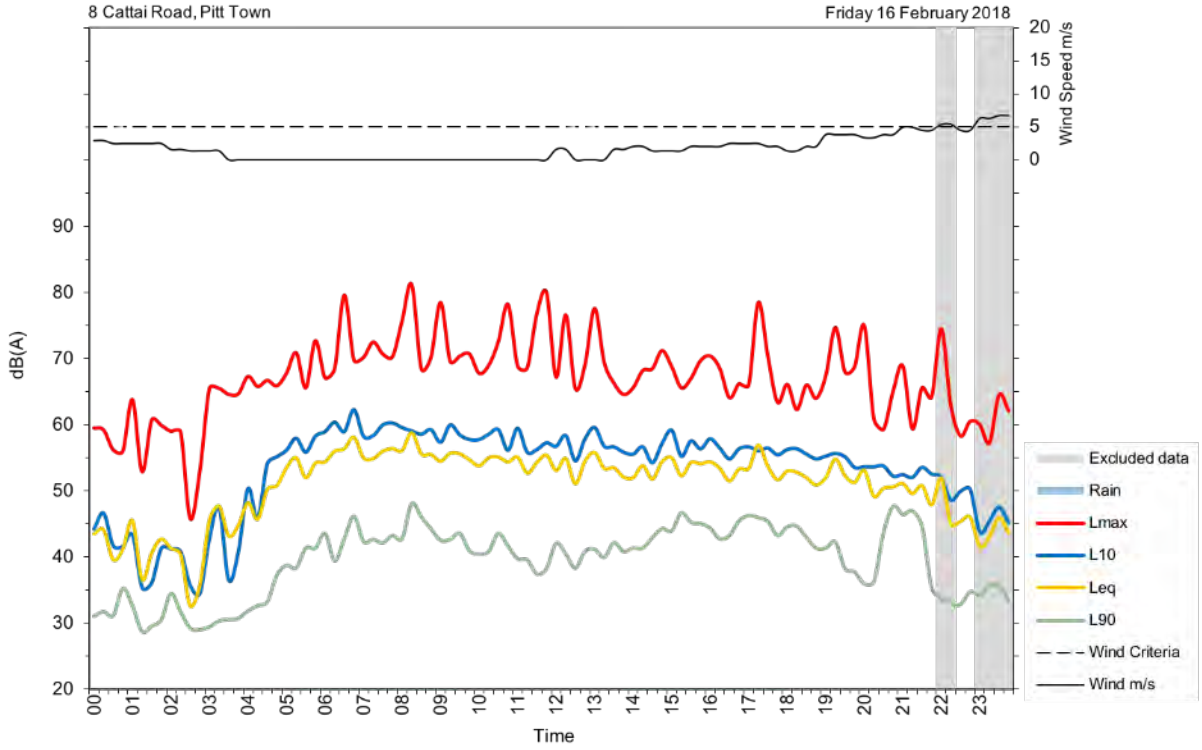
Unattended noise logger 3 (U3)

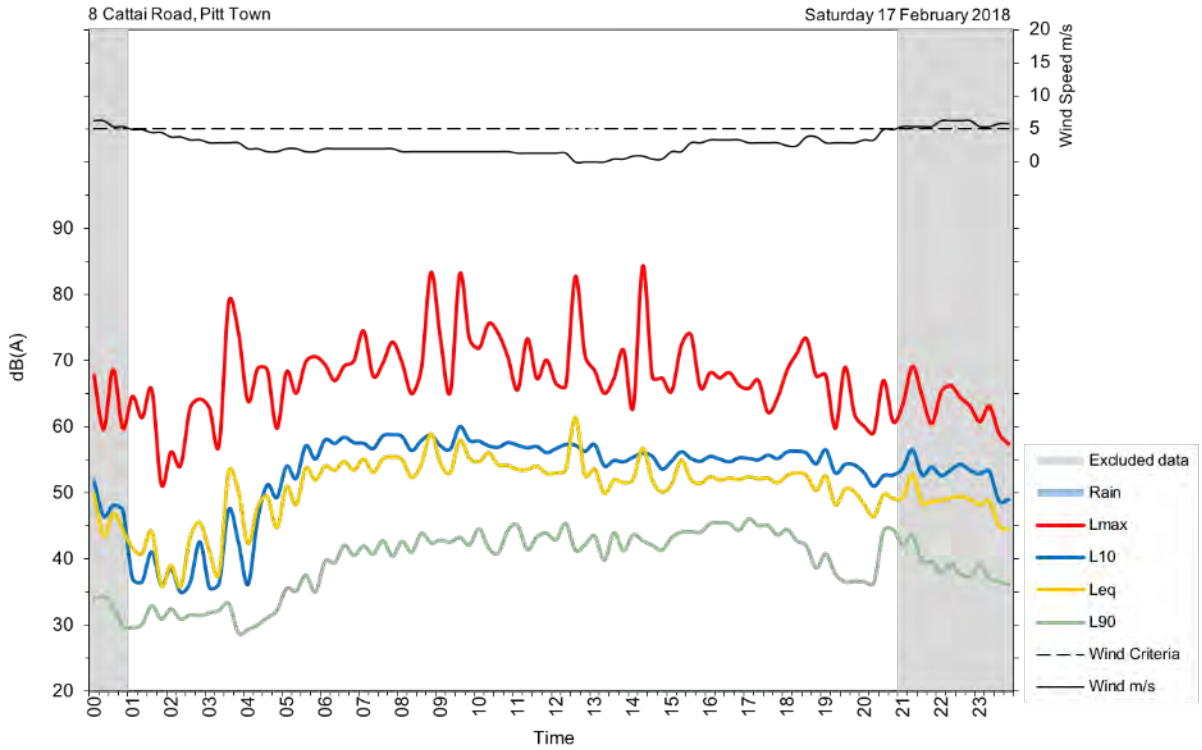
Address/location	8 Cattai Road, Pitt Town
Measurement location	Free-field
Measurement details	L_{Amax}, L_{Aeq}, L_{A90}
Logging period	Wednesday, 14 February 2018 to Tuesday, 20 February 2018

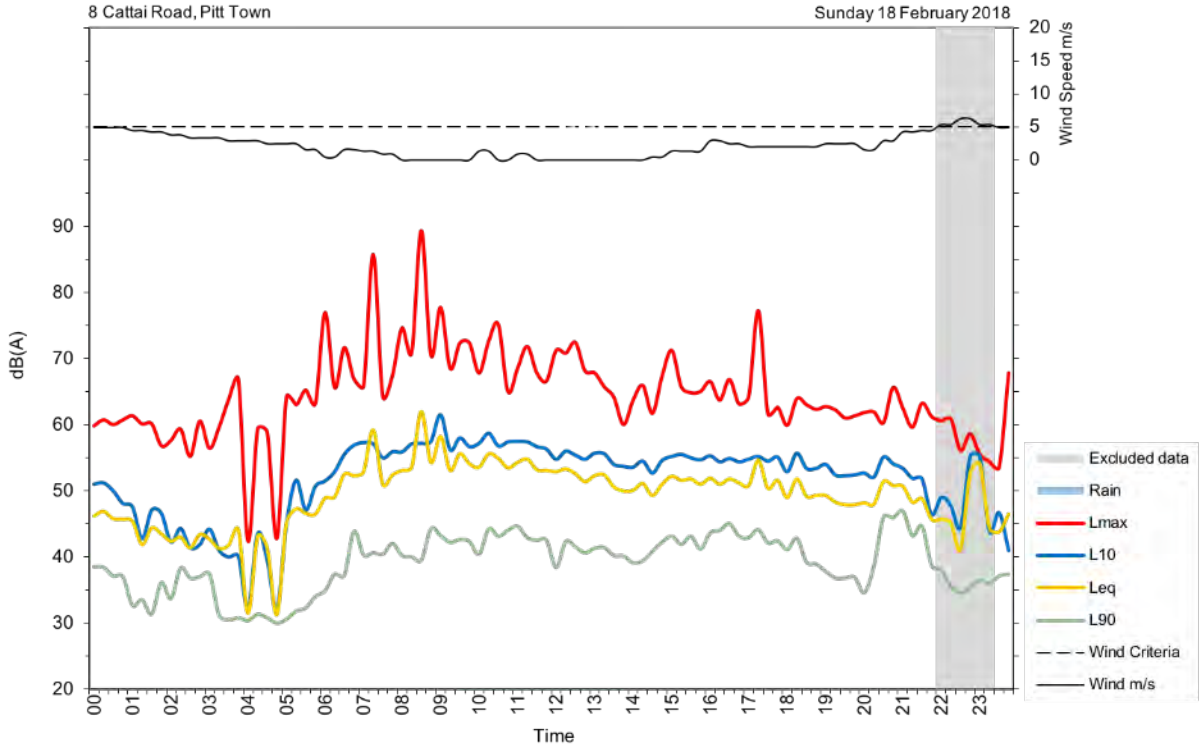


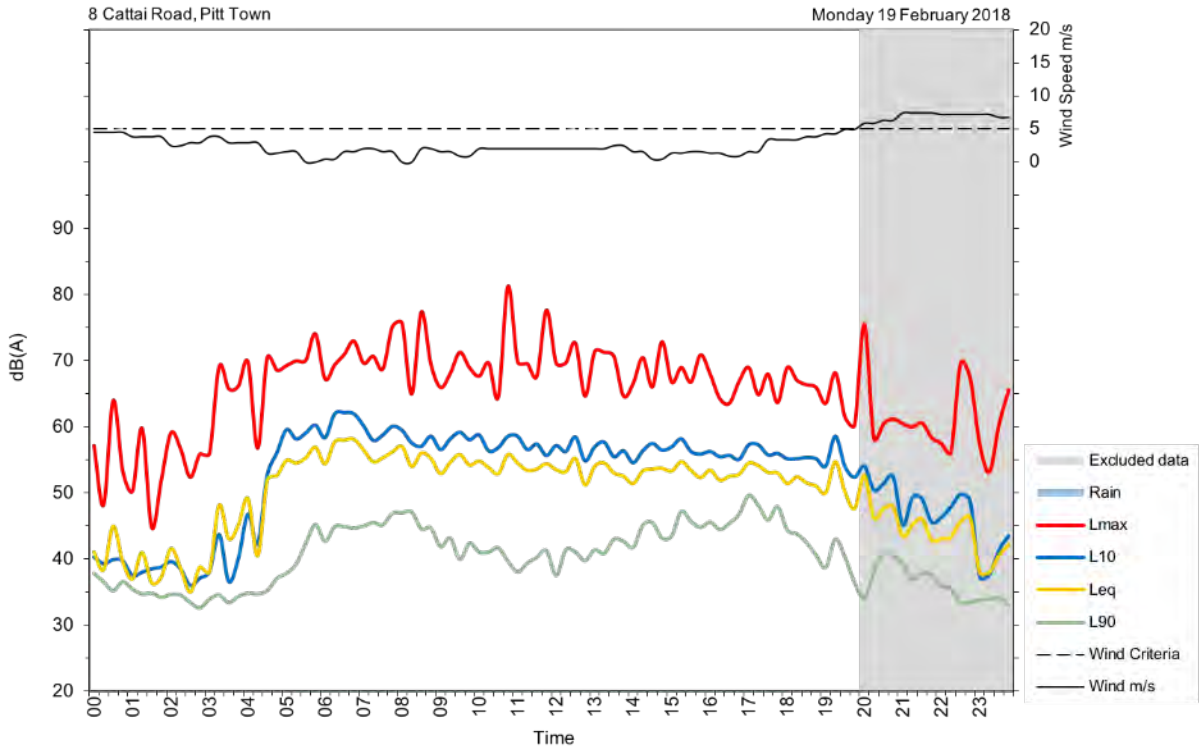

8 Cattai Road, Pitt Town
Wednesday 14 February 2018
dB(A)
Wind Speed m/s
Time
Excluded data
Rain
Lmax
L10
Leq
L90
Wind Criteria
Wind m/s

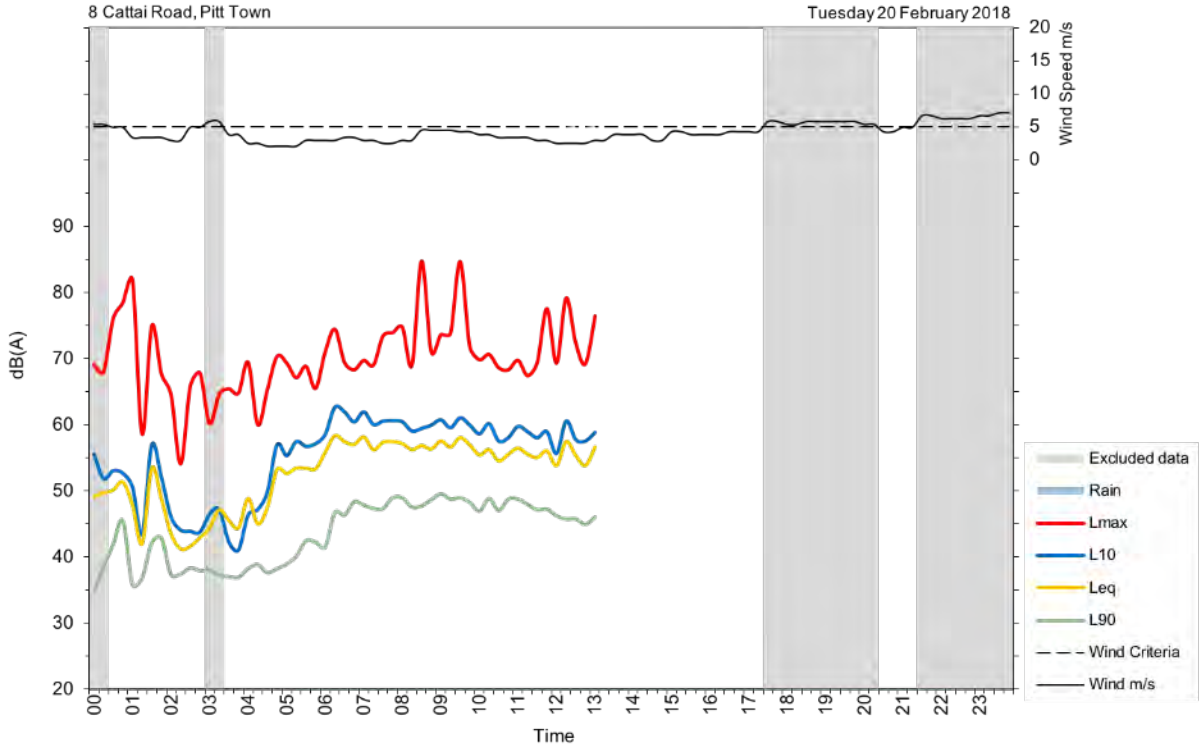

8 Cattai Road, Pitt Town
Thursday 15 February 2018
dB(A)
Wind Speed m/s
Time
Excluded data
Rain
Lmax
L10
Leq
L90
Wind Criteria
Wind m/s


8 Cattai Road, Pitt Town
Friday 16 February 2018
Wind Speed m/s
dB(A)
Time
Excluded data
Rain
Lmax
L10
Leq
L90
Wind Criteria
Wind m/s


8 Cattai Road, Pitt Town
Saturday 17 February 2018
Wind Speed m/s
dB(A)
Time
Excluded data
Rain
Lmax
L10
Leq
L90
Wind Criteria
Wind m/s


8 Cattai Road, Pitt Town
Sunday 18 February 2018
Wind Speed m/s
dB(A)
Time
Excluded data
Rain
Lmax
L10
Leq
L90
Wind Criteria
Wind m/s

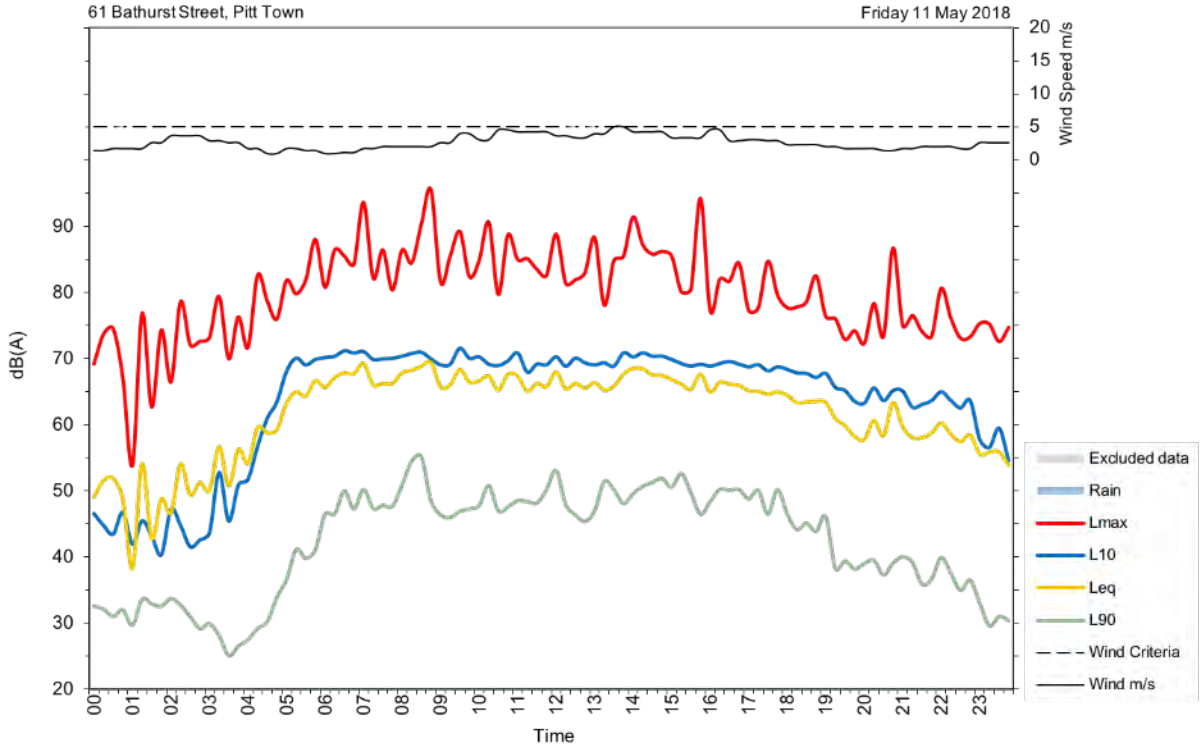

8 Cattai Road, Pitt Town
Monday 19 February 2018
Wind Speed m/s
dB(A)
Time
Excluded data
Rain
Lmax
L10
Leq
L90
Wind Criteria
Wind m/s

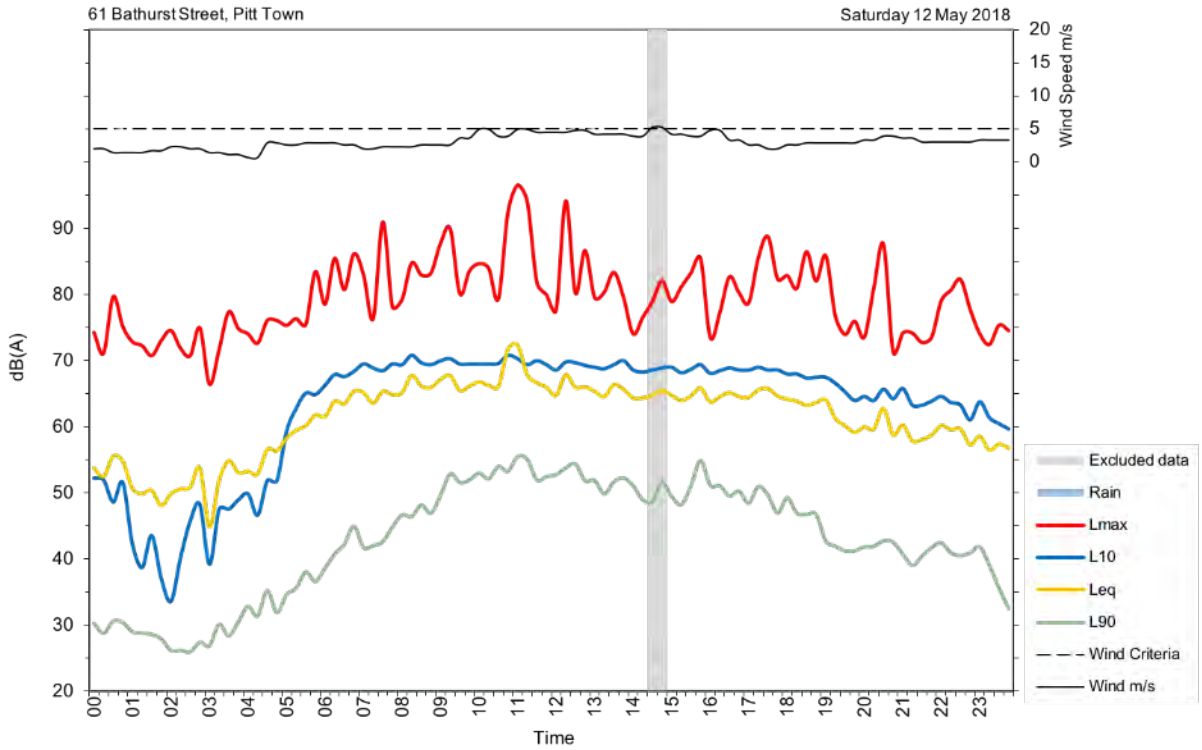

8 Cattai Road, Pitt Town
Tuesday 20 February 2018
dB(A)
Wind Speed m/s
Time
Excluded data
Rain
Lmax
L10
Leq
L90
Wind Criteria
Wind m/s

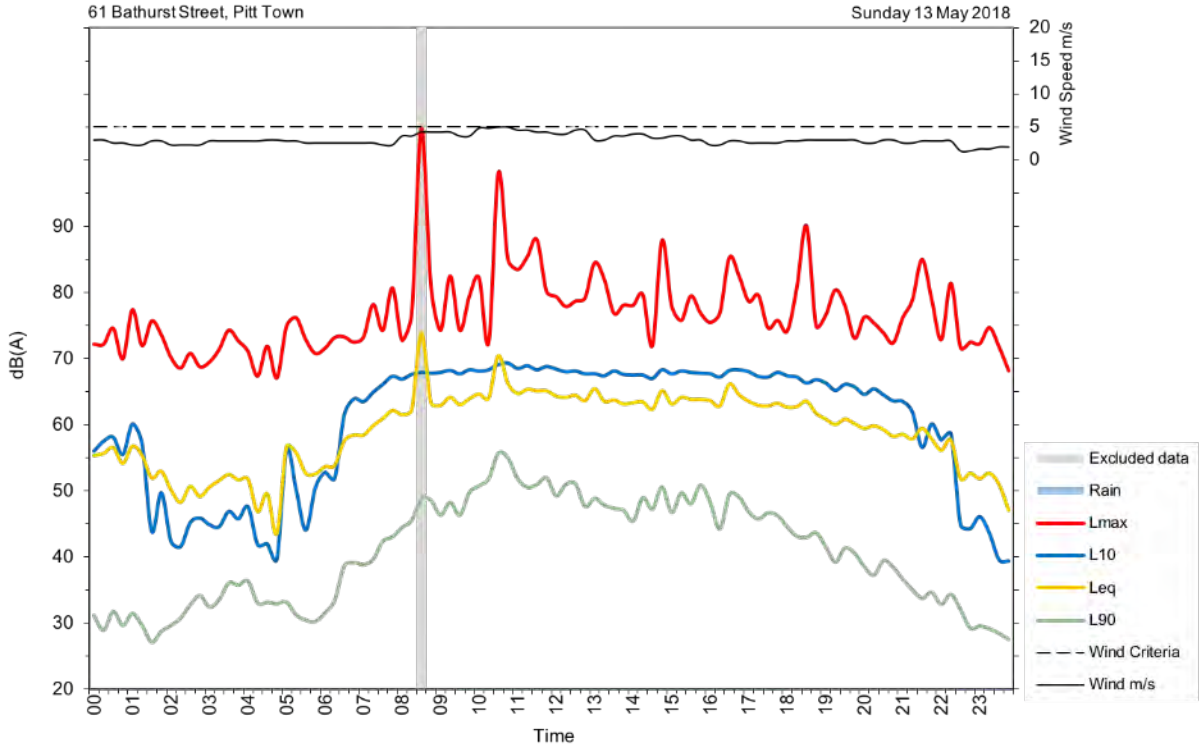
Unattended noise logger 4 (U3)

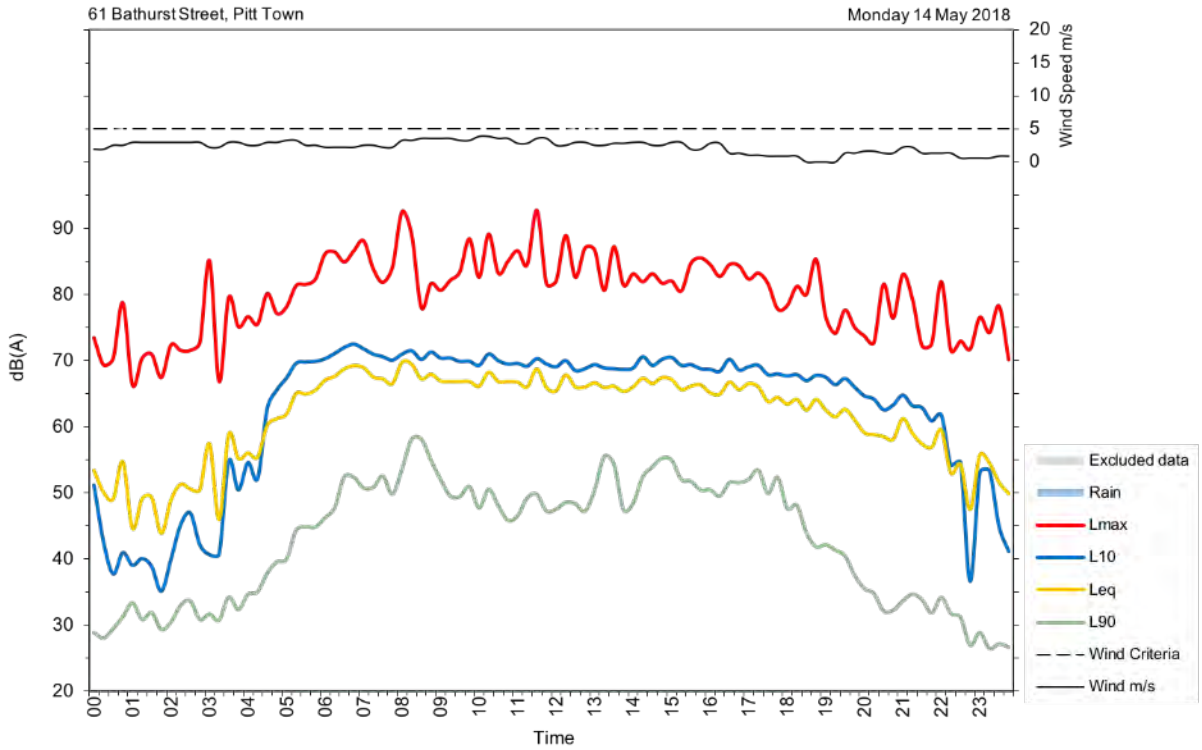
Address/location	61 Bathurst Street
Measurement location	1.5 m from façade
Measurement details	L_{Amax}, L_{Aeq}, L_{A90}
Logging period	Friday, 11 May 2018 to Thursday, 17 May 2018

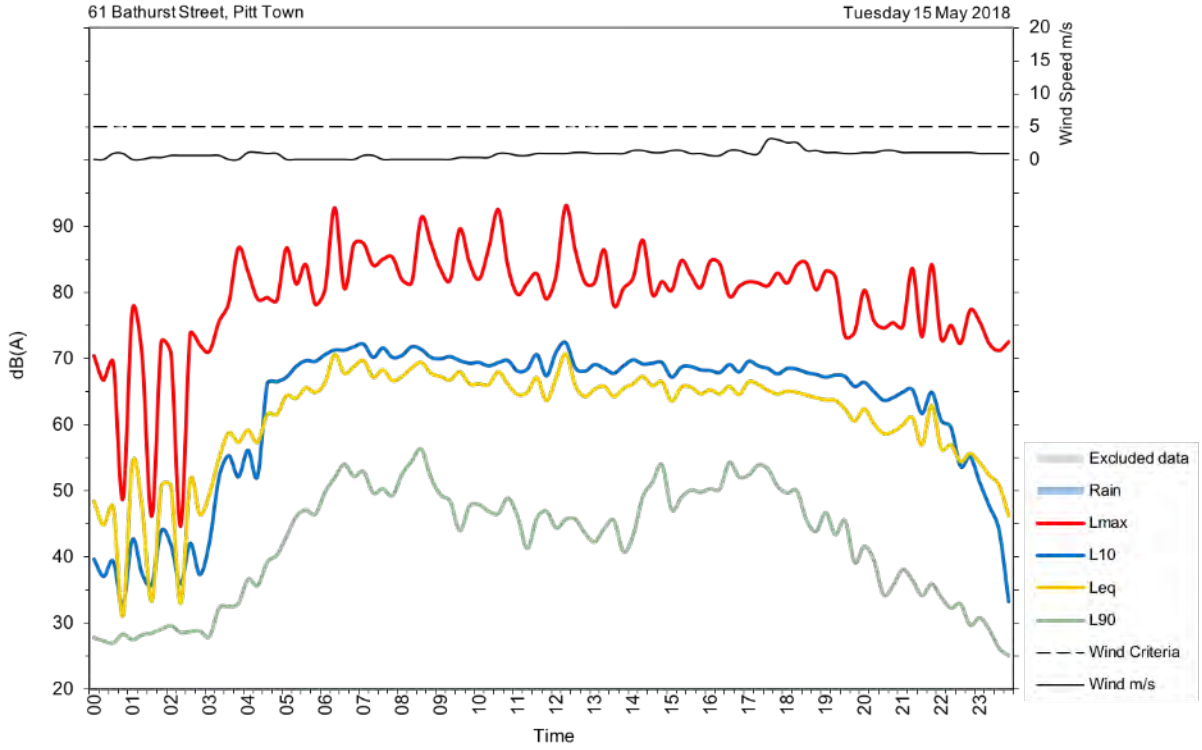


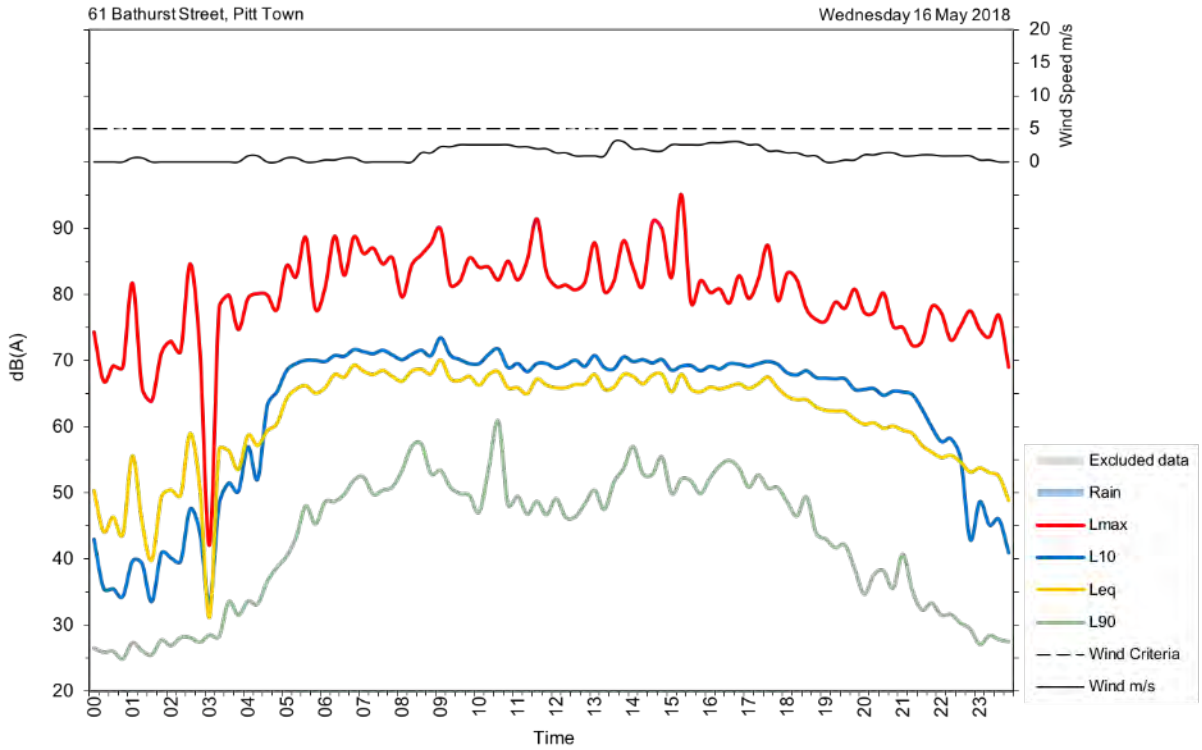

61 Bathurst Street, Pitt Town
Friday 11 May 2018
dB(A)
Wind Speed m/s
Time
Excluded data
Rain
Lmax
L10
Leq
L90
Wind Criteria
Wind m/s

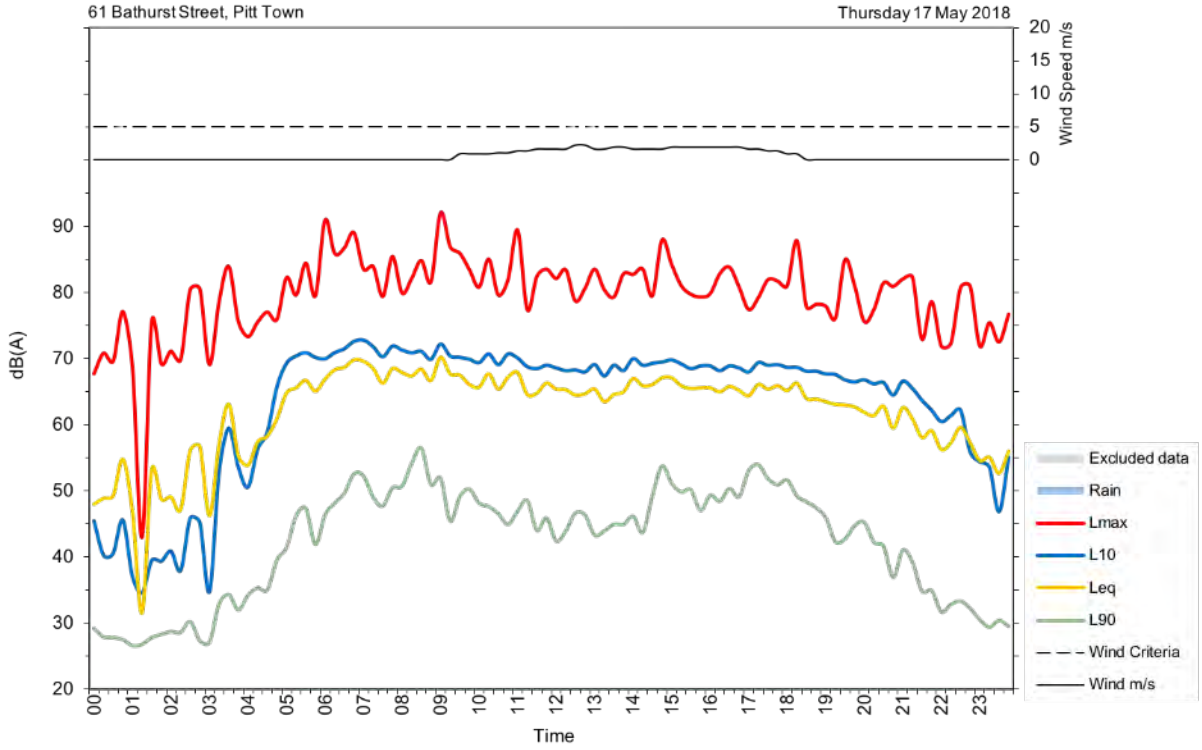

61 Bathurst Street, Pitt Town
Saturday 12 May 2018
dB(A)
Wind Speed m/s
Time
Excluded data
Rain
Lmax
L10
Leq
L90
Wind Criteria
Wind m/s


61 Bathurst Street, Pitt Town
Sunday 13 May 2018
dB(A)
Wind Speed m/s
Time
Excluded data
Rain
Lmax
L10
Leq
L90
Wind Criteria
Wind m/s


61 Bathurst Street, Pitt Town
Monday 14 May 2018
dB(A)
Wind Speed m/s
Time
Excluded data
Rain
Lmax
L10
Leq
L90
Wind Criteria
Wind m/s


61 Bathurst Street, Pitt Town
Tuesday 15 May 2018
dB(A)
Wind Speed m/s
Time
Excluded data
Rain
Lmax
L10
Leq
L90
Wind Criteria
Wind m/s


61 Bathurst Street, Pitt Town
Wednesday 16 May 2018
dB(A)
Wind Speed m/s
Time
Excluded data
Rain
Lmax
L10
Leq
L90
Wind Criteria
Wind m/s


61 Bathurst Street, Pitt Town
Thursday 17 May 2018
dB(A)
Wind Speed m/s
Time
Excluded data
Rain
Lmax
L10
Leq
L90
Wind Criteria
Wind m/s

Appendix C

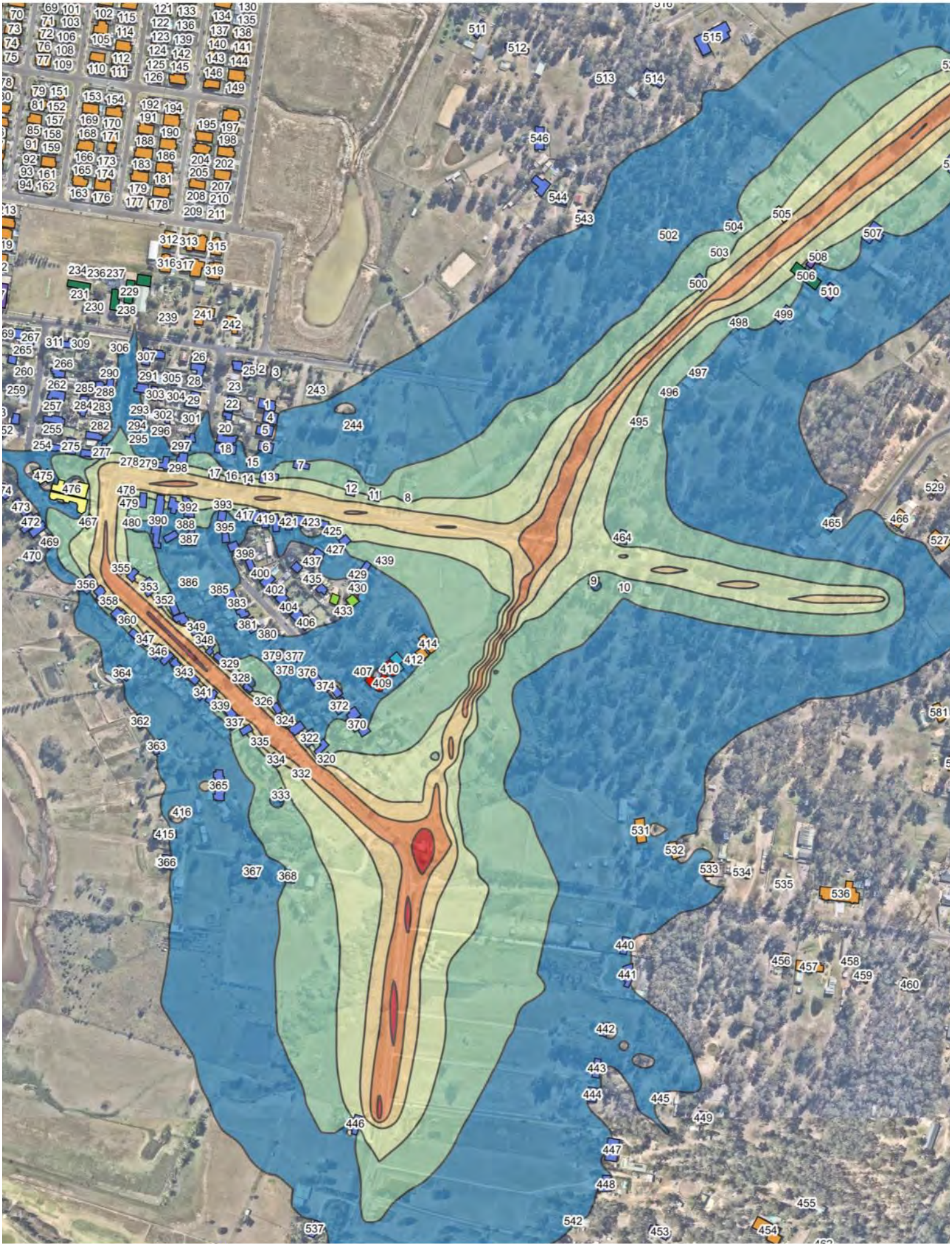
Traffic volumes and speeds

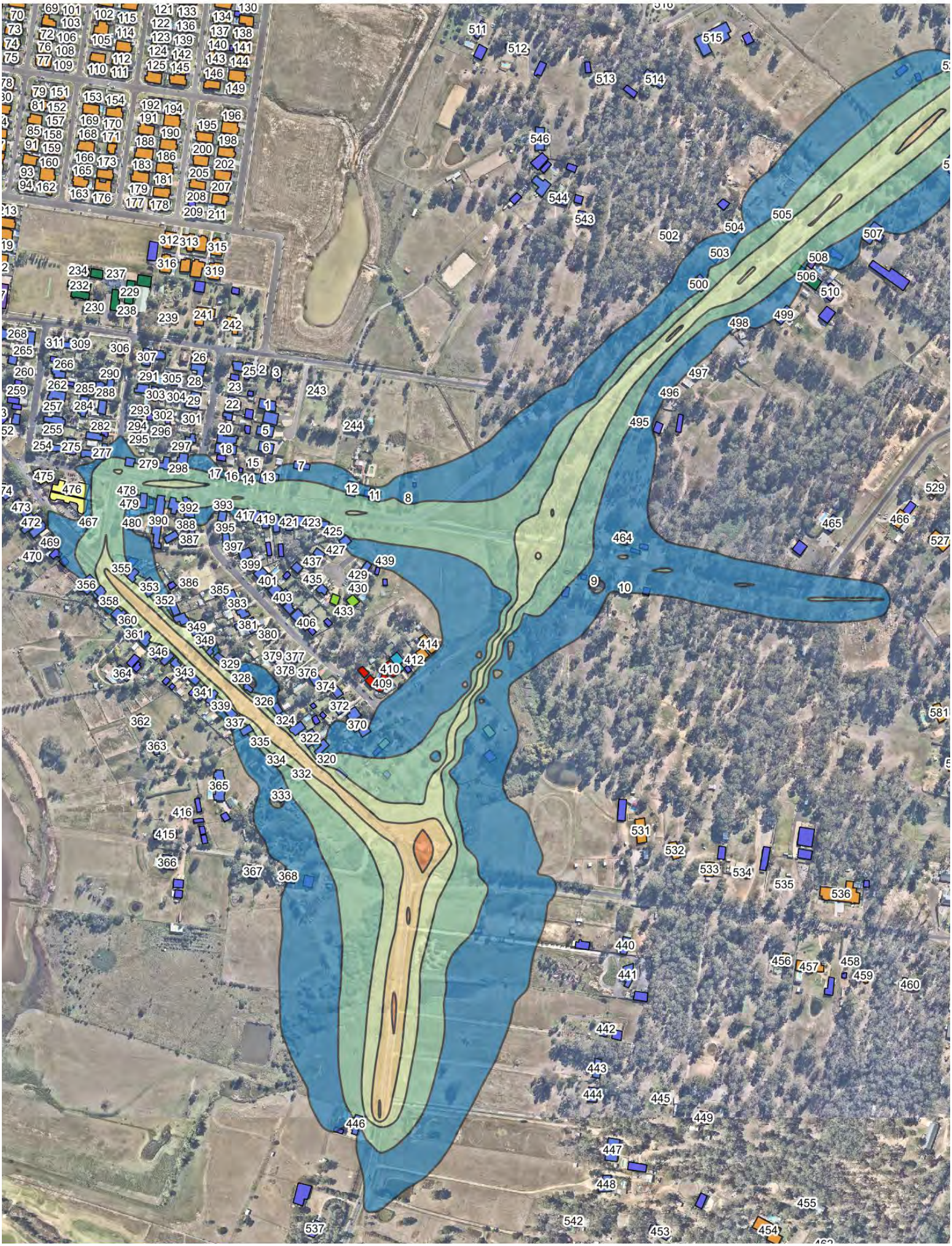
Road and location	For model validation		Forecast 2021 without Bypass		Forecast 2031 without Bypass		Forecast 2021 with Bypass		Forecast 2031 with Bypass		Road speeds	
	Total	% HV	Total	% HV	Total	% HV	Total	% HV	Total	% HV	Measured average for model validation	Forecast scenarios (assumed)
Cattai Rd, north of Buckingham St	3,930	13%	4,220	14%	5,200	13%	4,220	14%	5,200	13%	64	60
	510	22%	550	22%	680	22%	550	22%	680	22%		
	4,430	**14%**	**4,760**	**14%**	**5,870**	**14%**	**4,760**	**14%**	**5,870**	**14%**		
Cattai Rd, between Buckingham Rd and Old Pitt Town Rd	3,800	14%	4,080	14%	5,020	14%	4,080	14%	5,020	14%	64	60
	490	20%	520	19%	650	20%	520	19%	650	20%		
	4,280	**15%**	**4,600**	**15%**	**5,670**	**15%**	**4,600**	**15%**	**5,670**	**15%**		
Eldon St, between Liverpool St and Chatham St	4,860	15%	5,220	15%	6,440	15%	1,940	14%	2,400	15%	39	60
	580	24%	620	24%	760	24%	230	22%	290	24%		
	5,430	**16%**	**5,840**	**16%**	**7,200**	**16%**	**2,180**	**15%**	**2,690**	**16%**		
Chatham St, between Eldon St and Bathurst St.	4,860	15%	5,220	15%	6,440	15%	1,940	14%	2,400	15%	58	60
	580	24%	620	24%	760	24%	230	22%	290	24%		
	5,430	**16%**	**5,840**	**16%**	**7,200**	**16%**	**2,180**	**15%**	**2,690**	**16%**		
Bathurst St, between Chatham St and Lagoon Rd	8,460	9%	9,100	9%	11,220	9%	6,040	9%	7,440	9%	58	60
	1,120	14%	1,200	14%	1,480	14%	790	14%	980	14%		
	9,580	**10%**	**10,300**	**10%**	**12,690**	**10%**	**6,830**	**10%**	**8,420**	**10%**		
Pitt Town Rd, south of Glebe Rd	8,540	9%	9,180	9%	11,320	9%	9,180	9%	11,320	9%	58	60
	1,170	14%	1,260	14%	1,560	14%	1,260	14%	1,560	14%		
	9,710	**10%**	**10,440**	**10%**	**12,870**	**10%**	**10,440**	**10%**	**12,870**	**10%**		

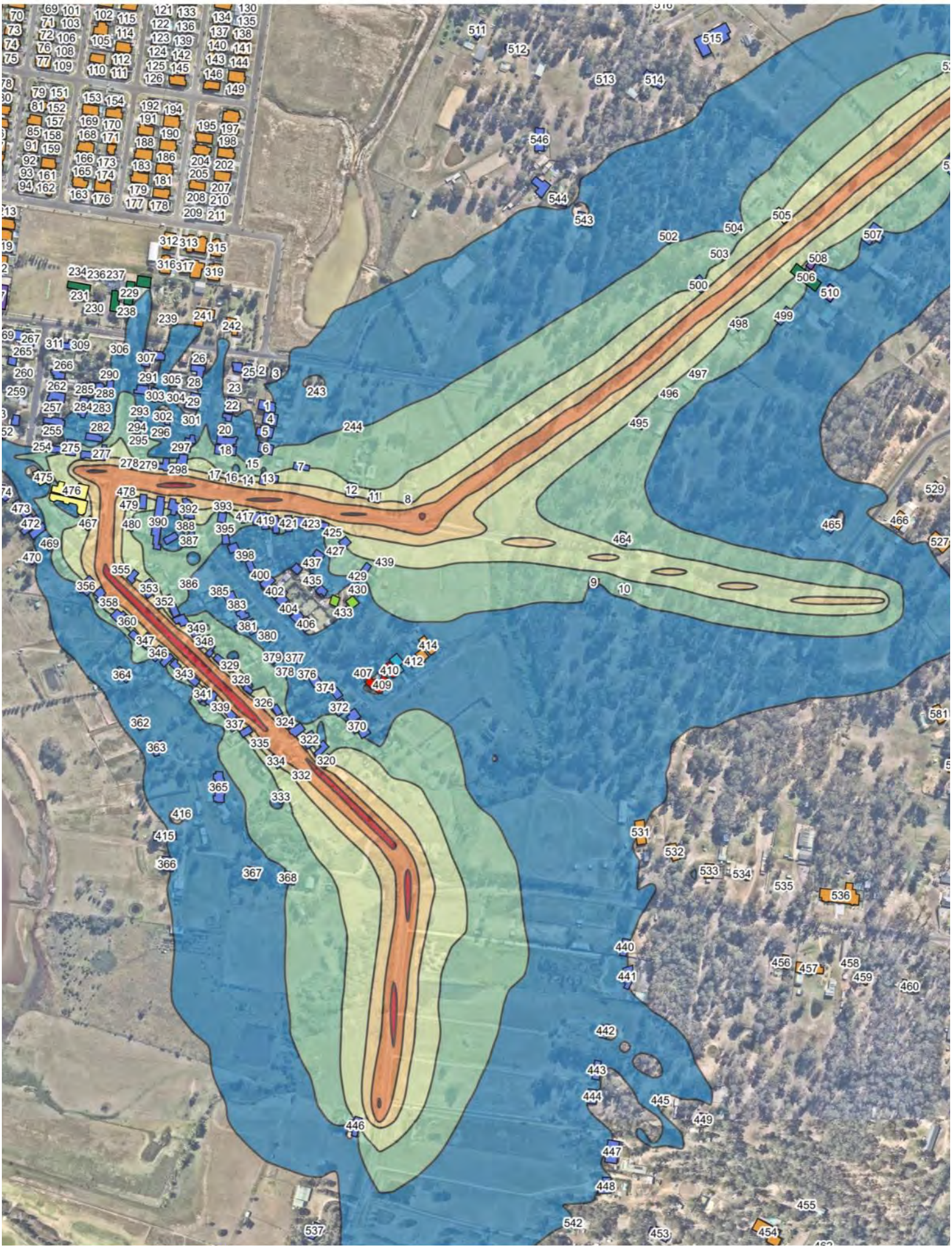
Road and location	For model validation		Forecast 2021 without Bypass		Forecast 2031 without Bypass		Forecast 2021 with Bypass		Forecast 2031 with Bypass		Road speeds	
	Total	% HV	Total	% HV	Total	% HV	Total	% HV	Total	% HV	Measured average for model validation	Forecast scenarios (assumed)
Old Pitt Town Rd	**986**	4%	**986**	4%	**1,223**	4%	**986**	4%	**1,223**	4%	60	60
	101	4%	**101**	4%	**125**	4%	**101**	4%	**125**	4%		
	1,097	**4%**	**1,097**	4%	**1,348**	4%	**1,097**	4%	**1,348**	4%		
Bathurst St, between Chatham St and Lagoon Rd (Additional traffic data for attended measurement U4 from 11 May 2018 to Thursday, 17 May 2018)	8,320	12%	9,100	9%	11,220	9%	6,040	9%	7,440	9%	57	60
	1,010	20%	1,200	14%	1,480	14%	790	14%	980	14%		
	8,789	**12%**	**10,300**	**10%**	**12,690**	**10%**	**6,830**	**10%**	**8,420**	**10%**		
Bypass							3,130	10%	3,870	11%	N/A	70
							440	16%	530	15%		
							3,570	**11%**	**4,400**	**11%**		

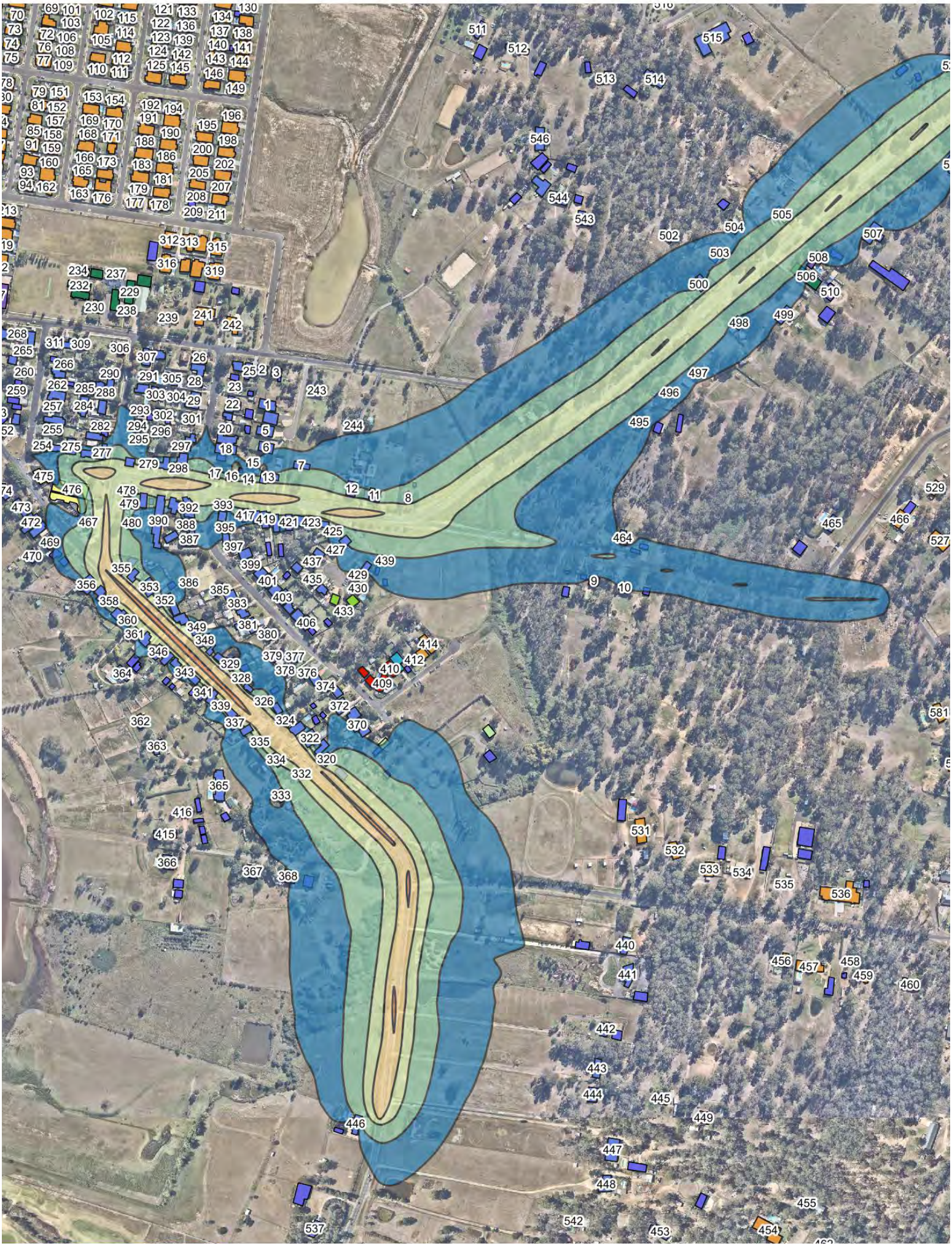
Appendix D

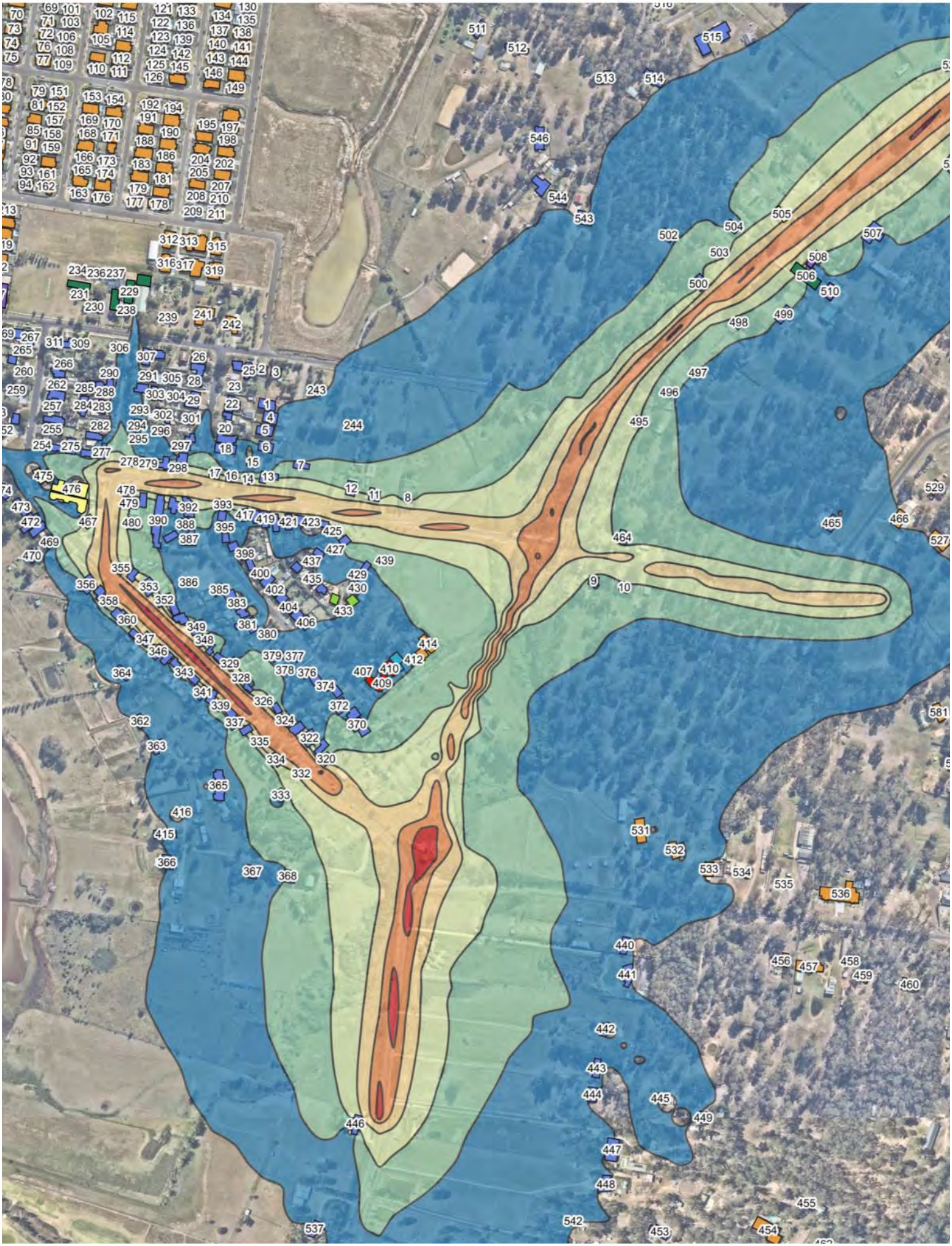
Road traffic noise contours

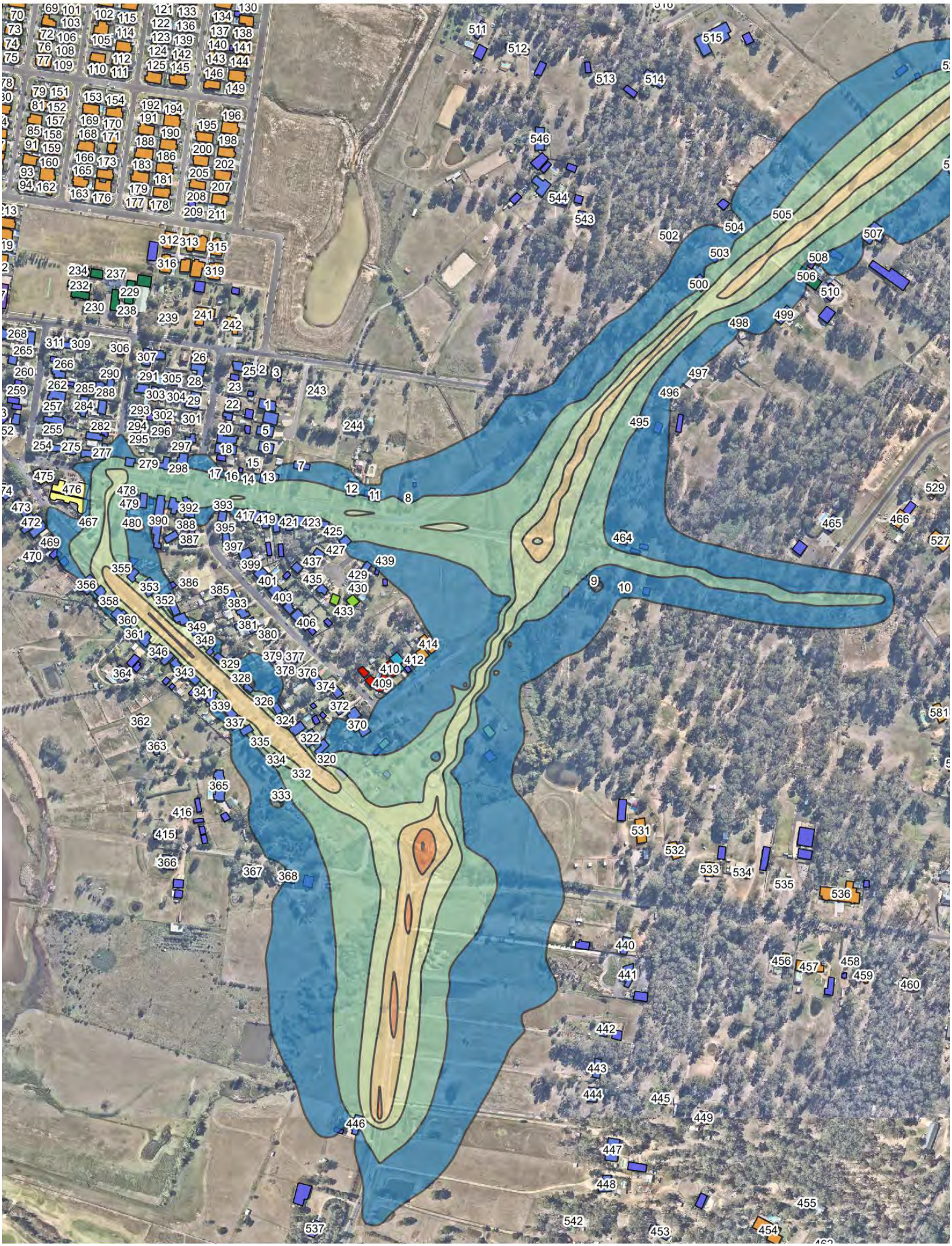


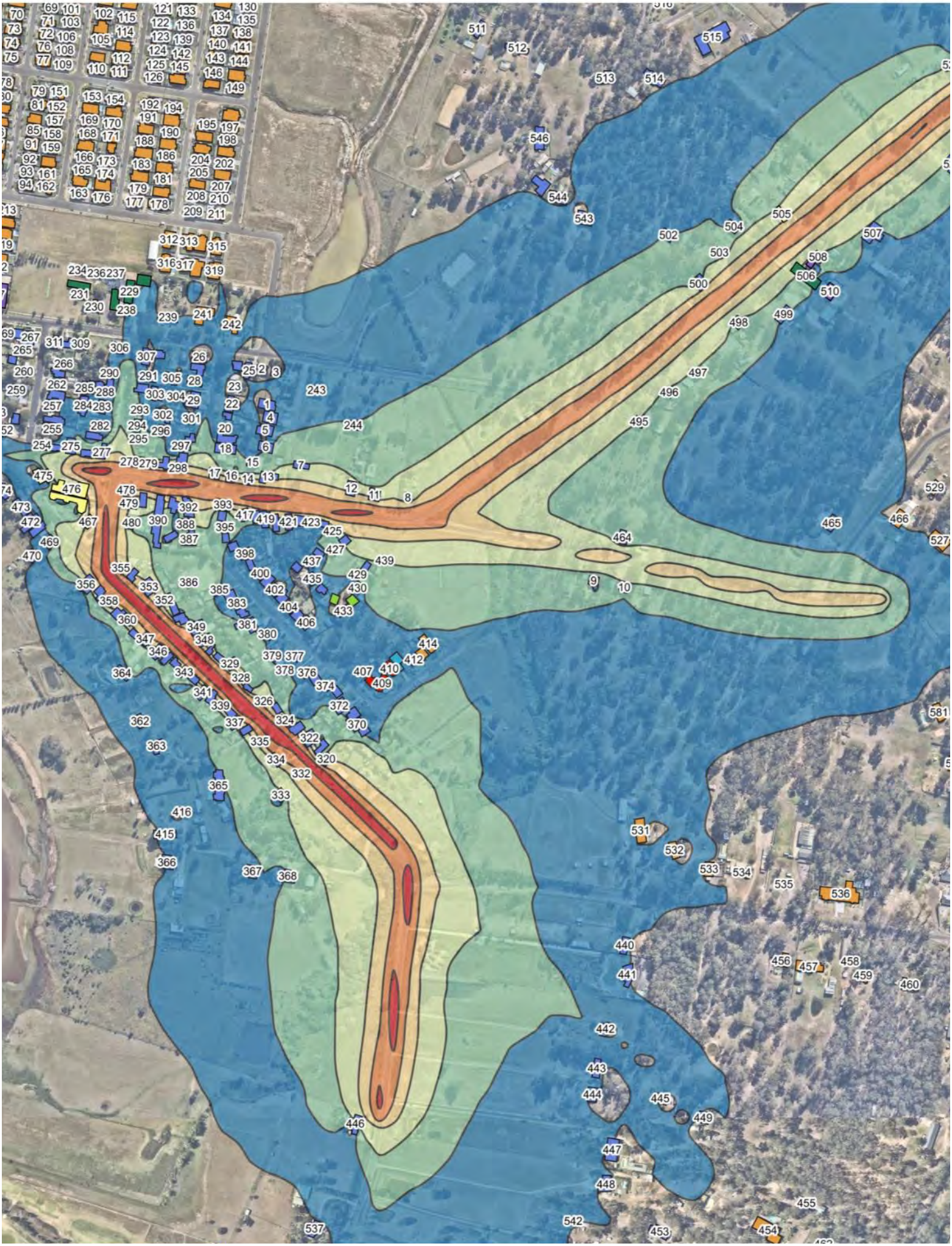


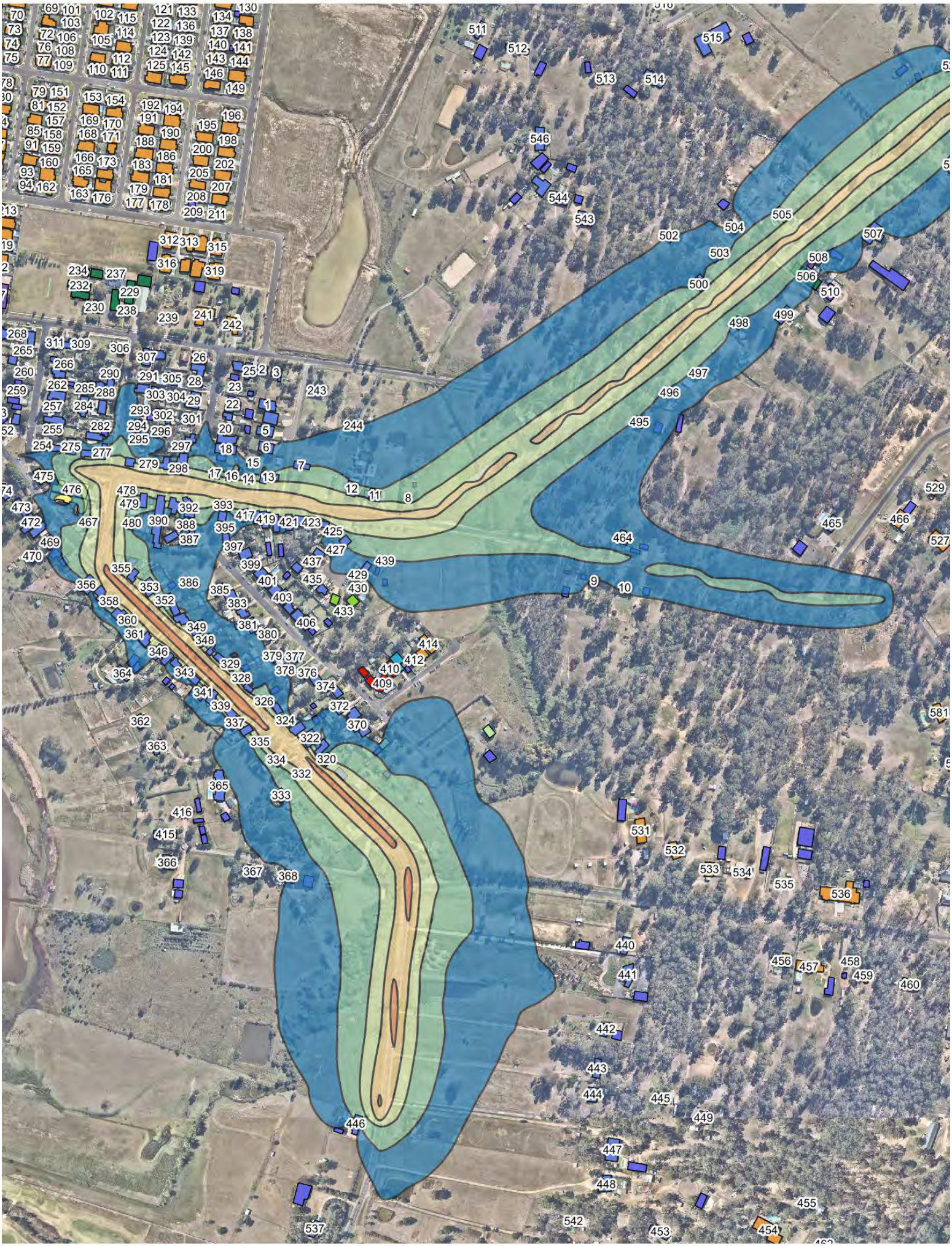












Appendix E

Predicted noise levels – operational

ID	Address	Class	Floor	Façade	2021 $L_{Aeq, period}$				2031 $L_{Aeq, period}$				NCG Criteria		Exceedance of NCG Criteria		Change in noise level				Equal to or above Cumulative Limit		Consider further additional noise mitigation
					Build		No Build		Build		No Build						2021		2031		2031		
					Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	
1	6 IRIS STREET PITT TOWN	R	F 1	E	48	42	50	45	48	43	51	45	60	55	No	No	-2.5	-2.3	-2.7	-2.5	No	No	No
1	6 IRIS STREET PITT TOWN	R	F 1	E	48	42	51	45	49	43	51	46	60	55	No	No	-2.5	-2.3	-2.6	-2.4	No	No	No
3	36 BUCKINGHAM STREET PITT TOWN	R	F 1	S	47	42	50	44	48	42	51	45	60	55	No	No	-2.6	-2.4	-2.9	-2.8	No	No	No
4	8 IRIS STREET PITT TOWN	R	GF	E	48	43	51	45	49	43	52	46	60	55	No	No	-2.6	-2.4	-3.1	-2.9	No	No	No
4	8 IRIS STREET PITT TOWN	R	F 1	E	50	44	53	47	50	45	53	48	60	55	No	No	-2.7	-2.6	-3.2	-3.1	No	No	No
5	10 IRIS STREET PITT TOWN	R	F 1	W	48	43	51	46	48	43	52	47	60	55	No	No	-3.2	-3.2	-4.1	-4	No	No	No
5	10 IRIS STREET PITT TOWN	R	F 1	S	49	44	52	46	50	44	53	47	60	55	No	No	-2.6	-2.5	-3.2	-3.1	No	No	No
5	10 IRIS STREET PITT TOWN	R	GF	E	49	43	52	46	49	44	52	47	60	55	No	No	-2.7	-2.7	-3.2	-3.1	No	No	No
5	10 IRIS STREET PITT TOWN	R	F 1	E	51	45	53	48	51	45	54	49	60	55	No	No	-2.8	-2.8	-3.3	-3.2	No	No	No
6	12 IRIS STREET PITT TOWN	R	F 1	W	48	43	51	46	48	43	52	47	60	55	No	No	-3.1	-3.1	-4	-3.8	No	No	No
6	12 IRIS STREET PITT TOWN	R	GF	S	51	46	55	49	51	46	56	50	60	55	No	No	-3.2	-3.2	-4.1	-4	No	No	No
6	12 IRIS STREET PITT TOWN	R	F 1	S	53	48	56	51	53	48	57	52	60	55	No	No	-3.2	-3.2	-4.2	-4	No	No	No
6	12 IRIS STREET PITT TOWN	R	GF	E	51	45	54	48	51	45	55	49	60	55	No	No	-3.1	-3	-3.8	-3.7	No	No	No
6	12 IRIS STREET PITT TOWN	R	F 1	E	53	47	56	50	53	47	57	51	60	55	No	No	-3.2	-3.1	-3.9	-3.8	No	No	No
7	8 ELDON STREET PITT TOWN	R	GF	W	52	46	55	50	52	46	56	51	60	55	No	No	-3.5	-3.5	-4.3	-4.3	No	No	No
7	8 ELDON STREET PITT TOWN	R	GF	S	56	50	59	54	56	50	60	55	60	55	No	No	-3.6	-3.5	-4.4	-4.3	No	No	No
7	8 ELDON STREET PITT TOWN	R	GF	S	55	50	59	53	55	50	60	54	60	55	No	No	-3.6	-3.5	-4.4	-4.3	No	No	No
7	8 ELDON STREET PITT TOWN	R	GF	S	56	50	59	54	56	50	60	55	60	55	No	No	-3.6	-3.5	-4.4	-4.3	No	No	No
7	8 ELDON STREET PITT TOWN	R	GF	E	54	48	57	52	54	48	58	53	60	55	No	No	-3.6	-3.5	-4.4	-4.3	No	No	No
7	8 ELDON STREET PITT TOWN	R	GF	N	47	42	51	45	48	42	51	46	60	55	No	No	-3.3	-3.2	-3.7	-3.6	No	No	No
8	1 CATTAI ROAD PITT TOWN	R	GF	W	57	52	61	55	58	52	62	56	60	55	No	No	-3.8	-3.7	-3.9	-3.8	No	No	No
8	1 CATTAI ROAD PITT TOWN	R	GF	S	60	54	66	59	61	55	65	59	60	55	Yes	Yes	-5.6	-4.5	-4.2	-4	No	No	No
8	1 CATTAI ROAD PITT TOWN	R	GF	E	57	51	64	57	58	52	63	57	60	55	No	No	-7.3	-5.6	-5	-4.5	No	No	No
8	1 CATTAI ROAD PITT TOWN	R	GF	N	53	47	58	52	54	48	59	53	60	55	No	No	-5.3	-5	-4.9	-4.7	No	No	No
8	1 CATTAI ROAD PITT TOWN	R	GF	E	53	47	58	52	54	48	59	53	60	55	No	No	-5.2	-4.9	-4.9	-4.6	No	No	No
8	1 CATTAI ROAD PITT TOWN	R	GF	N	51	45	57	51	52	46	57	52	60	55	No	No	-5.8	-5.6	-5.7	-5.6	No	No	No
8	1 CATTAI ROAD PITT TOWN	R	GF	W	55	49	58	53	55	50	59	53	60	55	No	No	-3.7	-3.6	-4	-3.8	No	No	No
8	1 CATTAI ROAD PITT TOWN	R	GF	N	54	49	58	52	55	49	59	53	60	55	No	No	-3.5	-3.4	-3.9	-3.7	No	No	No
9	22 OLD PITT TOWN ROAD PITT TOWN	R	GF	W	57	51	55	48	58	52	56	49	58	53	No	No	2.1	3.2	2.2	3.1	No	No	No
9	22 OLD PITT TOWN ROAD PITT TOWN	R	F 1	W	58	52	56	49	59	53	57	50	58	53	Yes	No	1.9	3	2.1	2.9	No	No	Yes
9	22 OLD PITT TOWN ROAD PITT TOWN	R	GF	S	54	49	51	45	55	49	51	45	58	53	No	No	3.1	4	3.3	3.9	No	No	No
9	22 OLD PITT TOWN ROAD PITT TOWN	R	F 1	S	55	50	52	46	56	50	53	47	58	53	No	No	3	4	3.1	3.8	No	No	No
9	22 OLD PITT TOWN ROAD PITT TOWN	R	F 1	E	52	46	53	45	53	47	53	46	58	53	No	No	-0.2	0.3	-0.2	0.1	No	No	No
9	22 OLD PITT TOWN ROAD PITT TOWN	R	GF	E	51	44	52	45	52	45	53	46	58	53	No	No	-1.1	-1	-1	-1	No	No	No
9	22 OLD PITT TOWN ROAD PITT TOWN	R	F 1	E	53	46	54	46	54	47	55	48	58	53	No	No	-0.9	-0.7	-0.8	-0.7	No	No	No
9	22 OLD PITT TOWN ROAD PITT TOWN	R	GF	N	57	51	57	50	58	52	58	51	58	53	Yes	No	0.3	1.3	0.5	1.2	No	No	No
9	22 OLD PITT TOWN ROAD PITT TOWN	R	F 1	N	59	52	58	51	59	53	59	52	58	53	Yes	Yes	0.2	1.1	0.3	1.1	No	No	No
10	28 OLD PITT TOWN ROAD PITT TOWN	R	GF	W	54	48	53	46	55	49	54	47	57	52	No	No	0.7	1.7	0.7	1.5	No	No	No
10	28 OLD PITT TOWN ROAD PITT TOWN	R	F 1	W	55	49	55	48	56	50	56	49	57	52	No	No	0.5	1.4	0.5	1.2	No	No	No
10	28 OLD PITT TOWN ROAD PITT TOWN	R	F 1	W	53	47	51	44	54	48	52	45	57	52	No	No	1.7	2.6	1.7	2.5	No	No	No
10	28 OLD PITT TOWN ROAD PITT TOWN	R	GF	W	53	47	51	44	54	48	52	45	57	52	No	No	1.4	2.3	1.5	2.3	No	No	No
10	28 OLD PITT TOWN ROAD PITT TOWN	R	F 1	W	54	48	53	46	55	49	54	47	57	52	No	No	1.1	2	1.2	1.9	No	No	No
10	28 OLD PITT TOWN ROAD PITT TOWN	R	F 1	E	53	45	52	45	54	47	53	46	57	52	No	No	0.4	0.7	0.4	0.6	No	No	No
10	28 OLD PITT TOWN ROAD PITT TOWN	R	F 1	E	52	44	51	44	53	46	52	45	57	52	No	No	0.3	0.5	0.3	0.4	No	No	No
10	28 OLD PITT TOWN ROAD PITT TOWN	R	GF	E	53	45	53	45	54	47	54	47	57	52	No	No	-0.2	-0.3	0	-0.1	No	No	No
10	28 OLD PITT TOWN ROAD PITT TOWN	R	F 1	E	54	47	54	47	55	48	55	48	57	52	No	No	-0.1	-0.1	0.1	0.1	No	No	No
10	28 OLD PITT TOWN ROAD PITT TOWN	R	GF	N	56	48	56	48	57	50	57	50	57	52	No	No	0	0.2	0.1	0.3	No	No	No
10	28 OLD PITT TOWN ROAD PITT TOWN	R	F 1	N	57	50	57	50	58	51	58	51	57	52	Yes	No	0	0.2	0.1	0.3	No	No	No
10	28 OLD PITT TOWN ROAD PITT TOWN	R	GF	E	55	48	56	48	57	49	57	49	57	52	No	No	-0.2	0	0	0.1	No	No	No
10	28 OLD PITT TOWN ROAD PITT TOWN	R	F 1	E	57	49	57	49	58	51	58	51	57	52	Yes	No	-0.1	0	0	0.1	No	No	No
10	28 OLD PITT TOWN ROAD PITT TOWN	R	GF	N	57	50	57	50	58	51	58	51	57	52	Yes	No	-0.1	0.3	0	0.4	No	No	No
10	28 OLD PITT TOWN ROAD PITT TOWN	R	F 1	N	58	51	58	51	59	52	59	52	57	52	Yes	Yes	-0.1	0.3	0	0.3	No	No	No
11	4 ELDON STREET PITT TOWN	R	GF	W	57	51	60	54	57	51	61	55	60	55	No	No	-3.5	-3.4	-4.3	-4.3	No	No	No
11	4 ELDON STREET PITT TOWN	R	F 1	W	58	52	61	56	58	52	62	57	60	55	No	No	-3.6	-3.6	-4.3	-4.3	No	No	No
11	4 ELDON STREET PITT TOWN	R	GF	S	62	55	65	59	62	56	66	60	60	55	Yes	Yes	-3.2	-3.3	-3.5	-3.9	No	No	No
11	4 ELDON STREET PITT TOWN	R	F 1	S	62	56	66	60	63	56	67	61	60	55	Yes	Yes	-3.8	-3.9	-4	-4.4	No	No	No
11	4 ELDON STREET PITT TOWN	R	GF	E	57	52	61	55	58	53	61	56	60	55	No	No	-3.5	-3.1	-3.1	-3	No	No	No
11	4 ELDON STREET PITT TOWN	R	F 1	E	58	53	62	56	59	54	63	57	60	55	No	No	-3.8	-3.5	-3.5	-3.4	No	No	No
11	4 ELDON STREET PITT TOWN	R	GF	N	46	41	51	46	47	41	52	47	60	55	No	No	-5	-5	-5.1	-5.1	No	No	No
11	4 ELDON STREET PITT TOWN	R	F 1	N	50	45	54	48	51	46	55	49	60	55	No	No	-3.6	-3.4	-3.7	-3.5	No	No	No
11	4 ELDON STREET PITT TOWN	R	GF	E	46	40	51	45	47	41	52	46	60	55	No	No	-5	-4.9	-5	-5	No	No	No
11	4 ELDON STREET PITT TOWN	R	F 1	E	50	44	54	48	51	45	55	49	60	55	No	No	-3.7	-3.6	-3.7	-3.7	No	No	No
11	4 ELDON STREET PITT TOWN	R	GF	N	47	42	52	46	48	43	52	47	60	55	No	No	-4.3	-4	-4.2	-4.2	No	No	No
11	4 ELDON STREET PITT TOWN	R	F 1	N	51	45	54	48	52	46	55	49	60	55	No	No	-3.1	-3	-3.2	-3.1	No	No	No
11	4 ELDON STREET PITT TOWN	R	GF	W	54	48	57	52	54	48	58	52	60	55	No	No	-3.5	-3.5	-4.4	-4.3	No	No	No
11	4 ELDON STREET PITT TOWN	R	F 1	W	55	50	59	53	55	50	59	54	60	55	No	No	-3.6	-3.5	-4.3	-4.2	No	No	No
12	6 ELDON STREET PITT TOWN	R	GF	W	56	51	60	54	56	51	61	55	60	55	No	No	-3.6	-3.6	-4.6	-4.4	No	No	No
12	6 ELDON STREET PITT TOWN	R	F 1	W	57	52	61	55	57	52	62	56	60	55	No	No	-3.7	-3.6	-4.5	-4.3	No	No	No
12	6 ELDON STREET PITT TOWN	R	GF	S	61	55	64	58	61	55	65	59	60	55	Yes	No	-3.5	-3.6	-4.2	-4.4	No	No	No
12	6 ELDON STREET PITT TOWN	R	F 1	S	62	56	65	60	62	56	66	60	60	55	Yes	Yes	-3.6	-3.8	-4.3	-4.5	No	No	No
12	6 ELDON STREET PITT TOWN	R	GF	E	55	49	58	53	55	50	59	54	60	55	No	No	-3.6	-3.5	-4.3	-4.2	No	No	No
12	6 ELDON STREET PITT TOWN	R	F 1	E	56	51	60	54	56	51	61	55	60	55	No	No	-3.6	-3.6	-4.3	-4.2	No	No	No
12	6 ELDON STREET PITT TOWN	R	F 1	N	49	43	52	46	49	44	53	47	60	55	No	No	-3.6	-3.6	-3.8	-3.8	No	No	No
13	16 ELDON STREET PITT TOWN	R	GF	W	54	49	58	53	55	49	59	54	60	55	No	No	-3.8	-3.8	-4.7	-4.6	No	No	No
13	16 ELDON STREET PITT TOWN	R	GF	S	61	55	65	59	62	55	66	60	60	55	Yes	Yes	-3.9	-4.1	-4.6	-5	No	No	No
13	16 ELDON STREET PITT TOWN	R	GF	E	59	53	62	56	59	53	63	57	60	55	No	No	-3.7	-3.8	-4.5	-4.6	No	No	No
13	16 ELDON STREET PITT TOWN	R	GF	S	59	54	63	57	59	54	64	58	60	55	No	No	-3.7	-3.7	-4.6	-4.5	No	No	No
13	16 ELDON STREET PITT TOWN	R	GF	E	57	52	61	55	57	52	62	56	60	55	No	No	-3.6	-3.6	-4.4	-4.2	No	No	No
13	16 ELDON STREET PITT TOWN	R	GF	N	48	42	51	46	48	43	52	46	60	55	No	No	-3.2	-3.2	-3.8	-3.6	No	No	No
14	18 ELDON STREET PITT TOWN	R	GF	N	48	43	52	46	49	43	53	47	60	55	No	No	-3.4	-3.3	-4	-3.9	No	No	No

ID	Address	Class	Floor	Façade	2021 $L_{Aeq,\ period}$				2031 $L_{Aeq,\ period}$				NCG Criteria		Exceedance of NCG Criteria		Change in noise level				Equal to or above Cumulative Limit		Consider further additional noise mitigation
					Build		No Build		Build		No Build						2021		2031		2031		
					Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	
14	18 ELDON STREET PITT TOWN	R	GF	W	57	51	61	56	58	51	62	56	60	55	No	No	-4	-4.1	-4.7	-5	No	No	No
14	18 ELDON STREET PITT TOWN	R	GF	S	63	56	67	60	63	56	68	61	60	55	Yes	Yes	-4	-4.4	-4.6	-5.4	No	No	No
14	18 ELDON STREET PITT TOWN	R	GF	E	58	52	62	56	58	52	63	57	60	55	No	No	-3.9	-4	-4.6	-4.8	No	No	No
15	18A ELDON STREET PITT TOWN	R	GF	W	50	45	54	48	50	45	55	49	60	55	No	No	-3.5	-3.5	-4.5	-4.4	No	No	No
15	18A ELDON STREET PITT TOWN	R	F 1	W	53	47	56	51	52	47	57	51	60	55	No	No	-3.4	-3.4	-4.5	-4.4	No	No	No
15	18A ELDON STREET PITT TOWN	R	GF	S	53	47	56	51	53	47	57	52	60	55	No	No	-3.4	-3.4	-4.4	-4.3	No	No	No
15	18A ELDON STREET PITT TOWN	R	F 1	S	57	51	60	54	56	51	61	55	60	55	No	No	-3.4	-3.3	-4.4	-4.2	No	No	No
15	18A ELDON STREET PITT TOWN	R	GF	E	51	46	55	49	52	46	56	50	60	55	No	No	-3.3	-3.3	-4	-3.9	No	No	No
15	18A ELDON STREET PITT TOWN	R	F 1	E	54	49	58	52	54	49	59	53	60	55	No	No	-3.3	-3.3	-4.2	-4	No	No	No
15	18A ELDON STREET PITT TOWN	R	GF	E	49	43	52	46	49	44	53	47	60	55	No	No	-3	-2.9	-3.7	-3.6	No	No	No
15	18A ELDON STREET PITT TOWN	R	F 1	E	52	46	55	49	52	46	56	50	60	55	No	No	-3.1	-3.1	-4	-3.8	No	No	No
15	18A ELDON STREET PITT TOWN	R	GF	E	49	44	52	47	49	44	53	47	60	55	No	No	-3	-2.9	-3.7	-3.6	No	No	No
15	18A ELDON STREET PITT TOWN	R	F 1	E	52	46	55	50	52	47	56	50	60	55	No	No	-3.1	-3.1	-4	-3.8	No	No	No
15	18A ELDON STREET PITT TOWN	R	F 1	W	48	43	51	46	48	43	52	47	60	55	No	No	-3.2	-3.2	-4.3	-4.2	No	No	No
15	18A ELDON STREET PITT TOWN	R	F 1	N	48	42	51	46	48	42	52	46	60	55	No	No	-3.2	-3.2	-4.3	-4.2	No	No	No
16	20 ELDON STREET PITT TOWN	R	GF	W	56	51	60	55	57	51	61	55	60	55	No	No	-3.9	-4	-4.8	-4.9	No	No	No
16	20 ELDON STREET PITT TOWN	R	GF	S	63	56	67	60	63	56	68	62	60	55	Yes	Yes	-4	-4.4	-4.6	-5.4	No	No	No
16	20 ELDON STREET PITT TOWN	R	GF	SE	62	55	66	60	62	55	67	61	60	55	Yes	Yes	-4	-4.3	-4.7	-5.2	No	No	No
16	20 ELDON STREET PITT TOWN	R	GF	E	57	51	61	55	57	51	62	56	60	55	No	No	-3.9	-4	-4.7	-4.8	No	No	No
16	20 ELDON STREET PITT TOWN	R	GF	N	48	42	51	46	48	43	52	46	60	55	No	No	-3.2	-3.2	-3.8	-3.7	No	No	No
17	22 ELDON STREET PITT TOWN	R	GF	W	58	52	62	56	58	52	63	57	60	55	No	No	-4	-4.1	-4.9	-5	No	No	No
17	22 ELDON STREET PITT TOWN	R	F 1	W	59	53	63	57	59	53	64	58	60	55	No	No	-4	-4.1	-4.8	-4.9	No	No	No
17	22 ELDON STREET PITT TOWN	R	GF	S	63	56	67	60	63	56	68	62	60	55	Yes	Yes	-4.1	-4.4	-4.7	-5.4	No	No	No
17	22 ELDON STREET PITT TOWN	R	F 1	S	63	57	68	61	64	57	69	62	60	55	Yes	Yes	-4.3	-4.7	-4.8	-5.4	No	No	No
17	22 ELDON STREET PITT TOWN	R	GF	E	56	50	60	54	56	50	61	55	60	55	No	No	-3.8	-3.9	-4.7	-4.8	No	No	No
17	22 ELDON STREET PITT TOWN	R	F 1	E	59	53	63	57	59	53	64	58	60	55	No	No	-3.8	-3.9	-4.4	-4.6	No	No	No
17	22 ELDON STREET PITT TOWN	R	F 1	N	49	43	51	45	49	44	52	46	60	55	No	No	-2.6	-2.5	-2.9	-2.8	No	No	No
18	14 LIVERPOOL STREET PITT TOWN	R	GF	W	51	46	55	49	51	46	56	50	60	55	No	No	-3.8	-3.7	-4.6	-4.5	No	No	No
18	14 LIVERPOOL STREET PITT TOWN	R	GF	S	52	47	56	50	52	47	57	51	60	55	No	No	-3.6	-3.5	-4.6	-4.4	No	No	No
18	14 LIVERPOOL STREET PITT TOWN	R	GF	S	52	46	55	50	52	46	56	51	60	55	No	No	-3.6	-3.5	-4.6	-4.4	No	No	No
18	14 LIVERPOOL STREET PITT TOWN	R	GF	S	52	46	55	49	51	46	56	50	60	55	No	No	-3.2	-3.2	-4.3	-4.2	No	No	No
18	14 LIVERPOOL STREET PITT TOWN	R	GF	E	49	44	52	46	49	44	53	47	60	55	No	No	-2.9	-2.8	-3.7	-3.7	No	No	No
19	12 LIVERPOOL STREET PITT TOWN	R	GF	W	50	44	53	48	50	44	54	49	60	55	No	No	-3.7	-3.6	-4.5	-4.4	No	No	No
19	12 LIVERPOOL STREET PITT TOWN	R	GF	E	47	42	50	45	48	42	51	45	60	55	No	No	-2.8	-2.8	-3.3	-3.2	No	No	No
19	12 LIVERPOOL STREET PITT TOWN	R	GF	S	48	42	50	45	48	42	51	46	60	55	No	No	-2.9	-2.9	-3.4	-3.3	No	No	No
19	12 LIVERPOOL STREET PITT TOWN	R	GF	E	49	43	52	46	49	43	53	47	60	55	No	No	-3.2	-3.1	-3.9	-3.7	No	No	No
19	12 LIVERPOOL STREET PITT TOWN	R	GF	E	49	43	52	46	49	43	53	47	60	55	No	No	-3.1	-3.1	-3.9	-3.7	No	No	No
19	12 LIVERPOOL STREET PITT TOWN	R	GF	E	49	43	52	46	49	43	53	47	60	55	No	No	-3.1	-3.1	-3.9	-3.7	No	No	No
19	12 LIVERPOOL STREET PITT TOWN	R	GF	E	48	43	51	46	48	43	52	47	60	55	No	No	-3	-3	-3.8	-3.6	No	No	No
19	12 LIVERPOOL STREET PITT TOWN	R	GF	NE	48	42	51	45	48	42	51	46	60	55	No	No	-3	-3	-3.8	-3.6	No	No	No
20	10 LIVERPOOL STREET PITT TOWN	R	GF	W	49	43	52	47	49	43	53	48	60	55	No	No	-3.7	-3.7	-4.6	-4.4	No	No	No
21	8 LIVERPOOL STREET PITT TOWN	R	GF	W	47	42	51	45	47	42	52	46	60	55	No	No	-3.6	-3.6	-4.4	-4.3	No	No	No
21	8 LIVERPOOL STREET PITT TOWN	R	GF	S	47	42	51	45	47	42	52	46	60	55	No	No	-3.4	-3.5	-4.3	-4.2	No	No	No
21	8 LIVERPOOL STREET PITT TOWN	R	GF	W	47	41	50	45	47	42	51	46	60	55	No	No	-3.4	-3.3	-4.2	-4	No	No	No
22	6 LIVERPOOL STREET PITT TOWN	R	F 1	W	48	42	51	46	48	43	52	47	60	55	No	No	-3.6	-3.5	-4.4	-4.2	No	No	No
22	6 LIVERPOOL STREET PITT TOWN	R	F 1	S	49	44	52	47	49	44	53	47	60	55	No	No	-2.9	-2.9	-3.9	-3.8	No	No	No
22	6 LIVERPOOL STREET PITT TOWN	R	F 1	S	48	43	51	46	49	43	52	46	60	55	No	No	-2.7	-2.6	-3.5	-3.3	No	No	No
23	4 LIVERPOOL STREET PITT TOWN	R	F 1	W	46	41	50	44	46	41	51	45	60	55	No	No	-3.3	-3.4	-4.1	-4	No	No	No
29	5 LIVERPOOL STREET PITT TOWN	R	GF	S	47	42	50	45	47	42	51	45	60	55	No	No	-2.7	-2.7	-3.5	-3.4	No	No	No
243	8 ELDON STREET PITT TOWN	R	GF	S	47	42	50	44	48	42	51	45	60	55	No	No	-2.7	-2.6	-3	-3	No	No	No
243	8 ELDON STREET PITT TOWN	R	F 1	S	48	43	51	45	49	43	52	46	60	55	No	No	-2.7	-2.6	-3.1	-3	No	No	No
243	8 ELDON STREET PITT TOWN	R	F 1	E	48	43	51	45	49	43	52	46	60	55	No	No	-2.6	-2.4	-2.8	-2.6	No	No	No
244	40 BUCKINGHAM STREET PITT TOWN	R	GF	W	47	42	50	45	47	42	51	46	60	55	No	No	-3.3	-3.2	-4.1	-4	No	No	No
244	40 BUCKINGHAM STREET PITT TOWN	R	F 1	W	49	43	52	46	49	43	53	47	60	55	No	No	-3.2	-3.1	-3.9	-3.7	No	No	No
244	40 BUCKINGHAM STREET PITT TOWN	R	GF	S	51	45	53	48	51	46	54	48	60	55	No	No	-2.8	-2.5	-3.1	-2.9	No	No	No
244	40 BUCKINGHAM STREET PITT TOWN	R	F 1	S	52	46	54	49	52	47	55	50	60	55	No	No	-2.8	-2.6	-3.2	-3	No	No	No
244	40 BUCKINGHAM STREET PITT TOWN	R	GF	E	49	44	52	46	50	44	53	47	60	55	No	No	-2.8	-2.6	-2.8	-2.7	No	No	No
244	40 BUCKINGHAM STREET PITT TOWN	R	F 1	E	50	45	53	47	51	46	54	48	60	55	No	No	-2.9	-2.7	-3	-2.8	No	No	No
254	38 ELDON STREET PITT TOWN	R	GF	S	51	44	56	50	52	45	57	51	60	55	No	No	-5.1	-5.3	-5.7	-6.2	No	No	No
274	36 ELDON STREET PITT TOWN	R	GF	S	52	46	58	52	53	46	59	53	60	55	No	No	-5.8	-6	-6.5	-6.9	No	No	No
274	36 ELDON STREET PITT TOWN	R	GF	S	51	45	58	52	52	45	59	53	60	55	No	No	-6.9	-7	-7.6	-8	No	No	No
274	36 ELDON STREET PITT TOWN	R	GF	S	51	45	59	52	51	45	60	54	60	55	No	No	-7.9	-7.9	-8.6	-8.9	No	No	No
275	34 ELDON STREET PITT TOWN	R	GF	S	54	48	62	55	55	48	63	57	60	55	No	No	-7.5	-7.6	-8.1	-8.5	No	No	No
275	34 ELDON STREET PITT TOWN	R	GF	E	49	44	59	53	50	44	60	54	60	55	No	No	-9.8	-9.5	-10.3	-10	No	No	No
275	34 ELDON STREET PITT TOWN	R	GF	N	46	41	50	45	46	41	51	46	60	55	No	No	-4.1	-4	-4.8	-4.7	No	No	No
275	34 ELDON STREET PITT TOWN	R	GF	E	46	41	50	45	47	41	52	46	60	55	No	No	-4.2	-4.2	-5	-4.8	No	No	No
275	34 ELDON STREET PITT TOWN	R	GF	SE	47	42	51	46	47	42	53	47	60	55	No	No	-4.3	-4.4	-5.1	-4.9	No	No	No
275	34 ELDON STREET PITT TOWN	R	GF	SE	48	42	55	49	48	43	56	50	60	55	No	No	-7.1	-7	-7.7	-7.6	No	No	No
275	34 ELDON STREET PITT TOWN	R	GF	E	48	42	55	49	48	43	56	50	60	55	No	No	-7.1	-7.1	-7.7	-7.6	No	No	No
275	34 ELDON STREET PITT TOWN	R	GF	E	48	42	54	49	48	42	55	50	60	55	No	No	-6.6	-6.5	-7.3	-7.2	No	No	No
276	32 ELDON STREET PITT TOWN	R	GF	W	43	38	57	50	44	38	58	52	60	55	No	No	-13.2	-12.8	-13.7	-13.4	No	No	No
276	32 ELDON STREET PITT TOWN	R	GF	S	57	50	65	59	57	50	66	60	60	55	No	No	-8.5	-8.7	-9.1	-9.6	No	No	No
276	32 ELDON STREET PITT TOWN	R	GF	SE	57	51	65	59	58	51	66	60	60	55	No	No	-8	-8	-8.6	-9	No	No	No
276	32 ELDON STREET PITT TOWN	R	GF	S	58	51	65	59	58	52	67	60	60	55	No	No	-7.6	-7.7	-8.2	-8.6	No	No	No
276	32 ELDON STREET PITT TOWN	R	GF	E	52	46	59	53	52	47	60	54	60	55	No	No	-7.5	-7.4	-8.1	-7.9	No	No	No
276	32 ELDON STREET PITT TOWN	R	GF	N	45	39	50	44	45	40	51	46	60	55	No	No	-5.3	-5.3	-5.9	-5.8	No	No	No
277	30 ELDON STREET PITT TOWN	R	GF	W	47	42	59	53	48	42	60	54	60	55	No	No	-11.1	-11.1	-11.7	-11.6	No	No	No
277	30 ELDON STREET PITT TOWN	R	GF	S	60	54	66	60	61	54	67	61	60	55	Yes	No	-5.8	-6.1	-6.5	-7.2	No	No	No
277	30 ELDON STREET PITT TOWN	R	GF	E	58	52	62	56	59	53	63	57	60	55	No	No	-3.3	-3.6	-4.2	-4.5	No	No	No
277	30 ELDON STREET PITT TOWN	R	GF	N	46	40	50	44	46	41	51	45	60	55	No	No	-3.7	-3.8	-4.4	-4.4	No	No	No

ID	Address	Class	Floor	Façade	2021 $L_{Aeq,\ period}$				2031 $L_{Aeq,\ period}$				NCG Criteria		Exceedance of NCG Criteria		Change in noise level				Equal to or above Cumulative Limit		Consider further additional noise mitigation
					Build		No Build		Build		No Build						2021		2031		2031		
					Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	
277	30 ELDON STREET PITT TOWN	R	GF	W	46	40	51	46	46	40	52	47	60	55	No	No	-5.5	-5.5	-6.2	-6.1	No	No	No
277	30 ELDON STREET PITT TOWN	R	GF	N	45	40	50	45	46	40	52	46	60	55	No	No	-5.1	-5.2	-5.9	-5.8	No	No	No
278	18 CHATHAM STREET PITT TOWN	R	GF	W	59	53	63	57	60	53	65	58	60	55	No	No	-3.9	-4.4	-4.9	-5.4	No	No	No
278	18 CHATHAM STREET PITT TOWN	R	GF	S	64	57	68	61	65	57	69	62	60	55	Yes	Yes	-3.6	-4.2	-4	-5.2	No	No	No
278	18 CHATHAM STREET PITT TOWN	R	GF	E	60	54	64	58	61	54	65	59	60	55	Yes	No	-3.6	-4	-4.2	-4.9	No	No	No
278	18 CHATHAM STREET PITT TOWN	R	GF	E	59	53	63	56	59	53	64	57	60	55	No	No	-3.5	-3.8	-4.2	-4.7	No	No	No
278	18 CHATHAM STREET PITT TOWN	R	GF	E	58	52	61	55	58	52	62	56	60	55	No	No	-3.6	-3.7	-4.4	-4.6	No	No	No
278	18 CHATHAM STREET PITT TOWN	R	GF	N	48	43	52	46	49	43	53	47	60	55	No	No	-3.5	-3.6	-4.3	-4.4	No	No	No
279	28 ELDON STREET PITT TOWN	R	GF	W	58	52	62	56	58	52	63	57	60	55	No	No	-3.6	-3.9	-4.5	-4.8	No	No	No
279	28 ELDON STREET PITT TOWN	R	GF	S	63	56	67	60	63	56	68	61	60	55	Yes	Yes	-4	-4.3	-4.6	-5.3	No	No	No
279	28 ELDON STREET PITT TOWN	R	GF	E	57	51	61	55	57	51	62	56	60	55	No	No	-3.9	-4	-4.7	-4.9	No	No	No
279	28 ELDON STREET PITT TOWN	R	GF	N	48	43	52	46	49	43	53	47	60	55	No	No	-3.5	-3.5	-4.2	-4.1	No	No	No
280	26 ELDON STREET PITT TOWN	R	GF	W	57	51	61	55	57	51	62	56	60	55	No	No	-4	-4.1	-4.8	-4.9	No	No	No
280	26 ELDON STREET PITT TOWN	R	GF	S	62	55	66	60	62	55	67	61	60	55	Yes	Yes	-3.9	-4.2	-4.7	-5.2	No	No	No
280	26 ELDON STREET PITT TOWN	R	GF	SW	62	55	66	60	62	55	67	61	60	55	Yes	Yes	-4	-4.2	-4.7	-5.2	No	No	No
280	26 ELDON STREET PITT TOWN	R	GF	S	62	56	66	60	63	56	67	61	60	55	Yes	Yes	-4	-4.3	-4.6	-5.3	No	No	No
280	26 ELDON STREET PITT TOWN	R	GF	E	52	47	56	50	53	47	57	51	60	55	No	No	-3.6	-3.6	-4.5	-4.4	No	No	No
280	26 ELDON STREET PITT TOWN	R	GF	N	48	42	51	45	48	42	52	46	60	55	No	No	-3.4	-3.4	-4.1	-4	No	No	No
280	26 ELDON STREET PITT TOWN	R	GF	W	49	44	53	47	50	44	54	48	60	55	No	No	-3.4	-3.4	-4.4	-4.3	No	No	No
280	26 ELDON STREET PITT TOWN	R	GF	N	48	43	52	46	49	43	53	47	60	55	No	No	-3.5	-3.5	-4.4	-4.3	No	No	No
281	15 CHATHAM STREET PITT TOWN	R	GF	S	49	43	53	48	49	44	54	49	60	55	No	No	-4.5	-4.5	-5.1	-5	No	No	No
281	15 CHATHAM STREET PITT TOWN	R	GF	E	50	44	53	48	50	44	54	48	60	55	No	No	-3.3	-3.2	-4.2	-4.1	No	No	No
281	15 CHATHAM STREET PITT TOWN	R	GF	N	47	41	50	44	47	41	51	45	60	55	No	No	-3.1	-3	-3.8	-3.6	No	No	No
282	13 CHATHAM STREET PITT TOWN	R	GF	S	48	42	51	45	48	42	52	46	60	55	No	No	-3	-2.9	-3.9	-3.9	No	No	No
282	13 CHATHAM STREET PITT TOWN	R	GF	E	53	47	57	51	53	47	58	52	60	55	No	No	-3.5	-3.6	-4.4	-4.6	No	No	No
282	13 CHATHAM STREET PITT TOWN	R	GF	E	47	42	50	44	47	42	51	45	60	55	No	No	-2.8	-2.6	-3.6	-3.5	No	No	No
282	13 CHATHAM STREET PITT TOWN	R	GF	E	49	44	52	47	49	44	53	48	60	55	No	No	-2.7	-2.7	-3.7	-3.6	No	No	No
283	9 CHATHAM STREET PITT TOWN	R	GF	S	47	41	50	44	47	42	51	45	60	55	No	No	-2.9	-3	-3.8	-3.7	No	No	No
283	9 CHATHAM STREET PITT TOWN	R	GF	E	48	43	51	46	48	43	52	47	60	55	No	No	-2.9	-2.9	-3.7	-3.6	No	No	No
284	11 CHATHAM STREET PITT TOWN	R	GF	S	47	41	50	45	47	42	51	46	60	55	No	No	-3.7	-3.7	-4.4	-4.3	No	No	No
284	11 CHATHAM STREET PITT TOWN	R	GF	E	47	41	50	45	47	42	51	46	60	55	No	No	-3.3	-3.3	-4	-3.9	No	No	No
284	11 CHATHAM STREET PITT TOWN	R	GF	E	47	41	50	45	47	42	51	46	60	55	No	No	-3.3	-3.3	-3.9	-3.8	No	No	No
286	7 CHATHAM STREET PITT TOWN	R	GF	S	47	41	50	44	47	42	51	45	60	55	No	No	-2.8	-2.8	-3.5	-3.4	No	No	No
288	7 CHATHAM STREET PITT TOWN	R	GF	S	47	42	50	44	47	42	51	45	60	55	No	No	-2.7	-2.6	-3.5	-3.5	No	No	No
288	7 CHATHAM STREET PITT TOWN	R	GF	E	49	43	52	47	49	44	54	48	60	55	No	No	-3.3	-3.3	-4.2	-4	No	No	No
289	5 CHATHAM STREET PITT TOWN	R	GF	S	49	43	52	46	49	43	53	47	60	55	No	No	-3.1	-3.2	-4.1	-4	No	No	No
289	5 CHATHAM STREET PITT TOWN	R	GF	E	50	44	53	47	50	45	54	48	60	55	No	No	-2.9	-3	-3.8	-3.8	No	No	No
290	3 CHATHAM STREET PITT TOWN	R	GF	E	50	44	53	47	50	44	54	48	60	55	No	No	-2.9	-3.1	-3.7	-3.8	No	No	No
290	3 CHATHAM STREET PITT TOWN	R	GF	E	50	44	52	47	50	44	54	48	60	55	No	No	-2.8	-3	-3.7	-3.9	No	No	No
290	3 CHATHAM STREET PITT TOWN	R	GF	E	49	43	52	47	50	44	54	48	60	55	No	No	-2.9	-3.2	-3.7	-4	No	No	No
292	10 CHATHAM STREET PITT TOWN	R	GF	W	49	43	53	47	50	44	54	48	60	55	No	No	-3.4	-3.8	-4.3	-4.5	No	No	No
292	10 CHATHAM STREET PITT TOWN	R	GF	S	50	44	53	47	50	45	54	48	60	55	No	No	-2.9	-3	-3.9	-3.8	No	No	No
292	10 CHATHAM STREET PITT TOWN	R	GF	E	48	42	50	45	48	43	51	46	60	55	No	No	-2.3	-2.3	-3.1	-2.9	No	No	No
293	12 CHATHAM STREET PITT TOWN	R	GF	W	49	43	53	47	50	44	54	48	60	55	No	No	-3.3	-3.5	-4.2	-4.3	No	No	No
293	12 CHATHAM STREET PITT TOWN	R	GF	S	48	42	51	45	48	42	52	46	60	55	No	No	-3	-3	-3.7	-3.6	No	No	No
293	12 CHATHAM STREET PITT TOWN	R	GF	E	47	42	50	44	47	42	51	45	60	55	No	No	-2.4	-2.4	-3.4	-3.2	No	No	No
294	14 CHATHAM STREET PITT TOWN	R	GF	W	51	45	54	49	51	45	56	50	60	55	No	No	-3.7	-4	-4.7	-4.8	No	No	No
294	14 CHATHAM STREET PITT TOWN	R	GF	S	47	42	50	45	48	42	51	46	60	55	No	No	-3.2	-3.1	-3.9	-3.9	No	No	No
294	14 CHATHAM STREET PITT TOWN	R	GF	E	48	42	50	45	48	42	51	46	60	55	No	No	-2.7	-2.7	-3.6	-3.5	No	No	No
295	16 CHATHAM STREET PITT TOWN	R	GF	W	52	46	55	50	52	46	57	51	60	55	No	No	-3.7	-3.8	-4.5	-4.5	No	No	No
295	16 CHATHAM STREET PITT TOWN	R	GF	S	52	47	56	51	52	47	57	52	60	55	No	No	-3.8	-3.7	-4.8	-4.8	No	No	No
295	16 CHATHAM STREET PITT TOWN	R	GF	E	50	44	53	47	50	44	54	48	60	55	No	No	-2.9	-2.9	-3.8	-3.7	No	No	No
296	9A LIVERPOOL STREET PITT TOWN	R	GF	W	48	43	52	46	49	43	53	47	60	55	No	No	-3.4	-3.4	-4.2	-4.1	No	No	No
296	9A LIVERPOOL STREET PITT TOWN	R	GF	S	50	45	54	48	50	45	55	49	60	55	No	No	-3.5	-3.5	-4.4	-4.3	No	No	No
296	9A LIVERPOOL STREET PITT TOWN	R	GF	E	48	43	51	46	48	43	52	47	60	55	No	No	-2.8	-2.8	-3.7	-3.6	No	No	No
296	9A LIVERPOOL STREET PITT TOWN	R	GF	E	47	41	50	44	47	42	51	45	60	55	No	No	-2.7	-2.7	-3.4	-3.3	No	No	No
297	11 LIVERPOOL STREET PITT TOWN	R	GF	W	49	43	52	47	48	43	53	48	60	55	No	No	-3.5	-3.5	-4.6	-4.5	No	No	No
297	11 LIVERPOOL STREET PITT TOWN	R	GF	S	49	43	52	47	49	44	53	47	60	55	No	No	-3.1	-3.1	-4	-3.9	No	No	No
297	11 LIVERPOOL STREET PITT TOWN	R	GF	E	52	47	56	50	52	47	57	51	60	55	No	No	-3.6	-3.6	-4.4	-4.3	No	No	No
298	24 ELDON STREET PITT TOWN	R	GF	W	55	49	60	54	56	49	61	55	60	55	No	No	-4.1	-4.2	-4.8	-5.1	No	No	No
298	24 ELDON STREET PITT TOWN	R	GF	S	62	56	66	60	63	56	67	61	60	55	Yes	Yes	-4	-4.4	-4.7	-5.3	No	No	No
298	24 ELDON STREET PITT TOWN	R	GF	S	62	55	66	60	62	55	67	61	60	55	Yes	Yes	-4.1	-4.4	-4.8	-5.4	No	No	No
298	24 ELDON STREET PITT TOWN	R	GF	S	63	56	67	60	63	56	68	61	60	55	Yes	Yes	-4.2	-4.4	-4.7	-5.4	No	No	No
298	24 ELDON STREET PITT TOWN	R	GF	E	59	53	62	57	59	53	63	57	60	55	No	No	-3.9	-4	-4.7	-4.9	No	No	No
298	24 ELDON STREET PITT TOWN	R	GF	N	48	43	52	46	48	43	53	47	60	55	No	No	-3.4	-3.4	-4.2	-4.1	No	No	No
298	24 ELDON STREET PITT TOWN	R	GF	W	48	43	52	46	49	43	53	47	60	55	No	No	-3.6	-3.6	-4.3	-4.3	No	No	No
298	24 ELDON STREET PITT TOWN	R	GF	N	48	43	52	46	49	43	53	47	60	55	No	No	-3.5	-3.5	-4.2	-4.2	No	No	No
299	13 LIVERPOOL STREET PITT TOWN	R	GF	W	49	44	52	47	49	44	53	48	60	55	No	No	-3.3	-3.3	-4.3	-4.1	No	No	No
299	13 LIVERPOOL STREET PITT TOWN	R	GF	S	48	42	51	46	48	43	52	47	60	55	No	No	-3.4	-3.4	-4.1	-4	No	No	No
299	13 LIVERPOOL STREET PITT TOWN	R	GF	E	55	49	59	53	55	49	60	54	60	55	No	No	-3.9	-3.8	-4.7	-4.5	No	No	No
299	13 LIVERPOOL STREET PITT TOWN	R	GF	N	47	41	50	44	47	42	51	45	60	55	No	No	-3.1	-3.1	-3.8	-3.6	No	No	No
299	13 LIVERPOOL STREET PITT TOWN	R	GF	W	48	43	52	46	48	43	53	47	60	55	No	No	-3.4	-3.3	-4.3	-4.1	No	No	No
299	13 LIVERPOOL STREET PITT TOWN	R	GF	N	47	42	51	45	48	42	52	46	60	55	No	No	-3.4	-3.4	-4.2	-4	No	No	No
300	9 LIVERPOOL STREET PITT TOWN	R	GF	W	47	41	50	45	47	42	51	46	60	55	No	No	-3.2	-3.3	-4.1	-3.9	No	No	No
300	9 LIVERPOOL STREET PITT TOWN	R	GF	S	49	44	53	48	50	44	54	48	60	55	No	No	-3.6	-3.5	-4.3	-4.3	No	No	No
300	9 LIVERPOOL STREET PITT TOWN	R	GF	E	51	46	55	49	51	46	56	50	60	55	No	No	-3.7	-3.7	-4.5	-4.3	No	No	No
300	9 LIVERPOOL STREET PITT TOWN	R	GF	E	48	43	51	46	48	43	52	47	60	55	No	No	-3.1	-3.2	-3.9	-3.7	No	No	No
301	7 LIVERPOOL STREET PITT TOWN	R	GF	W	47	41	50	44	47	41	51	45	60	55	No	No	-3	-3	-4.1	-4	No	No	No
301	7 LIVERPOOL STREET PITT TOWN	R	GF	S	48	42	51	45	48	42	52	46	60	55	No	No	-2.9	-2.9	-3.9	-3.8	No	No	No
301	7 LIVERPOOL STREET PITT TOWN	R	GF	E	48	42	51	45	48	42	52	46	60	55	No	No	-2.9	-2.9	-3.6	-3.6	No	No	No

ID	Address	Class	Floor	Façade	2021 $L_{Aeq,\ period}$				2031 $L_{Aeq,\ period}$				NCG Criteria		Exceedance of NCG Criteria		Change in noise level				Equal to or above Cumulative Limit		Consider further additional noise mitigation
					Build		No Build		Build		No Build						2021		2031		2031		
					Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	
302	7A LIVERPOOL STREET PITT TOWN	R	GF	S	47	42	50	45	47	42	51	46	60	55	No	No	-3.1	-3	-3.9	-3.8	No	No	No
302	7A LIVERPOOL STREET PITT TOWN	R	GF	S	47	42	50	45	48	42	51	46	60	55	No	No	-2.8	-2.7	-3.6	-3.4	No	No	No
302	7A LIVERPOOL STREET PITT TOWN	R	GF	E	47	42	50	44	47	42	51	45	60	55	No	No	-2.6	-2.5	-3.4	-3.3	No	No	No
303	5B LIVERPOOL STREET PITT TOWN	R	GF	S	48	42	50	45	48	42	51	46	60	55	No	No	-2.7	-2.7	-3.6	-3.5	No	No	No
303	5B LIVERPOOL STREET PITT TOWN	R	GF	S	48	42	50	45	48	42	51	46	60	55	No	No	-2.7	-2.7	-3.7	-3.6	No	No	No
303	5B LIVERPOOL STREET PITT TOWN	R	GF	S	48	42	50	45	48	42	52	46	60	55	No	No	-2.7	-2.7	-3.7	-3.6	No	No	No
304	5A LIVERPOOL STREET PITT TOWN	R	GF	S	47	42	50	44	47	42	51	45	60	55	No	No	-2.6	-2.6	-3.6	-3.5	No	No	No
304	5A LIVERPOOL STREET PITT TOWN	R	GF	S	47	42	50	45	48	42	51	46	60	55	No	No	-2.7	-2.6	-3.6	-3.5	No	No	No
304	5A LIVERPOOL STREET PITT TOWN	R	GF	E	47	42	50	44	47	42	51	45	60	55	No	No	-2.4	-2.4	-3.3	-3.2	No	No	No
304	5A LIVERPOOL STREET PITT TOWN	R	GF	S	47	42	50	44	47	42	51	45	60	55	No	No	-2.4	-2.4	-3.4	-3.1	No	No	No
305	3A LIVERPOOL STREET PITT TOWN	R	GF	S	47	42	50	45	48	42	51	46	60	55	No	No	-2.7	-2.7	-3.5	-3.4	No	No	No
306	22 BUCKINGHAM STREET PITT TOWN	R	GF	S	49	43	51	46	49	43	53	47	60	55	No	No	-2.9	-3.2	-3.7	-3.9	No	No	No
306	22 BUCKINGHAM STREET PITT TOWN	R	GF	E	48	42	51	45	49	43	52	46	60	55	No	No	-2.8	-3	-3.6	-3.8	No	No	No
307	24 BUCKINGHAM STREET PITT TOWN	R	GF	S	47	42	50	44	48	42	51	45	60	55	No	No	-2.6	-2.7	-3.4	-3.3	No	No	No
320	21 BATHURST STREET PITT TOWN	R	GF	NW	57	52	59	54	58	53	60	55	60	55	No	No	-1.9	-2	-1.9	-1.9	No	No	No
320	21 BATHURST STREET PITT TOWN	R	GF	SW	68	61	69	63	68	63	70	64	60	55	Yes	Yes	-1.5	-1.8	-1.7	-1.7	No	No	No
320	21 BATHURST STREET PITT TOWN	R	GF	SE	63	57	64	58	63	58	65	59	60	55	Yes	Yes	-1.5	-1.6	-1.9	-1.9	No	No	No
320	21 BATHURST STREET PITT TOWN	R	GF	NE	54	49	53	47	54	49	54	48	60	55	No	No	1.7	2	0.6	1	No	No	No
321	25 BATHURST STREET PITT TOWN	R	GF	NW	54	48	56	50	55	49	56	51	60	55	No	No	-1.7	-1.7	-1.8	-1.7	No	No	No
321	25 BATHURST STREET PITT TOWN	R	GF	SW	56	51	58	52	57	51	59	53	60	55	No	No	-1.8	-1.8	-1.9	-1.8	No	No	No
321	25 BATHURST STREET PITT TOWN	R	GF	NW	58	53	60	55	59	54	61	56	60	55	No	No	-1.9	-2	-1.9	-1.9	No	No	No
321	25 BATHURST STREET PITT TOWN	R	GF	SW	66	60	67	61	66	61	68	62	60	55	Yes	Yes	-1.7	-1.9	-1.8	-1.8	No	No	No
321	25 BATHURST STREET PITT TOWN	R	GF	SE	56	50	57	52	56	51	58	53	60	55	No	No	-1.5	-1.5	-1.5	-1.5	No	No	No
321	25 BATHURST STREET PITT TOWN	R	GF	NE	53	48	52	46	53	48	53	47	60	55	No	No	1	1.3	0.2	0.5	No	No	No
322	27 BATHURST STREET PITT TOWN	R	GF	NW	53	48	55	50	54	49	56	51	60	55	No	No	-2	-2	-2	-1.9	No	No	No
322	27 BATHURST STREET PITT TOWN	R	F 1	NW	55	50	57	52	56	51	58	52	60	55	No	No	-1.8	-1.8	-1.8	-1.7	No	No	No
322	27 BATHURST STREET PITT TOWN	R	GF	SW	65	59	67	61	66	60	68	62	60	55	Yes	Yes	-1.8	-2.1	-1.8	-1.8	No	No	No
322	27 BATHURST STREET PITT TOWN	R	F 1	SW	66	60	68	62	67	62	69	63	60	55	Yes	Yes	-1.8	-2	-1.8	-1.9	No	No	No
322	27 BATHURST STREET PITT TOWN	R	GF	SE	59	53	61	55	60	54	62	56	60	55	No	No	-1.9	-1.9	-1.9	-1.9	No	No	No
322	27 BATHURST STREET PITT TOWN	R	F 1	SE	61	56	63	57	62	57	64	58	60	55	Yes	Yes	-1.6	-1.7	-1.7	-1.7	No	No	No
322	27 BATHURST STREET PITT TOWN	R	F 1	NE	53	48	52	47	54	48	53	48	60	55	No	No	1	1.3	0.4	0.7	No	No	No
323	29 BATHURST STREET PITT TOWN	R	GF	NW	49	43	51	45	50	44	52	46	60	55	No	No	-1.9	-2	-2	-2	No	No	No
323	29 BATHURST STREET PITT TOWN	R	F 1	NW	52	46	54	48	53	47	54	49	60	55	No	No	-1.8	-1.7	-1.8	-1.7	No	No	No
323	29 BATHURST STREET PITT TOWN	R	F 1	NW	50	45	52	46	51	46	53	47	60	55	No	No	-1.5	-1.6	-1.6	-1.5	No	No	No
323	29 BATHURST STREET PITT TOWN	R	GF	NW	57	51	59	54	58	52	60	54	60	55	No	No	-2.2	-2.4	-2.2	-2.2	No	No	No
323	29 BATHURST STREET PITT TOWN	R	F 1	NW	58	53	61	55	59	54	62	56	60	55	No	No	-2.2	-2.2	-2.1	-2.2	No	No	No
323	29 BATHURST STREET PITT TOWN	R	GF	SW	66	60	68	62	67	61	69	63	60	55	Yes	Yes	-1.8	-2.2	-1.9	-2	No	No	No
323	29 BATHURST STREET PITT TOWN	R	F 1	SW	67	61	69	63	68	62	70	64	60	55	Yes	Yes	-1.9	-2.3	-2	-2.1	No	No	No
323	29 BATHURST STREET PITT TOWN	R	GF	S	66	60	68	62	67	61	69	63	60	55	Yes	Yes	-1.8	-2.1	-1.9	-1.9	No	No	No
323	29 BATHURST STREET PITT TOWN	R	F 1	S	67	61	69	63	68	62	70	64	60	55	Yes	Yes	-1.9	-2.1	-2	-2	No	No	No
323	29 BATHURST STREET PITT TOWN	R	GF	SW	66	60	68	62	67	61	69	63	60	55	Yes	Yes	-1.9	-2.1	-1.8	-1.9	No	No	No
323	29 BATHURST STREET PITT TOWN	R	F 1	SW	67	61	69	63	68	62	70	64	60	55	Yes	Yes	-1.9	-2.2	-2	-2	No	No	No
323	29 BATHURST STREET PITT TOWN	R	GF	SE	58	52	60	54	59	53	61	55	60	55	No	No	-2.1	-2.1	-2.1	-2.1	No	No	No
323	29 BATHURST STREET PITT TOWN	R	F 1	SE	59	54	61	56	60	55	62	57	60	55	Yes	No	-2	-2.1	-2	-2	No	No	No
323	29 BATHURST STREET PITT TOWN	R	F 1	NE	50	45	51	45	51	45	52	46	60	55	No	No	-0.6	-0.5	-0.7	-0.5	No	No	No
324	33 BATHURST STREET PITT TOWN	R	GF	NW	62	56	64	58	63	57	65	59	60	55	Yes	Yes	-2	-2.1	-2	-2	No	No	No
324	33 BATHURST STREET PITT TOWN	R	F 1	NW	63	57	65	59	64	58	66	60	60	55	Yes	Yes	-2	-2.1	-2	-2	No	No	No
324	33 BATHURST STREET PITT TOWN	R	GF	SW	66	60	68	62	67	61	69	63	60	55	Yes	Yes	-1.9	-2.1	-1.9	-1.9	No	No	No
324	33 BATHURST STREET PITT TOWN	R	F 1	SW	67	61	69	63	68	62	70	64	60	55	Yes	Yes	-2	-2.2	-2	-2.1	No	No	No
324	33 BATHURST STREET PITT TOWN	R	GF	SE	56	50	58	53	57	51	59	54	60	55	No	No	-2.2	-2.3	-2.2	-2.2	No	No	No
324	33 BATHURST STREET PITT TOWN	R	F 1	SE	58	52	60	54	59	53	61	55	60	55	No	No	-2.1	-2.3	-2.2	-2.1	No	No	No
324	33 BATHURST STREET PITT TOWN	R	F 1	NE	50	45	51	46	51	46	52	47	60	55	No	No	-1.2	-1.1	-1.1	-1.1	No	No	No
324	33 BATHURST STREET PITT TOWN	R	F 1	SE	50	45	52	46	51	46	52	47	60	55	No	No	-1.2	-1.1	-1.3	-1.1	No	No	No
324	33 BATHURST STREET PITT TOWN	R	F 1	NE	50	45	52	46	51	46	53	47	60	55	No	No	-1.3	-1.2	-1.4	-1.3	No	No	No
324	33 BATHURST STREET PITT TOWN	R	F 1	NW	51	46	53	47	52	46	54	48	60	55	No	No	-1.6	-1.6	-1.6	-1.6	No	No	No
324	33 BATHURST STREET PITT TOWN	R	F 1	NE	51	45	52	47	52	46	53	47	60	55	No	No	-1.4	-1.4	-1.5	-1.4	No	No	No
325	35 BATHURST STREET PITT TOWN	R	GF	NW	55	49	57	51	55	50	58	52	60	55	No	No	-2.2	-2.2	-2.2	-2.1	No	No	No
325	35 BATHURST STREET PITT TOWN	R	F 1	NW	56	51	59	53	57	52	59	54	60	55	No	No	-2.1	-2.2	-2.1	-2.1	No	No	No
325	35 BATHURST STREET PITT TOWN	R	GF	SW	63	58	65	60	64	59	66	61	60	55	Yes	Yes	-2.1	-2.2	-2	-2	No	No	No
325	35 BATHURST STREET PITT TOWN	R	F 1	SW	64	59	66	61	65	60	67	62	60	55	Yes	Yes	-2	-2.2	-2	-2	No	No	No
325	35 BATHURST STREET PITT TOWN	R	GF	SE	58	52	60	55	59	53	61	56	60	55	No	No	-2.1	-2.2	-2.1	-2.1	No	No	No
325	35 BATHURST STREET PITT TOWN	R	F 1	SE	59	54	61	56	60	55	62	57	60	55	Yes	No	-2.1	-2.2	-2.1	-2	No	No	No
325	35 BATHURST STREET PITT TOWN	R	F 1	NE	50	45	51	46	51	45	52	47	60	55	No	No	-1.2	-1.1	-1.3	-1.2	No	No	No
326	37 BATHURST STREET PITT TOWN	R	GF	NW	62	56	64	58	62	57	65	59	60	55	Yes	Yes	-2.1	-2.3	-2.1	-2.1	No	No	No
326	37 BATHURST STREET PITT TOWN	R	F 1	NW	63	57	65	59	64	58	66	60	60	55	Yes	Yes	-2	-2.2	-2.1	-2	No	No	No
326	37 BATHURST STREET PITT TOWN	R	GF	SW	66	60	68	62	67	61	69	63	60	55	Yes	Yes	-2	-2.3	-2.1	-2.1	No	No	No
326	37 BATHURST STREET PITT TOWN	R	F 1	SW	67	61	69	63	68	62	70	64	60	55	Yes	Yes	-2.1	-2.4	-2.1	-2.2	No	No	No
326	37 BATHURST STREET PITT TOWN	R	GF	SE	62	56	64	58	63	57	65	59	60	55	Yes	Yes	-2	-2.2	-2	-2	No	No	No
326	37 BATHURST STREET PITT TOWN	R	F 1	SE	63	57	65	59	64	58	66	60	60	55	Yes	Yes	-2	-2.2	-2.1	-2	No	No	No
326	37 BATHURST STREET PITT TOWN	R	F 1	NE	52	46	54	48	53	47	55	49	60	55	No	No	-1.8	-1.8	-1.9	-1.8	No	No	No
327	39 BATHURST STREET PITT TOWN	R	GF	NW	61	55	63	57	62	56	64	58	60	55	Yes	Yes	-2.3	-2.4	-2.2	-2.3	No	No	No
327	39 BATHURST STREET PITT TOWN	R	GF	NW	65	59	67	61	66	60	68	62	60	55	Yes	Yes	-2.1	-2.3	-2.1	-2.1	No	No	No
327	39 BATHURST STREET PITT TOWN	R	GF	SW	65	59	67	61	66	60	68	62	60	55	Yes	Yes	-2.1	-2.4	-2.2	-2.2	No	No	No
327	39 BATHURST STREET PITT TOWN	R	GF	SW	67	61	69	63	68	62	70	64	60	55	Yes	Yes	-2	-2.3	-2	-2.1	No	No	No
327	39 BATHURST STREET PITT TOWN	R	GF	SW	65	59	67	61	66	60	68	62	60	55	Yes	Yes	-2.1	-2.3	-2.2	-2.1	No	No	No
327	39 BATHURST STREET PITT TOWN	R	GF	SW	66	60	68	62	67	61	69	63	60	55	Yes	Yes	-2	-2.3	-2.1	-2.1	No	No	No
327	39 BATHURST STREET PITT TOWN	R	GF	SE	62	56	64	58	63	57	65	59	60	55	Yes	Yes	-2.1	-2.3	-2.1	-2.1	No	No	No
327	39 BATHURST STREET PITT TOWN	R	GF	NE	51	46	53	48	52	47	54	49	60	55	No	No	-1.9	-1.9	-1.9	-1.9	No	No	No
328	41 BATHURST STREET PITT TOWN	R	GF	NW	61	55	63	57	61	56	64	58	60	55	Yes	Yes	-2.1	-2.2	-2.1	-2	No	No	No
328	41 BATHURST STREET PITT TOWN	R	GF	SW	66	60	68	62	67	61	69	63	60	55	Yes	Yes	-2	-2.3	-2	-2.1	No	No	No

ID	Address	Class	Floor	Façade	2021 $L_{Aeq,\ period}$				2031 $L_{Aeq,\ period}$				NCG Criteria		Exceedance of NCG Criteria		Change in noise level				Equal to or above Cumulative Limit		Consider further additional noise mitigation
					Build		No Build		Build		No Build						2021		2031		2031		
					Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	
328	41 BATHURST STREET PITT TOWN	R	GF	SE	58	52	60	55	59	53	61	55	60	55	No	No	-2.2	-2.4	-2.3	-2.2	No	No	No
328	41 BATHURST STREET PITT TOWN	R	GF	NE	51	45	53	47	52	46	54	48	60	55	No	No	-1.8	-1.8	-1.9	-1.8	No	No	No
329	43 BATHURST STREET PITT TOWN	R	GF	NW	54	48	56	51	55	49	57	52	60	55	No	No	-2.1	-2.2	-2.2	-2.1	No	No	No
329	43 BATHURST STREET PITT TOWN	R	GF	SW	65	59	67	61	66	60	68	62	60	55	Yes	Yes	-2.1	-2.2	-2	-2.1	No	No	No
329	43 BATHURST STREET PITT TOWN	R	GF	SE	64	58	66	60	65	59	67	61	60	55	Yes	Yes	-2.2	-2.3	-2.1	-2.2	No	No	No
329	43 BATHURST STREET PITT TOWN	R	GF	SW	65	59	67	61	66	60	68	62	60	55	Yes	Yes	-2.1	-2.2	-2	-2	No	No	No
329	43 BATHURST STREET PITT TOWN	R	GF	SE	62	56	64	58	63	57	65	59	60	55	Yes	Yes	-2.2	-2.3	-2.1	-2.1	No	No	No
329	43 BATHURST STREET PITT TOWN	R	GF	NE	51	46	53	48	52	47	54	49	60	55	No	No	-1.8	-1.8	-1.8	-1.8	No	No	No
329	43 BATHURST STREET PITT TOWN	R	GF	SE	52	46	54	48	53	47	55	49	60	55	No	No	-1.8	-1.9	-1.8	-1.8	No	No	No
329	43 BATHURST STREET PITT TOWN	R	GF	NE	51	45	52	47	51	46	53	48	60	55	No	No	-1.7	-1.7	-1.7	-1.7	No	No	No
330	45 BATHURST STREET PITT TOWN	R	GF	NW	58	52	60	55	59	53	61	56	60	55	No	No	-2.3	-2.5	-2.4	-2.3	No	No	No
330	45 BATHURST STREET PITT TOWN	R	GF	SW	65	59	67	62	66	60	68	63	60	55	Yes	Yes	-2	-2.3	-2.1	-2.1	No	No	No
330	45 BATHURST STREET PITT TOWN	R	GF	SE	60	54	62	57	61	56	63	58	60	55	Yes	Yes	-2.2	-2.3	-2.2	-2.1	No	No	No
330	45 BATHURST STREET PITT TOWN	R	GF	NE	51	46	53	48	52	47	54	48	60	55	No	No	-1.9	-1.9	-2	-1.9	No	No	No
331	47 BATHURST STREET PITT TOWN	R	GF	NW	58	53	61	55	59	54	62	56	60	55	No	No	-2.2	-2.4	-2.3	-2.2	No	No	No
331	47 BATHURST STREET PITT TOWN	R	GF	SW	66	60	68	62	67	61	69	63	60	55	Yes	Yes	-2	-2.3	-2.1	-2.1	No	No	No
331	47 BATHURST STREET PITT TOWN	R	GF	SE	61	55	63	58	62	56	64	59	60	55	Yes	Yes	-2.2	-2.4	-2.3	-2.2	No	No	No
331	47 BATHURST STREET PITT TOWN	R	GF	NE	52	46	54	48	52	47	54	49	60	55	No	No	-1.9	-1.9	-2	-1.8	No	No	No
331	47 BATHURST STREET PITT TOWN	R	GF	SE	52	47	54	49	53	48	55	50	60	55	No	No	-2	-2	-2	-1.9	No	No	No
331	47 BATHURST STREET PITT TOWN	R	GF	NE	51	46	53	47	52	46	54	48	60	55	No	No	-1.9	-1.9	-2	-1.9	No	No	No
332	22 BATHURST STREET PITT TOWN	R	GF	NW	63	57	65	59	64	58	66	60	60	55	Yes	Yes	-2	-2.2	-2	-2.1	No	No	No
332	22 BATHURST STREET PITT TOWN	R	GF	SW	55	50	57	52	56	51	58	53	60	55	No	No	-2	-2.1	-2.1	-2	No	No	No
332	22 BATHURST STREET PITT TOWN	R	GF	SE	64	58	66	60	65	59	67	61	60	55	Yes	Yes	-1.7	-1.8	-2	-2	No	No	No
332	22 BATHURST STREET PITT TOWN	R	GF	NE	68	62	70	64	69	63	71	65	60	55	Yes	Yes	-1.6	-2	-1.6	-1.8	No	No	No
333	22 BATHURST STREET PITT TOWN	R	GF	NW	53	47	54	49	54	48	55	50	60	55	No	No	-1.9	-2	-1.8	-1.8	No	No	No
333	22 BATHURST STREET PITT TOWN	R	F 1	NW	54	49	56	51	55	50	57	52	60	55	No	No	-1.8	-1.8	-1.8	-1.7	No	No	No
333	22 BATHURST STREET PITT TOWN	R	F 1	SW	50	44	50	45	50	45	51	46	60	55	No	No	-0.7	-0.6	-0.8	-0.7	No	No	No
333	22 BATHURST STREET PITT TOWN	R	GF	SE	56	51	57	52	56	51	58	53	60	55	No	No	-0.8	-0.8	-1.7	-1.5	No	No	No
333	22 BATHURST STREET PITT TOWN	R	F 1	SE	58	52	59	53	58	52	59	54	60	55	No	No	-0.9	-0.8	-1.7	-1.5	No	No	No
333	22 BATHURST STREET PITT TOWN	R	GF	NE	58	53	59	54	58	53	60	55	60	55	No	No	-1.5	-1.4	-1.9	-1.7	No	No	No
333	22 BATHURST STREET PITT TOWN	R	F 1	NE	59	54	61	55	60	55	62	56	60	55	No	No	-1.4	-1.5	-1.8	-1.7	No	No	No
334	26 BATHURST STREET PITT TOWN	R	GF	NW	61	56	63	58	62	57	64	59	60	55	Yes	Yes	-2.2	-2.3	-2.2	-2.1	No	No	No
334	26 BATHURST STREET PITT TOWN	R	F 1	NW	62	57	65	59	63	58	66	60	60	55	Yes	Yes	-2.2	-2.3	-2.2	-2.1	No	No	No
334	26 BATHURST STREET PITT TOWN	R	F 1	SW	50	45	52	46	51	46	53	47	60	55	No	No	-1.4	-1.4	-1.5	-1.4	No	No	No
334	26 BATHURST STREET PITT TOWN	R	GF	SE	58	52	60	54	59	53	61	55	60	55	No	No	-1.8	-1.9	-2	-1.9	No	No	No
334	26 BATHURST STREET PITT TOWN	R	F 1	SE	60	54	61	56	60	55	62	57	60	55	Yes	No	-1.8	-1.8	-2	-1.9	No	No	No
334	26 BATHURST STREET PITT TOWN	R	GF	NE	62	56	64	59	63	57	65	59	60	55	Yes	Yes	-2.1	-2.2	-2	-2.1	No	No	No
334	26 BATHURST STREET PITT TOWN	R	F 1	NE	63	58	65	60	64	59	66	61	60	55	Yes	Yes	-2	-2.1	-2.1	-2	No	No	No
334	26 BATHURST STREET PITT TOWN	R	GF	SE	62	56	64	59	63	57	65	59	60	55	Yes	Yes	-2.1	-2.2	-2.1	-2.1	No	No	No
334	26 BATHURST STREET PITT TOWN	R	F 1	SE	63	58	65	60	64	59	66	61	60	55	Yes	Yes	-2	-2.1	-2	-2	No	No	No
334	26 BATHURST STREET PITT TOWN	R	GF	NE	64	58	66	61	65	59	67	61	60	55	Yes	Yes	-2.1	-2.2	-2.1	-2	No	No	No
334	26 BATHURST STREET PITT TOWN	R	F 1	NE	65	60	67	62	66	61	68	63	60	55	Yes	Yes	-2	-2.2	-2.1	-2	No	No	No
334	26 BATHURST STREET PITT TOWN	R	GF	NW	63	58	66	60	64	59	67	61	60	55	Yes	Yes	-2.2	-2.3	-2.2	-2.2	No	No	No
334	26 BATHURST STREET PITT TOWN	R	F 1	NW	65	59	67	61	66	60	68	62	60	55	Yes	Yes	-2.2	-2.3	-2.1	-2.1	No	No	No
334	26 BATHURST STREET PITT TOWN	R	GF	NE	64	58	66	60	65	59	67	61	60	55	Yes	Yes	-2.1	-2.3	-2.1	-2	No	No	No
334	26 BATHURST STREET PITT TOWN	R	F 1	NE	65	59	67	62	66	61	68	63	60	55	Yes	Yes	-2	-2.2	-2	-2	No	No	No
335	28 BATHURST STREET PITT TOWN	R	GF	NW	61	55	63	58	62	56	64	59	60	55	Yes	Yes	-2.3	-2.4	-2.3	-2.2	No	No	No
335	28 BATHURST STREET PITT TOWN	R	GF	NW	61	55	63	58	62	56	64	59	60	55	Yes	Yes	-2.3	-2.4	-2.3	-2.2	No	No	No
335	28 BATHURST STREET PITT TOWN	R	F 1	NW	62	56	64	59	63	58	65	60	60	55	Yes	Yes	-2.2	-2.4	-2.3	-2.2	No	No	No
335	28 BATHURST STREET PITT TOWN	R	F 1	SW	50	45	52	46	51	46	53	47	60	55	No	No	-1.6	-1.5	-1.7	-1.5	No	No	No
335	28 BATHURST STREET PITT TOWN	R	GF	SE	60	54	62	56	60	55	62	57	60	55	Yes	No	-2	-2.1	-2	-2	No	No	No
335	28 BATHURST STREET PITT TOWN	R	F 1	SE	61	55	63	57	62	56	64	58	60	55	Yes	Yes	-1.9	-2	-2	-1.9	No	No	No
335	28 BATHURST STREET PITT TOWN	R	GF	NE	65	59	67	61	66	60	68	62	60	55	Yes	Yes	-2.1	-2.3	-2.1	-2.1	No	No	No
335	28 BATHURST STREET PITT TOWN	R	F 1	NE	66	60	68	62	67	61	69	63	60	55	Yes	Yes	-2.1	-2.3	-2.1	-2	No	No	No
336	38 BATHURST STREET PITT TOWN	R	GF	NW	60	55	63	57	61	56	64	58	60	55	Yes	Yes	-2.3	-2.4	-2.3	-2.2	No	No	No
336	38 BATHURST STREET PITT TOWN	R	F 1	NW	62	56	64	59	63	57	65	60	60	55	Yes	Yes	-2.2	-2.4	-2.2	-2.2	No	No	No
336	38 BATHURST STREET PITT TOWN	R	F 1	SW	50	44	51	46	51	45	52	47	60	55	No	No	-1.6	-1.6	-1.6	-1.6	No	No	No
336	38 BATHURST STREET PITT TOWN	R	GF	SE	58	52	60	54	59	53	61	55	60	55	No	No	-2.1	-2.2	-2.1	-2.1	No	No	No
336	38 BATHURST STREET PITT TOWN	R	F 1	SE	59	53	61	56	60	54	62	56	60	55	No	No	-2	-2.1	-2	-2	No	No	No
336	38 BATHURST STREET PITT TOWN	R	GF	NE	66	60	68	62	67	61	69	63	60	55	Yes	Yes	-2	-2.3	-2.1	-2.1	No	No	No
336	38 BATHURST STREET PITT TOWN	R	F 1	NE	67	61	69	63	67	62	70	64	60	55	Yes	Yes	-2.1	-2.4	-2.2	-2.2	No	No	No
337	40 BATHURST STREET PITT TOWN	R	GF	NW	54	48	56	50	54	49	57	51	60	55	No	No	-2.1	-2.2	-2.1	-2.1	No	No	No
337	40 BATHURST STREET PITT TOWN	R	GF	SW	49	43	50	45	50	44	51	46	60	55	No	No	-1.6	-1.5	-1.7	-1.5	No	No	No
337	40 BATHURST STREET PITT TOWN	R	GF	SE	54	49	56	51	55	50	57	52	60	55	No	No	-2.1	-2.1	-2.1	-2	No	No	No
337	40 BATHURST STREET PITT TOWN	R	GF	NE	56	50	58	52	57	51	59	53	60	55	No	No	-2.1	-2.2	-2.1	-2.1	No	No	No
337	40 BATHURST STREET PITT TOWN	R	GF	SE	58	52	60	55	59	53	61	55	60	55	No	No	-2.2	-2.3	-2.2	-2.1	No	No	No
337	40 BATHURST STREET PITT TOWN	R	GF	NE	66	60	68	62	67	61	69	63	60	55	Yes	Yes	-2.1	-2.2	-2.1	-2.1	No	No	No
338	42 BATHURST STREET PITT TOWN	R	GF	NW	61	55	63	57	62	56	64	58	60	55	Yes	Yes	-2.3	-2.4	-2.3	-2.3	No	No	No
338	42 BATHURST STREET PITT TOWN	R	F 1	NW	63	57	65	60	64	58	66	60	60	55	Yes	Yes	-2.2	-2.4	-2.3	-2.2	No	No	No
338	42 BATHURST STREET PITT TOWN	R	F 1	SW	51	45	52	47	52	46	53	48	60	55	No	No	-1.8	-1.9	-1.8	-1.8	No	No	No
338	42 BATHURST STREET PITT TOWN	R	GF	SE	55	50	58	52	56	51	59	53	60	55	No	No	-2.3	-2.4	-2.2	-2.2	No	No	No
338	42 BATHURST STREET PITT TOWN	R	F 1	SE	60	55	63	57	61	56	64	58	60	55	Yes	Yes	-2.1	-2.3	-2.2	-2.1	No	No	No
338	42 BATHURST STREET PITT TOWN	R	GF	NE	66	60	68	62	67	61	69	63	60	55	Yes	Yes	-2	-2.4	-2.1	-2.1	No	No	No
338	42 BATHURST STREET PITT TOWN	R	F 1	NE	67	61	69	63	68	62	70	64	60	55	Yes	Yes	-2.2	-2.5	-2.2	-2.2	No	No	No
339	44 BATHURST STREET PITT TOWN	R	GF	NW	59	53	61	56	60	55	62	57	60	55	No	No	-2.3	-2.4	-2.3	-2.2	No	No	No
339	44 BATHURST STREET PITT TOWN	R	GF	SW	49	44	51	46	50	45	52	47	60	55	No	No	-1.8	-1.9	-1.9	-1.8	No	No	No
339	44 BATHURST STREET PITT TOWN	R	GF	SE	58	52	60	54	59	53	61	55	60	55	No	No	-2.2	-2.4	-2.2	-2.2	No	No	No
339	44 BATHURST STREET PITT TOWN	R	GF	NE	66	60	68	62	67	61	69	63	60	55	Yes	Yes	-2.1	-2.3	-2.1	-2.1	No	No	No
340	46 BATHURST STREET PITT TOWN	R	GF	NW	63	57	65	59	64	58	66	60	60	55	Yes	Yes	-2.1	-2.3	-2.1	-2.2	No	No	No
340	46 BATHURST STREET PITT TOWN	R	GF	NW	53	48	56	50	54	49	57	51	60	55	No	No	-2.2	-2.2	-2.2	-2.1	No	No	No
340	46 BATHURST STREET PITT TOWN	R	GF	SW	49	44	51	45	50	45	52	46	60	55	No	No	-1.7	-1.7	-1.8	-1.6	No	No	No

ID	Address	Class	Floor	Façade	2021 $L_{Aeq,\ period}$				2031 $L_{Aeq,\ period}$				NCG Criteria		Exceedance of NCG Criteria		Change in noise level				Equal to or above Cumulative Limit		Consider further additional noise mitigation
					Build		No Build		Build		No Build						2021		2031		2031		
					Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	
340	46 BATHURST STREET PITT TOWN	R	GF	SE	59	53	61	55	60	54	62	56	60	55	No	No	-2.3	-2.3	-2.2	-2.1	No	No	No
340	46 BATHURST STREET PITT TOWN	R	GF	SE	62	57	65	59	63	58	66	60	60	55	Yes	Yes	-2.1	-2.3	-2.1	-2.1	No	No	No
340	46 BATHURST STREET PITT TOWN	R	GF	SE	64	58	66	60	65	59	67	61	60	55	Yes	Yes	-2	-2.3	-2.1	-2.1	No	No	No
340	46 BATHURST STREET PITT TOWN	R	GF	NE	68	62	69	64	69	63	70	65	60	55	Yes	Yes	-1.5	-1.9	-1.6	-1.7	No	No	No
341	48 BATHURST STREET PITT TOWN	R	GF	NW	58	52	60	55	59	53	61	55	60	55	No	No	-2.2	-2.3	-2.2	-2.2	No	No	No
341	48 BATHURST STREET PITT TOWN	R	F 1	NW	60	54	62	57	61	55	63	58	60	55	Yes	Yes	-2.1	-2.2	-2.1	-2.1	No	No	No
341	48 BATHURST STREET PITT TOWN	R	F 1	SW	49	44	51	46	50	45	52	47	60	55	No	No	-1.9	-1.9	-2	-1.9	No	No	No
341	48 BATHURST STREET PITT TOWN	R	F 1	NW	51	45	53	47	51	46	54	48	60	55	No	No	-2.1	-2.2	-2.1	-2.1	No	No	No
341	48 BATHURST STREET PITT TOWN	R	F 1	SW	49	44	51	45	50	45	52	46	60	55	No	No	-1.4	-1.4	-1.6	-1.4	No	No	No
341	48 BATHURST STREET PITT TOWN	R	GF	SE	54	48	56	50	55	49	57	51	60	55	No	No	-2.1	-2.1	-2.1	-2	No	No	No
341	48 BATHURST STREET PITT TOWN	R	F 1	SE	58	53	60	55	59	54	61	56	60	55	No	No	-2	-2.1	-2	-1.9	No	No	No
341	48 BATHURST STREET PITT TOWN	R	GF	NE	65	59	67	61	66	60	68	62	60	55	Yes	Yes	-2.1	-2.3	-2	-2	No	No	No
341	48 BATHURST STREET PITT TOWN	R	F 1	NE	66	60	68	62	67	61	69	63	60	55	Yes	Yes	-2	-2.2	-2.1	-2.1	No	No	No
342	50 BATHURST STREET PITT TOWN	R	GF	NW	56	50	58	53	57	51	59	54	60	55	No	No	-2.3	-2.4	-2.3	-2.3	No	No	No
342	50 BATHURST STREET PITT TOWN	R	GF	SW	49	43	51	45	50	44	52	46	60	55	No	No	-2	-2	-2	-1.9	No	No	No
342	50 BATHURST STREET PITT TOWN	R	GF	SE	60	55	63	57	61	56	64	58	60	55	Yes	Yes	-2.2	-2.3	-2.1	-2.1	No	No	No
342	50 BATHURST STREET PITT TOWN	R	GF	NE	66	60	67	62	66	61	68	63	60	55	Yes	Yes	-1.9	-2.2	-2	-1.9	No	No	No
343	52 BATHURST STREET PITT TOWN	R	GF	NW	56	51	59	53	57	52	59	54	60	55	No	No	-2.3	-2.3	-2.2	-2.2	No	No	No
343	52 BATHURST STREET PITT TOWN	R	F 1	NW	60	54	62	57	61	55	63	57	60	55	Yes	Yes	-2.1	-2.2	-2.2	-2.1	No	No	No
343	52 BATHURST STREET PITT TOWN	R	F 1	SW	49	44	51	45	50	45	52	46	60	55	No	No	-1.5	-1.4	-1.6	-1.4	No	No	No
343	52 BATHURST STREET PITT TOWN	R	F 1	SE	52	46	53	48	53	47	54	49	60	55	No	No	-1.6	-1.7	-1.7	-1.6	No	No	No
343	52 BATHURST STREET PITT TOWN	R	F 1	SW	50	44	51	46	51	45	52	47	60	55	No	No	-1.6	-1.7	-1.7	-1.6	No	No	No
343	52 BATHURST STREET PITT TOWN	R	GF	SE	57	51	59	53	58	52	60	54	60	55	No	No	-2.3	-2.4	-2.2	-2.2	No	No	No
343	52 BATHURST STREET PITT TOWN	R	F 1	SE	62	56	64	58	63	57	65	59	60	55	Yes	Yes	-2.1	-2.2	-2.2	-2.2	No	No	No
343	52 BATHURST STREET PITT TOWN	R	GF	NE	65	59	67	62	66	61	68	63	60	55	Yes	Yes	-2	-2.2	-2	-2	No	No	No
343	52 BATHURST STREET PITT TOWN	R	F 1	NE	66	60	68	63	67	61	69	64	60	55	Yes	Yes	-2	-2.3	-2.1	-2.1	No	No	No
344	54 BATHURST STREET PITT TOWN	R	GF	NW	56	50	58	53	57	51	59	54	60	55	No	No	-2.3	-2.3	-2.2	-2.2	No	No	No
344	54 BATHURST STREET PITT TOWN	R	GF	SW	50	44	52	46	50	45	52	47	60	55	No	No	-2	-2	-2	-1.9	No	No	No
344	54 BATHURST STREET PITT TOWN	R	GF	SE	57	52	60	54	58	53	61	55	60	55	No	No	-2.3	-2.3	-2.2	-2.3	No	No	No
344	54 BATHURST STREET PITT TOWN	R	GF	NE	64	58	66	61	65	60	67	62	60	55	Yes	Yes	-2	-2.2	-2	-2	No	No	No
344	54 BATHURST STREET PITT TOWN	R	GF	SE	64	58	66	60	65	59	67	61	60	55	Yes	Yes	-2	-2.2	-2	-2	No	No	No
344	54 BATHURST STREET PITT TOWN	R	GF	NE	66	60	67	62	67	61	68	63	60	55	Yes	Yes	-1.9	-2.2	-1.9	-1.9	No	No	No
345	56 BATHURST STREET PITT TOWN	R	GF	NW	53	47	55	49	54	48	56	50	60	55	No	No	-2.1	-2.2	-2.1	-2	No	No	No
345	56 BATHURST STREET PITT TOWN	R	GF	SW	50	44	52	46	51	45	53	47	60	55	No	No	-2	-2	-2	-1.9	No	No	No
345	56 BATHURST STREET PITT TOWN	R	GF	NW	51	45	53	47	51	46	53	48	60	55	No	No	-2	-2.1	-2	-2	No	No	No
345	56 BATHURST STREET PITT TOWN	R	GF	SW	49	44	51	46	50	45	52	47	60	55	No	No	-1.8	-1.9	-1.9	-1.8	No	No	No
345	56 BATHURST STREET PITT TOWN	R	GF	SE	54	49	57	51	55	50	57	52	60	55	No	No	-2.2	-2.2	-2.2	-2.1	No	No	No
345	56 BATHURST STREET PITT TOWN	R	GF	NE	66	60	67	62	67	61	68	63	60	55	Yes	Yes	-1.8	-2.1	-1.9	-1.9	No	No	No
345	56 BATHURST STREET PITT TOWN	R	GF	NW	62	56	64	59	63	58	65	60	60	55	Yes	Yes	-2.1	-2.3	-2.1	-2	No	No	No
345	56 BATHURST STREET PITT TOWN	R	GF	NE	61	56	64	58	62	57	65	59	60	55	Yes	Yes	-2.2	-2.3	-2.1	-2.1	No	No	No
346	58 BATHURST STREET PITT TOWN	R	GF	NW	58	53	60	55	59	54	61	56	60	55	No	No	-2	-2.1	-2	-2	No	No	No
346	58 BATHURST STREET PITT TOWN	R	GF	SW	49	44	51	45	50	45	52	46	60	55	No	No	-1.8	-1.9	-1.8	-1.8	No	No	No
346	58 BATHURST STREET PITT TOWN	R	GF	SE	51	45	53	48	52	46	54	49	60	55	No	No	-2	-2.2	-2.1	-2.1	No	No	No
346	58 BATHURST STREET PITT TOWN	R	GF	NE	66	60	68	62	67	61	69	63	60	55	Yes	Yes	-1.8	-2	-1.8	-1.8	No	No	No
346	58 BATHURST STREET PITT TOWN	R	GF	NE	64	58	66	60	65	59	67	61	60	55	Yes	Yes	-2	-2.1	-1.9	-2	No	No	No
346	58 BATHURST STREET PITT TOWN	R	GF	NE	65	59	67	61	66	60	68	62	60	55	Yes	Yes	-1.8	-2.1	-1.9	-1.9	No	No	No
346	58 BATHURST STREET PITT TOWN	R	GF	NE	64	58	66	60	65	59	67	61	60	55	Yes	Yes	-2	-2.1	-2	-2	No	No	No
346	58 BATHURST STREET PITT TOWN	R	GF	NE	65	59	67	61	66	60	68	62	60	55	Yes	Yes	-1.9	-2.1	-2	-2	No	No	No
346	58 BATHURST STREET PITT TOWN	R	GF	NE	64	58	66	60	65	59	67	61	60	55	Yes	Yes	-2	-2.1	-2	-2	No	No	No
346	58 BATHURST STREET PITT TOWN	R	GF	NE	65	59	67	61	66	60	67	62	60	55	Yes	Yes	-1.9	-2.1	-1.9	-1.9	No	No	No
346	58 BATHURST STREET PITT TOWN	R	GF	NE	65	59	67	61	66	60	68	62	60	55	Yes	Yes	-1.8	-2.1	-1.9	-2	No	No	No
346	58 BATHURST STREET PITT TOWN	R	GF	NE	64	58	66	60	65	59	67	61	60	55	Yes	Yes	-2	-2.1	-2	-2	No	No	No
346	58 BATHURST STREET PITT TOWN	R	GF	NE	64	58	66	60	65	59	67	61	60	55	Yes	Yes	-2	-2.1	-2	-2	No	No	No
346	58 BATHURST STREET PITT TOWN	R	GF	NE	65	59	67	61	66	60	67	62	60	55	Yes	Yes	-1.9	-2.1	-1.9	-1.9	No	No	No
346	58 BATHURST STREET PITT TOWN	R	GF	NE	65	59	67	61	66	60	67	62	60	55	Yes	Yes	-1.9	-2.1	-1.9	-1.9	No	No	No
346	58 BATHURST STREET PITT TOWN	R	GF	NE	65	59	67	61	66	60	67	62	60	55	Yes	Yes	-2	-2.1	-1.9	-2	No	No	No
346	58 BATHURST STREET PITT TOWN	R	GF	NE	64	58	66	60	65	59	67	61	60	55	Yes	Yes	-2	-2.1	-2	-2	No	No	No
346	58 BATHURST STREET PITT TOWN	R	GF	NE	64	58	66	60	65	59	67	61	60	55	Yes	Yes	-2	-2.1	-1.9	-2	No	No	No
347	60 BATHURST STREET PITT TOWN	R	GF	NW	60	54	62	56	60	55	63	57	60	55	Yes	No	-2.1	-2.2	-2.1	-2	No	No	No
347	60 BATHURST STREET PITT TOWN	R	GF	SW	49	44	51	45	50	45	52	46	60	55	No	No	-1.9	-1.8	-1.9	-1.8	No	No	No
347	60 BATHURST STREET PITT TOWN	R	GF	SE	58	52	60	54	59	53	61	55	60	55	No	No	-2	-2.1	-2	-2	No	No	No
347	60 BATHURST STREET PITT TOWN	R	GF	NE	61	55	63	57	62	56	64	58	60	55	Yes	Yes	-2.1	-2.1	-2.1	-2	No	No	No
347	60 BATHURST STREET PITT TOWN	R	GF	SE	62	56	64	58	62	57	64	59	60	55	Yes	Yes	-2	-2.1	-2	-2	No	No	No
347	60 BATHURST STREET PITT TOWN	R	GF	NE	64	59	66	61	65	60	67	62	60	55	Yes	Yes	-1.9	-2.1	-2	-2	No	No	No
347	60 BATHURST STREET PITT TOWN	R	GF	NE	64	58	66	60	65	59	67	61	60	55	Yes	Yes	-2	-2.2	-2	-2	No	No	No
347	60 BATHURST STREET PITT TOWN	R	GF	NE	65	59	67	62	66	61	68	63	60	55	Yes	Yes	-1.8	-2.1	-1.9	-1.9	No	No	No
348	49 BATHURST STREET PITT TOWN	R	GF	W	65	59	67	61	66	60	68	62	60	55	Yes	Yes	-2.1	-2.3	-2.1	-2.2	No	No	No
348	49 BATHURST STREET PITT TOWN	R	GF	S	60	54	62	56	61	55	63	57	60	55	Yes	No	-2.3	-2.3	-2.2	-2.3	No	No	No
348	49 BATHURST STREET PITT TOWN	R	GF	E	51	45	53	47	52	46	54	48	60	55	No	No	-1.9	-1.9	-2.1	-1.9	No	No	No
348	49 BATHURST STREET PITT TOWN	R	GF	N	54	49	57	51	55	50	57	52	60	55	No	No	-2.1	-2.2	-2.1	-2.1	No	No	No
349	53 BATHURST STREET PITT TOWN	R	GF	W	62	57	65	59	63	58	65	60	60	55	Yes	Yes	-2.1	-2.3	-2.1	-2.1	No	No	No
349	53 BATHURST STREET PITT TOWN	R	GF	W	63	57	65	59	64	58	66	60	60	55	Yes	Yes	-2.1	-2.3	-2.1	-2.1	No	No	No
349	53 BATHURST STREET PITT TOWN	R	GF	W	64	58	66	60	65	59	67	61	60	55	Yes	Yes	-2.1	-2.3	-2.1	-2.1	No	No	No
349	53 BATHURST STREET PITT TOWN	R	GF	S	58	52	60	54	59	53	61	55	60	55	No	No	-2.2	-2.3	-2.2	-2.2	No	No	No
349	53 BATHURST STREET PITT TOWN	R	GF	E	51	45	52	47	51	46	53	48	60	55	No	No	-1.9	-1.9	-2	-1.9	No	No	No
349	53 BATHURST STREET PITT TOWN	R	GF	S	51	45	53	47	52	46	54	48	60	55	No	No	-1.9	-1.9	-1.9	-1.8	No	No	No
349	53 BATHURST STREET PITT TOWN	R	GF	NE	50	45	52	47	51	46	53	48	60	55	No	No	-2	-2	-2.3	-2.2	No	No	No
349	53 BATHURST STREET PITT TOWN	R	GF	N	52	47	55	49	53	48	55	50	60	55	No	No	-2.3	-2.3	-2.4	-2.4	No	No	No
350	55 BATHURST STREET PITT TOWN	R	GF	N	52	46	54	48	52	47	55	49	60	55	No	No	-2.1	-2.1	-2.1	-2	No	No	No
350	55 BATHURST STREET PITT TOWN	R	GF	W	65	59	67	61	66	60	68	62	60	55	Yes	Yes	-2	-2.2	-2	-2	No	No	No
350	55 BATHURST STREET PITT TOWN	R	GF	SW	65	59	67	61	66	60	68	62	60	55	Yes	Yes	-2	-2.2	-2	-1.9	No	No	No
350	55 BATHURST STREET PITT TOWN	R	GF	SW	65	59	67	62	66	60	68	62	60	55	Yes	Yes	-2	-2.2	-2	-2	No	No	No
350	55 BATHURST STREET PITT TOWN	R	GF	S	63	58	65	60	64	59	66	61	60	55	Yes	Yes	-2.1	-2.3	-2.2	-2.1	No	No	No
350	55 BATHURST STREET PITT TOWN	R	GF	W	64	58	66	60	65	59	67	61	60	55	Yes	Yes	-2.1	-2.3	-2.1	-2	No	No	No
350	55 BATHURST STREET PITT TOWN	R	GF	S	61	56	63	58	62	57	64	59	60	55	Yes	Yes	-2.1	-2.2	-2.1	-2.1	No	No	No
350	55 BATHURST STREET PITT TOWN	R	GF	NE	51	45	53	47	51	46	54	48	60	55	No	No	-2	-2.1	-2.3	-2.2	No	No	No
350	55 BATHURST STREET PITT TOWN	R	GF	NE	50	44	52	46	51	45	53	47	60	55	No	No	-2.1	-2	-2.2	-2.1	No	No	No
350	55 BATHURST STREET PITT TOWN	R	GF	NE	50	45	52	47	51	46	53	48	60	55	No	No	-2	-2.1	-2.3	-2.2	No	No	No
351	57 BATHURST STREET PITT TOWN	R	GF	NW	53	47	55	50	54	48	56	50	60	55	No	No	-2.2	-2.3	-2.4	-2.3	No	No	No
351	57 BATHURST STREET PITT TOWN	R	F 1	NW	57	51	59	54	57	52	60	54	60	55	No	No	-2.3	-2.4	-2.5	-2.4	No	No	No

ID	Address	Class	Floor	Façade	2021 $L_{Aeq,\ period}$				2031 $L_{Aeq,\ period}$				NCG Criteria		Exceedance of NCG Criteria		Change in noise level				Equal to or above Cumulative Limit		Consider further additional noise mitigation
					Build		No Build		Build		No Build						2021		2031		2031		
					Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	
351	57 BATHURST STREET PITT TOWN	R	GF	W	62	56	64	58	63	57	65	59	60	55	Yes	Yes	-2.1	-2.2	-2.2	-2.1	No	No	No
351	57 BATHURST STREET PITT TOWN	R	F 1	W	64	58	66	60	65	59	67	61	60	55	Yes	Yes	-2.1	-2.2	-2.1	-2	No	No	No
351	57 BATHURST STREET PITT TOWN	R	GF	SE	53	47	55	49	54	48	56	50	60	55	No	No	-2.1	-2.2	-2.1	-2.1	No	No	No
351	57 BATHURST STREET PITT TOWN	R	F 1	SE	61	56	64	58	62	57	64	59	60	55	Yes	Yes	-2.2	-2.2	-2.1	-2.1	No	No	No
351	57 BATHURST STREET PITT TOWN	R	GF	NE	48	43	50	44	49	43	51	45	60	55	No	No	-1.6	-1.7	-1.9	-1.9	No	No	No
351	57 BATHURST STREET PITT TOWN	R	F 1	NE	53	48	55	50	54	49	56	51	60	55	No	No	-1.9	-1.9	-2	-2	No	No	No
352	59 BATHURST STREET PITT TOWN	R	GF	NW	55	50	58	52	56	51	58	53	60	55	No	No	-2.3	-2.3	-2.4	-2.4	No	No	No
352	59 BATHURST STREET PITT TOWN	R	GF	SW	65	59	67	61	66	60	68	62	60	55	Yes	Yes	-2	-2.2	-2	-2	No	No	No
352	59 BATHURST STREET PITT TOWN	R	GF	SE	60	55	63	57	61	56	63	58	60	55	Yes	Yes	-2.1	-2.2	-2.1	-2.1	No	No	No
352	59 BATHURST STREET PITT TOWN	R	GF	NE	50	44	52	47	51	45	53	48	60	55	No	No	-2.1	-2.2	-2.5	-2.5	No	No	No
353	61 BATHURST STREET PITT TOWN	R	GF	NW	56	51	58	53	57	51	60	54	60	55	No	No	-2.5	-2.5	-2.7	-2.6	No	No	No
353	61 BATHURST STREET PITT TOWN	R	GF	SW	62	56	64	59	63	57	65	60	60	55	Yes	Yes	-2.2	-2.2	-2.1	-2.2	No	No	No
353	61 BATHURST STREET PITT TOWN	R	GF	SW	61	55	63	58	62	56	64	58	60	55	Yes	Yes	-2.2	-2.3	-2.2	-2.1	No	No	No
353	61 BATHURST STREET PITT TOWN	R	GF	SW	61	55	63	57	62	56	64	58	60	55	Yes	Yes	-2.1	-2.2	-2.1	-2.1	No	No	No
353	61 BATHURST STREET PITT TOWN	R	GF	NW	61	55	63	57	62	56	64	58	60	55	Yes	Yes	-2.1	-2.3	-2.2	-2.1	No	No	No
353	61 BATHURST STREET PITT TOWN	R	GF	SW	65	59	67	62	66	60	68	63	60	55	Yes	Yes	-2	-2.3	-2.1	-2.1	No	No	No
353	61 BATHURST STREET PITT TOWN	R	GF	SE	60	55	63	57	61	56	64	58	60	55	Yes	Yes	-2.1	-2.3	-2.2	-2.1	No	No	No
353	61 BATHURST STREET PITT TOWN	R	GF	NE	51	45	53	48	51	46	54	48	60	55	No	No	-2.2	-2.3	-2.5	-2.4	No	No	No
353	61 BATHURST STREET PITT TOWN	R	GF	SE	50	45	53	47	51	46	54	48	60	55	No	No	-2.1	-2.2	-2.3	-2.2	No	No	No
353	61 BATHURST STREET PITT TOWN	R	GF	NE	52	46	54	49	52	47	56	50	60	55	No	No	-2.8	-2.9	-3.3	-3.2	No	No	No
354	63 BATHURST STREET PITT TOWN	R	GF	NW	58	52	61	55	59	53	62	56	60	55	No	No	-2.5	-2.6	-2.7	-2.6	No	No	No
354	63 BATHURST STREET PITT TOWN	R	GF	SW	65	59	67	62	66	60	68	63	60	55	Yes	Yes	-2	-2.3	-2.1	-2.1	No	No	No
354	63 BATHURST STREET PITT TOWN	R	GF	SE	62	56	64	59	63	57	65	60	60	55	Yes	Yes	-2.1	-2.3	-2.2	-2.1	No	No	No
354	63 BATHURST STREET PITT TOWN	R	GF	NE	56	51	58	53	57	52	59	53	60	55	No	No	-1.9	-2	-2	-1.9	No	No	No
354	63 BATHURST STREET PITT TOWN	R	GF	SE	58	52	60	54	58	53	60	55	60	55	No	No	-2	-2.1	-2.1	-2.1	No	No	No
354	63 BATHURST STREET PITT TOWN	R	GF	NE	54	48	57	51	54	49	58	52	60	55	No	No	-3.1	-3.2	-3.8	-3.6	No	No	No
355	65 BATHURST STREET PITT TOWN	R	GF	NW	61	55	64	58	62	56	66	60	60	55	Yes	Yes	-3.4	-3.7	-3.9	-4	No	No	No
355	65 BATHURST STREET PITT TOWN	R	GF	SW	67	60	68	63	67	62	70	64	60	55	Yes	Yes	-1.9	-2.3	-2.1	-2.2	No	No	No
355	65 BATHURST STREET PITT TOWN	R	GF	SE	61	55	63	58	62	56	64	59	60	55	Yes	Yes	-2.1	-2.3	-2.2	-2.2	No	No	No
355	65 BATHURST STREET PITT TOWN	R	GF	NE	56	50	59	53	56	51	60	55	60	55	No	No	-3.2	-3.3	-3.9	-3.8	No	No	No
356	72 BATHURST STREET PITT TOWN	R	GF	NW	52	46	55	50	53	47	57	51	60	55	No	No	-3.2	-3.5	-3.9	-3.9	No	No	No
356	72 BATHURST STREET PITT TOWN	R	GF	S	49	44	51	46	50	45	52	47	60	55	No	No	-2	-2	-2.2	-2.1	No	No	No
356	72 BATHURST STREET PITT TOWN	R	GF	SW	49	43	51	45	50	44	52	46	60	55	No	No	-2	-2.1	-2.2	-2.1	No	No	No
356	72 BATHURST STREET PITT TOWN	R	GF	SE	55	49	57	51	56	50	58	52	60	55	No	No	-2.2	-2.2	-2.2	-2.1	No	No	No
356	72 BATHURST STREET PITT TOWN	R	GF	NE	58	52	61	55	59	53	62	56	60	55	No	No	-2.7	-2.7	-2.9	-2.7	No	No	No
356	72 BATHURST STREET PITT TOWN	R	GF	SE	60	54	62	56	61	55	63	57	60	55	Yes	No	-2.2	-2.4	-2.4	-2.3	No	No	No
356	72 BATHURST STREET PITT TOWN	R	GF	NE	63	57	65	59	64	58	67	60	60	55	Yes	Yes	-2.3	-2.6	-2.5	-2.6	No	No	No
357	70 BATHURST STREET PITT TOWN	R	GF	NW	58	51	60	54	59	52	62	56	60	55	No	No	-2.8	-2.9	-3.2	-3.2	No	No	No
357	70 BATHURST STREET PITT TOWN	R	GF	SW	49	44	52	46	50	45	53	47	60	55	No	No	-2.2	-2.2	-2.4	-2.3	No	No	No
357	70 BATHURST STREET PITT TOWN	R	GF	NW	50	44	52	46	51	45	53	47	60	55	No	No	-2.3	-2.3	-2.4	-2.4	No	No	No
357	70 BATHURST STREET PITT TOWN	R	GF	SW	51	45	53	47	52	46	54	48	60	55	No	No	-2	-2	-2.1	-1.9	No	No	No
357	70 BATHURST STREET PITT TOWN	R	GF	SE	57	51	59	54	58	52	60	55	60	55	No	No	-2.1	-2.2	-2.2	-2.1	No	No	No
357	70 BATHURST STREET PITT TOWN	R	GF	NE	60	54	62	56	61	55	63	57	60	55	Yes	Yes	-2.2	-2.3	-2.2	-2.2	No	No	No
357	70 BATHURST STREET PITT TOWN	R	GF	SE	62	56	64	58	62	57	65	59	60	55	Yes	Yes	-2.1	-2.3	-2.2	-2.1	No	No	No
357	70 BATHURST STREET PITT TOWN	R	GF	NE	65	59	67	61	66	60	68	62	60	55	Yes	Yes	-2.1	-2.3	-2.3	-2.3	No	No	No
357	70 BATHURST STREET PITT TOWN	R	GF	NE	65	59	67	61	66	60	68	62	60	55	Yes	Yes	-2.2	-2.4	-2.4	-2.2	No	No	No
357	70 BATHURST STREET PITT TOWN	R	GF	NE	65	58	67	61	66	60	68	62	60	55	Yes	Yes	-2.2	-2.5	-2.4	-2.4	No	No	No
358	68 BATHURST STREET PITT TOWN	R	GF	NW	57	52	60	54	58	53	60	55	60	55	No	No	-2.3	-2.4	-2.2	-2.2	No	No	No
358	68 BATHURST STREET PITT TOWN	R	GF	SW	50	45	52	47	51	46	53	47	60	55	No	No	-1.9	-1.9	-2.1	-1.9	No	No	No
358	68 BATHURST STREET PITT TOWN	R	GF	SW	50	44	52	46	51	45	53	47	60	55	No	No	-2	-2	-2.1	-2.1	No	No	No
358	68 BATHURST STREET PITT TOWN	R	GF	SW	51	45	53	47	51	46	53	48	60	55	No	No	-2	-2	-2	-2	No	No	No
358	68 BATHURST STREET PITT TOWN	R	GF	SE	52	46	54	48	52	47	55	49	60	55	No	No	-2	-2.1	-2.1	-2.1	No	No	No
358	68 BATHURST STREET PITT TOWN	R	GF	SW	51	45	53	47	52	46	54	48	60	55	No	No	-2	-2.1	-2.1	-2	No	No	No
358	68 BATHURST STREET PITT TOWN	R	GF	SE	61	55	63	57	62	56	64	58	60	55	Yes	Yes	-2	-2.2	-2.1	-2.1	No	No	No
358	68 BATHURST STREET PITT TOWN	R	GF	NE	64	58	66	61	65	60	67	62	60	55	Yes	Yes	-2	-2.2	-2	-2.1	No	No	No
359	66 BATHURST STREET PITT TOWN	R	GF	NW	57	51	59	53	58	52	60	54	60	55	No	No	-2.2	-2.2	-2.2	-2.1	No	No	No
359	66 BATHURST STREET PITT TOWN	R	GF	SW	49	44	51	46	50	45	52	47	60	55	No	No	-2.1	-2.1	-2.2	-2.1	No	No	No
359	66 BATHURST STREET PITT TOWN	R	GF	SE	54	48	56	50	55	49	57	51	60	55	No	No	-2.2	-2.3	-2.3	-2.1	No	No	No
359	66 BATHURST STREET PITT TOWN	R	GF	NE	65	59	67	61	65	60	67	62	60	55	Yes	Yes	-2	-2.3	-2	-2	No	No	No
359	66 BATHURST STREET PITT TOWN	R	GF	NW	62	56	64	58	63	57	65	59	60	55	Yes	Yes	-2.2	-2.4	-2.3	-2.2	No	No	No
359	66 BATHURST STREET PITT TOWN	R	GF	NE	62	57	64	59	63	58	65	60	60	55	Yes	Yes	-2.2	-2.3	-2.2	-2.1	No	No	No
360	64 BATHURST STREET PITT TOWN	R	GF	NW	53	47	55	49	54	48	56	50	60	55	No	No	-2.2	-2.3	-2.2	-2.2	No	No	No
360	64 BATHURST STREET PITT TOWN	R	GF	SW	49	44	51	46	50	45	52	47	60	55	No	No	-2.1	-2.1	-2.1	-2.1	No	No	No
360	64 BATHURST STREET PITT TOWN	R	GF	SE	51	45	53	48	52	46	54	48	60	55	No	No	-2.2	-2.1	-2.2	-2.1	No	No	No
360	64 BATHURST STREET PITT TOWN	R	GF	SW	50	45	52	47	51	46	53	48	60	55	No	No	-2.1	-2.2	-2.2	-2.1	No	No	No
360	64 BATHURST STREET PITT TOWN	R	GF	SE	61	55	63	57	61	56	63	58	60	55	Yes	Yes	-2	-2.1	-2	-1.9	No	No	No
360	64 BATHURST STREET PITT TOWN	R	GF	NE	65	59	67	61	66	60	67	62	60	55	Yes	Yes	-2	-2.1	-1.9	-2	No	No	No
361	62 BATHURST STREET PITT TOWN	R	GF	NW	55	49	57	52	56	50	58	53	60	55	No	No	-2.3	-2.4	-2.3	-2.3	No	No	No
361	62 BATHURST STREET PITT TOWN	R	F 1	NW	59	54	61	56	60	55	62	57	60	55	No	No	-2.3	-2.3	-2.3	-2.2	No	No	No
361	62 BATHURST STREET PITT TOWN	R	F 1	SW	49	43	50	45	50	44	51	46	60	55	No	No	-1.8	-1.7	-1.8	-1.7	No	No	No
361	62 BATHURST STREET PITT TOWN	R	GF	SE	54	48	56	50	55	49	57	51	60	55	No	No	-2.1	-2.2	-2.1	-2.1	No	No	No
361	62 BATHURST STREET PITT TOWN	R	F 1	SE	58	52	60	55	59	53	61	55	60	55	No	No	-2.1	-2.1	-2.1	-1.9	No	No	No
361	62 BATHURST STREET PITT TOWN	R	GF	NE	61	55	63	57	62	56	64	58	60	55	Yes	Yes	-2.1	-2.1	-2	-2	No	No	No
361	62 BATHURST STREET PITT TOWN	R	F 1	NE	63	57	65	60	64	59	66	60	60	55	Yes	Yes	-2	-2.1	-2	-1.9	No	No	No
362	36 BATHURST STREET PITT TOWN	R	GF	NE	49	43	50	45	50	44	51	46	60	55	No	No	-1.5	-1.6	-1.7	-1.6	No	No	No
363	36 BATHURST STREET PITT TOWN	R	GF	E	49	44	51	45	50	45	52	46	60	55	No	No	-1.3	-1.3	-1.6	-1.5	No	No	No
364	62A BATHURST STREET PITT TOWN	R	GF	NW	50	45	52	47	51	46	53	48	60	55	No	No	-2.1	-2.3	-2.3	-2.2	No	No	No
364	62A BATHURST STREET PITT TOWN	R	GF	W	48	43	50	45	49	44	51	46	60	55	No	No	-2.3	-2.3	-2.4	-2.4	No	No	No
364	62A BATHURST STREET PITT TOWN	R	GF	NW	48	43	51	45	49	44	51	46	60	55	No	No	-2.2	-2.2	-2.3	-2.2	No	No	No
364	62A BATHURST STREET PITT TOWN	R	GF	SE	49	44	51	46	50	45	52	47	60	55	No	No	-1.7	-1.7	-1.7	-1.7	No	No	No

ID	Address	Class	Floor	Façade	2021 $L_{Aeq,\ period}$				2031 $L_{Aeq,\ period}$				NCG Criteria		Exceedance of NCG Criteria		Change in noise level				Equal to or above Cumulative Limit		Consider further additional noise mitigation
					Build		No Build		Build		No Build						2021		2031		2031		
					Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	
364	62A BATHURST STREET PITT TOWN	R	GF	NE	51	46	53	48	52	47	54	49	60	55	No	No	-2.1	-2.1	-2.1	-2	No	No	No
365	24 BATHURST STREET PITT TOWN	R	GF	N	51	45	52	47	51	46	53	48	60	55	No	No	-1.7	-1.7	-1.7	-1.5	No	No	No
365	24 BATHURST STREET PITT TOWN	R	GF	E	51	46	52	46	52	47	53	47	60	55	No	No	-0.3	-0.2	-0.8	-0.7	No	No	No
365	24 BATHURST STREET PITT TOWN	R	GF	E	51	46	51	46	51	46	52	47	60	55	No	No	-0.2	-0.1	-0.7	-0.5	No	No	No
365	24 BATHURST STREET PITT TOWN	R	GF	E	51	46	52	47	52	47	53	48	60	55	No	No	-1.3	-1.2	-1.3	-1.1	No	No	No
365	24 BATHURST STREET PITT TOWN	R	GF	NE	51	46	53	47	52	47	54	48	60	55	No	No	-1.3	-1.3	-1.5	-1.3	No	No	No
365	24 BATHURST STREET PITT TOWN	R	GF	E	51	46	53	47	52	47	54	48	60	55	No	No	-1.5	-1.5	-1.5	-1.4	No	No	No
367	18 LAGOON ROAD PITT TOWN	R	GF	S	50	44	50	44	50	45	50	45	60	55	No	No	0.2	0.2	0	0	No	No	No
367	18 LAGOON ROAD PITT TOWN	R	GF	E	52	47	52	46	52	47	53	47	60	55	No	No	0.3	0.4	-0.2	0	No	No	No
367	18 LAGOON ROAD PITT TOWN	R	GF	N	51	45	51	45	51	46	51	46	60	55	No	No	0.1	0.3	-0.6	-0.3	No	No	No
368	397 PITT TOWN ROAD PITT TOWN	R	GF	S	49	44	49	44	50	45	50	45	60	55	No	No	0	0.1	-0.1	-0.1	No	No	No
368	397 PITT TOWN ROAD PITT TOWN	R	GF	S	52	47	52	47	53	47	53	47	60	55	No	No	0.1	0.1	0	0	No	No	No
368	397 PITT TOWN ROAD PITT TOWN	R	GF	E	55	50	55	50	56	51	56	51	60	55	No	No	0.3	0.5	0	0.2	No	No	No
368	397 PITT TOWN ROAD PITT TOWN	R	GF	N	54	49	54	49	55	49	55	50	60	55	No	No	0.1	0.3	-0.5	-0.3	No	No	No
368	397 PITT TOWN ROAD PITT TOWN	R	GF	E	54	49	54	49	54	49	55	50	60	55	No	No	0.1	0.3	-0.6	-0.3	No	No	No
368	397 PITT TOWN ROAD PITT TOWN	R	GF	N	54	49	54	48	54	49	55	49	60	55	No	No	0.1	0.2	-0.6	-0.4	No	No	No
368	397 PITT TOWN ROAD PITT TOWN	R	GF	W	50	44	51	45	50	45	52	46	60	55	No	No	-1.1	-1	-1.3	-1.1	No	No	No
368	397 PITT TOWN ROAD PITT TOWN	R	GF	N	51	45	52	46	51	46	53	47	60	55	No	No	-1.1	-1.1	-1.6	-1.5	No	No	No
369	49 WELLESLEY STREET PITT TOWN	R	GF	SW	55	50	56	51	55	50	57	51	60	55	No	No	-0.6	-0.5	-1.4	-1.2	No	No	No
369	49 WELLESLEY STREET PITT TOWN	R	GF	SE	56	51	56	50	56	51	57	51	60	55	No	No	0.1	0.3	-0.6	-0.4	No	No	No
370	47 WELLESLEY STREET PITT TOWN	R	GF	SW	55	49	56	50	55	50	56	51	60	55	No	No	-0.8	-0.7	-1.4	-1.2	No	No	No
371	45 WELLESLEY STREET PITT TOWN	R	GF	SW	49	43	50	44	49	44	51	45	60	55	No	No	-0.9	-0.8	-1.2	-1.1	No	No	No
371	45 WELLESLEY STREET PITT TOWN	R	GF	SW	54	49	55	49	54	49	56	50	60	55	No	No	-0.8	-0.7	-1.5	-1.3	No	No	No
372	43 WELLESLEY STREET PITT TOWN	R	GF	SW	53	47	54	48	53	48	54	49	60	55	No	No	-0.9	-0.8	-1.5	-1.3	No	No	No
372	43 WELLESLEY STREET PITT TOWN	R	GF	SE	52	47	53	48	53	47	54	49	60	55	No	No	-1.1	-1	-1.8	-1.6	No	No	No
373	41 WELLESLEY STREET PITT TOWN	R	F 1	NW	50	44	51	45	50	45	52	46	60	55	No	No	-1.4	-1	-1.3	-1.1	No	No	No
373	41 WELLESLEY STREET PITT TOWN	R	F 1	SW	52	47	53	48	53	48	54	49	60	55	No	No	-1	-0.9	-1.5	-1.3	No	No	No
373	41 WELLESLEY STREET PITT TOWN	R	F 1	SE	52	47	52	47	53	48	53	48	60	55	No	No	0	0.2	-0.4	-0.2	No	No	No
373	41 WELLESLEY STREET PITT TOWN	R	F 1	NE	50	44	50	44	51	45	51	45	60	55	No	No	-0.4	0.1	-0.3	-0.1	No	No	No
374	39 WELLESLEY STREET PITT TOWN	R	F 1	NW	50	44	51	45	50	45	52	46	60	55	No	No	-1.6	-1.4	-1.5	-1.4	No	No	No
374	39 WELLESLEY STREET PITT TOWN	R	GF	SW	50	45	51	46	51	46	52	47	60	55	No	No	-0.9	-0.9	-1.3	-1.2	No	No	No
374	39 WELLESLEY STREET PITT TOWN	R	F 1	SW	52	47	53	48	53	48	54	49	60	55	No	No	-1	-0.9	-1.5	-1.3	No	No	No
374	39 WELLESLEY STREET PITT TOWN	R	GF	SE	49	44	50	45	50	44	51	46	60	55	No	No	-1.1	-1.1	-1.6	-1.6	No	No	No
374	39 WELLESLEY STREET PITT TOWN	R	F 1	SE	52	47	53	47	52	47	54	48	60	55	No	No	-0.7	-0.6	-1.3	-1.1	No	No	No
374	39 WELLESLEY STREET PITT TOWN	R	GF	SW	49	44	51	45	50	45	52	46	60	55	No	No	-1.2	-1.1	-1.7	-1.6	No	No	No
374	39 WELLESLEY STREET PITT TOWN	R	F 1	SW	52	47	53	47	52	47	54	48	60	55	No	No	-0.7	-0.6	-1.3	-1.2	No	No	No
374	39 WELLESLEY STREET PITT TOWN	R	F 1	SE	52	46	52	47	52	47	53	48	60	55	No	No	-0.6	-0.5	-0.9	-0.8	No	No	No
374	39 WELLESLEY STREET PITT TOWN	R	F 1	NE	49	44	50	44	50	45	51	45	60	55	No	No	-1.1	-0.7	-1	-0.8	No	No	No
375	37 WELLESLEY STREET PITT TOWN	R	GF	SW	50	45	51	46	51	46	52	47	60	55	No	No	-1	-0.9	-1.3	-1.1	No	No	No
375	37 WELLESLEY STREET PITT TOWN	R	F 1	SW	52	47	53	48	53	48	54	49	60	55	No	No	-1	-0.9	-1.4	-1.2	No	No	No
375	37 WELLESLEY STREET PITT TOWN	R	F 1	NE	49	44	50	45	50	45	51	45	60	55	No	No	-1.1	-0.7	-1	-0.8	No	No	No
376	35 WELLESLEY STREET PITT TOWN	R	GF	NW	48	43	50	45	49	44	51	46	60	55	No	No	-2.4	-2.3	-2.3	-2.2	No	No	No
376	35 WELLESLEY STREET PITT TOWN	R	F 1	NW	50	45	52	47	51	46	53	48	60	55	No	No	-2.1	-1.9	-2.1	-2	No	No	No
376	35 WELLESLEY STREET PITT TOWN	R	GF	SW	50	45	51	46	51	45	52	47	60	55	No	No	-1.2	-1.1	-1.5	-1.3	No	No	No
376	35 WELLESLEY STREET PITT TOWN	R	F 1	SW	52	47	53	48	53	47	54	49	60	55	No	No	-1.2	-1.1	-1.5	-1.3	No	No	No
376	35 WELLESLEY STREET PITT TOWN	R	F 1	NE	49	44	51	45	50	45	51	46	60	55	No	No	-1.2	-0.9	-1.2	-1	No	No	No
377	31 WELLESLEY STREET PITT TOWN	R	GF	NW	48	42	50	44	49	43	51	45	60	55	No	No	-2.2	-2.2	-2.3	-2.2	No	No	No
377	31 WELLESLEY STREET PITT TOWN	R	F 1	NW	50	44	52	46	51	45	53	47	60	55	No	No	-1.9	-1.9	-2	-1.9	No	No	No
377	31 WELLESLEY STREET PITT TOWN	R	F 1	SW	50	45	52	46	51	45	53	47	60	55	No	No	-1.6	-1.6	-2	-1.8	No	No	No
377	31 WELLESLEY STREET PITT TOWN	R	F 1	SE	50	45	51	45	51	45	52	46	60	55	No	No	-0.6	-0.4	-0.7	-0.6	No	No	No
378	33 WELLESLEY STREET PITT TOWN	R	GF	NW	49	44	51	46	50	45	52	47	60	55	No	No	-2.1	-2.2	-2.1	-2.1	No	No	No
378	33 WELLESLEY STREET PITT TOWN	R	F 1	NW	51	46	53	48	52	47	54	49	60	55	No	No	-2	-1.9	-2	-1.9	No	No	No
378	33 WELLESLEY STREET PITT TOWN	R	GF	SW	52	47	54	48	53	48	54	49	60	55	No	No	-1.6	-1.6	-1.6	-1.5	No	No	No
378	33 WELLESLEY STREET PITT TOWN	R	F 1	SW	54	48	55	50	54	49	56	51	60	55	No	No	-1.5	-1.5	-1.6	-1.5	No	No	No
378	33 WELLESLEY STREET PITT TOWN	R	GF	SE	51	46	52	47	52	47	53	48	60	55	No	No	-1.1	-1	-1.3	-1.1	No	No	No
378	33 WELLESLEY STREET PITT TOWN	R	F 1	SE	53	48	54	48	54	48	55	49	60	55	No	No	-1	-0.9	-1.2	-1.1	No	No	No
379	29 WELLESLEY STREET PITT TOWN	R	GF	NW	49	44	52	46	50	45	53	47	60	55	No	No	-2.3	-2.3	-2.4	-2.3	No	No	No
379	29 WELLESLEY STREET PITT TOWN	R	F 1	NW	52	46	54	48	52	47	55	49	60	55	No	No	-2.1	-2.2	-2.3	-2.2	No	No	No
379	29 WELLESLEY STREET PITT TOWN	R	GF	SW	52	47	54	49	53	48	55	49	60	55	No	No	-1.7	-1.7	-1.8	-1.7	No	No	No
379	29 WELLESLEY STREET PITT TOWN	R	F 1	SW	54	48	56	50	55	49	56	51	60	55	No	No	-1.6	-1.7	-1.8	-1.7	No	No	No
379	29 WELLESLEY STREET PITT TOWN	R	GF	SE	50	44	51	46	50	45	52	47	60	55	No	No	-1.6	-1.7	-1.6	-1.5	No	No	No
379	29 WELLESLEY STREET PITT TOWN	R	F 1	SE	52	46	53	48	53	47	54	48	60	55	No	No	-1.4	-1.4	-1.4	-1.3	No	No	No
380	23 WELLESLEY STREET PITT TOWN	R	F 1	NW	50	45	52	47	51	45	53	48	60	55	No	No	-2.2	-2.2	-2.5	-2.3	No	No	No
380	23 WELLESLEY STREET PITT TOWN	R	GF	SW	50	45	52	46	51	45	53	47	60	55	No	No	-1.7	-1.8	-1.8	-1.8	No	No	No
380	23 WELLESLEY STREET PITT TOWN	R	F 1	SW	52	46	54	48	53	47	55	49	60	55	No	No	-1.8	-1.8	-1.9	-1.7	No	No	No
380	23 WELLESLEY STREET PITT TOWN	R	F 1	SE	51	46	52	46	52	46	53	47	60	55	No	No	-0.9	-0.8	-1.1	-0.9	No	No	No
381	21 WELLESLEY STREET PITT TOWN	R	GF	SW	51	45	53	48	52	46	54	48	60	55	No	No	-2.1	-2.1	-2.3	-2.1	No	No	No
381	21 WELLESLEY STREET PITT TOWN	R	GF	SE	51	45	52	47	51	46	53	48	60	55	No	No	-1.5	-1.5	-1.6	-1.5	No	No	No
381	21 WELLESLEY STREET PITT TOWN	R	GF	SW	51	45	53	47	51	46	53	48	60	55	No	No	-1.9	-2	-2	-2	No	No	No
381	21 WELLESLEY STREET PITT TOWN	R	GF	SE	50	45	52	47	51	46	53	47	60	55	No	No	-1.8	-1.8	-1.8	-1.8	No	No	No
381	21 WELLESLEY STREET PITT TOWN	R	GF	E	48	43	50	45	49	44	51	46	60	55	No	No	-1.8	-1.8	-1.8	-1.7	No	No	No
381	21 WELLESLEY STREET PITT TOWN	R	GF	SE	48	43	50	45	49	44	51	46	60	55	No	No	-1.9	-1.8	-1.7	-1.7	No	No	No
381	21 WELLESLEY STREET PITT TOWN	R	GF	NW	49	43	51	45	49	44	52	46	60	55	No	No	-2.1	-2.1	-2.3	-2.2	No	No	No
382	19 WELLESLEY STREET PITT TOWN	R	GF	SW	49	44	51	46	50	45	52	47	60	55	No	No	-2.1	-2.2	-2.3	-2.2	No	No	No
382	19 WELLESLEY STREET PITT TOWN	R	GF	S	49	44	51	46	50	45	52	47	60	55	No	No	-1.9	-1.9	-1.9	-1.9	No	No	No
382	19 WELLESLEY STREET PITT TOWN	R	GF	SW	49	44	51	46	50	45	52	47	60	55	No	No	-2.1	-2.1	-2.1	-2.1	No	No	No
382	19 WELLESLEY STREET PITT TOWN	R	GF	S	48	43	50	44	49	43	50	45	60	55	No	No	-1.7	-1.6	-1.7	-1.7	No	No	No
383	17 WELLESLEY STREET PITT TOWN	R	GF	W	49	43	51	46	50	44	52	47	60	55	No	No	-2	-2.2	-2.3	-2.2	No	No	No
384	15 WELLESLEY STREET PITT TOWN	R	GF	SW	49	43	51	46	50	44	52	46	60	55	No	No	-2.2	-2.2	-2.3	-2.3	No	No	No
384	15 WELLESLEY STREET PITT TOWN	R	GF	NE	48	42	50	44	48	43	51	45	60	55	No	No	-2	-1.9	-2.4	-2.3	No	No	No

ID	Address	Class	Floor	Façade	2021 $L_{Aeq,\ period}$				2031 $L_{Aeq,\ period}$				NCG Criteria		Exceedance of NCG Criteria		Change in noise level				Equal to or above Cumulative Limit		Consider further additional noise mitigation
					Build		No Build		Build		No Build						2021		2031		2031		
					Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	
385	13 WELLESLEY STREET PITT TOWN	R	GF	NW	49	43	52	46	49	44	53	47	60	55	No	No	-2.8	-2.8	-3.2	-3.1	No	No	No
385	13 WELLESLEY STREET PITT TOWN	R	GF	W	49	43	51	46	50	44	52	47	60	55	No	No	-2.3	-2.3	-2.6	-2.6	No	No	No
385	13 WELLESLEY STREET PITT TOWN	R	GF	SE	48	43	50	45	49	44	51	46	60	55	No	No	-1.8	-1.8	-2	-1.9	No	No	No
385	13 WELLESLEY STREET PITT TOWN	R	GF	NE	48	43	50	45	48	43	51	46	60	55	No	No	-2.4	-2.3	-2.8	-2.7	No	No	No
385	13 WELLESLEY STREET PITT TOWN	R	GF	NE	48	42	51	45	48	43	51	46	60	55	No	No	-2.8	-2.7	-3.2	-3.1	No	No	No
385	13 WELLESLEY STREET PITT TOWN	R	GF	NE	48	42	51	45	48	43	52	46	60	55	No	No	-2.7	-2.7	-3.3	-3.1	No	No	No
385	13 WELLESLEY STREET PITT TOWN	R	GF	N	48	42	50	45	48	43	51	46	60	55	No	No	-2.5	-2.4	-2.9	-2.9	No	No	No
385	13 WELLESLEY STREET PITT TOWN	R	GF	E	48	43	50	45	48	43	51	46	60	55	No	No	-2.4	-2.4	-2.9	-2.9	No	No	No
386	9 WELLESLEY STREET PITT TOWN	C	GF	W	51	45	53	48	52	46	55	49	0	0	N/A	N/A	-2.5	-2.6	-2.9	-2.7	No	No	No
386	9 WELLESLEY STREET PITT TOWN	C	GF	SE	50	44	52	46	51	45	53	47	0	0	N/A	N/A	-1.9	-1.9	-2	-1.9	No	No	No
386	9 WELLESLEY STREET PITT TOWN	C	GF	NE	49	44	51	46	50	44	52	47	0	0	N/A	N/A	-2	-2	-2.5	-2.4	No	No	No
386	9 WELLESLEY STREET PITT TOWN	C	GF	N	50	45	53	48	51	46	54	49	0	0	N/A	N/A	-2.7	-2.8	-3.1	-3	No	No	No
387	5 WELLESLEY STREET PITT TOWN	R	GF	W	49	44	52	46	50	44	53	47	60	55	No	No	-2.6	-2.7	-3.1	-3	No	No	No
387	5 WELLESLEY STREET PITT TOWN	R	GF	S	49	44	52	46	50	45	53	47	60	55	No	No	-2.4	-2.5	-2.7	-2.5	No	No	No
387	5 WELLESLEY STREET PITT TOWN	R	GF	E	50	45	53	48	50	45	54	49	60	55	No	No	-3.2	-3.2	-3.9	-3.8	No	No	No
387	5 WELLESLEY STREET PITT TOWN	R	GF	E	50	45	53	48	50	45	54	49	60	55	No	No	-3.3	-3.2	-4	-3.9	No	No	No
387	5 WELLESLEY STREET PITT TOWN	R	GF	E	51	45	54	48	51	45	55	49	60	55	No	No	-3.4	-3.3	-4.1	-3.9	No	No	No
387	5 WELLESLEY STREET PITT TOWN	R	GF	E	50	45	54	48	51	45	55	49	60	55	No	No	-3.5	-3.5	-4.3	-4.1	No	No	No
387	5 WELLESLEY STREET PITT TOWN	R	GF	E	51	46	55	49	51	46	55	50	60	55	No	No	-3.4	-3.4	-4.2	-4.1	No	No	No
387	5 WELLESLEY STREET PITT TOWN	R	GF	W	48	43	51	46	49	43	52	47	60	55	No	No	-3	-2.9	-3.4	-3.3	No	No	No
387	5 WELLESLEY STREET PITT TOWN	R	GF	N	48	42	51	45	48	43	52	46	60	55	No	No	-3	-3.1	-3.6	-3.5	No	No	No
387	5 WELLESLEY STREET PITT TOWN	R	GF	W	48	43	51	46	49	43	52	47	60	55	No	No	-2.9	-3	-3.6	-3.5	No	No	No
387	5 WELLESLEY STREET PITT TOWN	R	GF	N	48	43	51	46	49	43	52	47	60	55	No	No	-2.9	-3	-3.6	-3.5	No	No	No
388	3 WELLESLEY STREET PITT TOWN	R	GF	W	49	43	52	46	49	44	53	47	60	55	No	No	-3.1	-3.1	-3.8	-3.7	No	No	No
388	3 WELLESLEY STREET PITT TOWN	R	GF	S	48	43	51	46	49	44	52	47	60	55	No	No	-2.6	-2.6	-3	-2.9	No	No	No
388	3 WELLESLEY STREET PITT TOWN	R	GF	E	52	46	55	50	52	46	56	51	60	55	No	No	-3.8	-3.7	-4.6	-4.5	No	No	No
388	3 WELLESLEY STREET PITT TOWN	R	GF	N	51	45	55	49	51	46	56	50	60	55	No	No	-3.9	-3.9	-4.8	-4.6	No	No	No
388	3 WELLESLEY STREET PITT TOWN	R	GF	N	50	45	54	49	51	45	55	50	60	55	No	No	-3.9	-3.9	-4.7	-4.6	No	No	No
388	3 WELLESLEY STREET PITT TOWN	R	GF	N	50	44	54	48	50	44	55	49	60	55	No	No	-3.9	-3.9	-4.8	-4.6	No	No	No
388	3 WELLESLEY STREET PITT TOWN	R	GF	E	51	46	55	49	51	46	56	50	60	55	No	No	-3.7	-3.6	-4.5	-4.4	No	No	No
388	3 WELLESLEY STREET PITT TOWN	R	GF	N	49	43	52	46	49	44	53	47	60	55	No	No	-3.3	-3.3	-4	-3.8	No	No	No
389	7 WELLESLEY STREET PITT TOWN	R	GF	NW	50	44	53	47	50	44	54	48	60	55	No	No	-3	-3	-3.9	-3.8	No	No	No
389	7 WELLESLEY STREET PITT TOWN	R	GF	SW	49	44	52	46	50	44	53	47	60	55	No	No	-2.7	-2.7	-3.2	-3	No	No	No
389	7 WELLESLEY STREET PITT TOWN	R	GF	SE	50	44	52	46	50	45	53	47	60	55	No	No	-2.2	-2.3	-2.5	-2.5	No	No	No
389	7 WELLESLEY STREET PITT TOWN	R	GF	NE	49	44	52	46	49	44	53	47	60	55	No	No	-2.5	-2.5	-3.4	-3.3	No	No	No
390	21 ELDON STREET PITT TOWN	R	GF	N	49	43	51	46	49	44	52	47	60	55	No	No	-2.8	-2.7	-3.5	-3.3	No	No	No
390	21 ELDON STREET PITT TOWN	R	GF	E	50	45	53	48	51	45	54	49	60	55	No	No	-3.1	-3	-3.7	-3.7	No	No	No
390	21 ELDON STREET PITT TOWN	R	GF	E	57	51	61	55	57	51	62	56	60	55	No	No	-4	-4.1	-4.7	-4.9	No	No	No
390	21 ELDON STREET PITT TOWN	R	GF	E	58	52	63	57	59	52	63	57	60	55	No	No	-4.1	-4.2	-4.8	-5	No	No	No
390	21 ELDON STREET PITT TOWN	R	GF	N	62	56	66	60	62	56	67	61	60	55	Yes	Yes	-4.2	-4.4	-4.8	-5.4	No	No	No
390	21 ELDON STREET PITT TOWN	R	GF	W	54	48	57	52	54	49	58	53	60	55	No	No	-3.5	-3.6	-4.3	-4.1	No	No	No
390	21 ELDON STREET PITT TOWN	R	GF	S	52	47	55	50	53	48	57	51	60	55	No	No	-3.2	-3.3	-3.7	-3.5	No	No	No
390	21 ELDON STREET PITT TOWN	R	GF	W	53	47	56	51	53	48	57	52	60	55	No	No	-3.1	-3.3	-3.8	-3.7	No	No	No
390	21 ELDON STREET PITT TOWN	R	GF	S	53	47	56	50	53	48	57	52	60	55	No	No	-3.2	-3.3	-3.7	-3.6	No	No	No
390	21 ELDON STREET PITT TOWN	R	GF	W	53	47	56	51	54	48	57	52	60	55	No	No	-3.1	-3.2	-3.7	-3.5	No	No	No
390	21 ELDON STREET PITT TOWN	R	GF	S	52	47	55	49	53	47	56	51	60	55	No	No	-2.8	-2.9	-3.3	-3.2	No	No	No
390	21 ELDON STREET PITT TOWN	R	GF	E	49	44	52	46	50	44	53	47	60	55	No	No	-2.4	-2.5	-2.9	-2.8	No	No	No
391	19 ELDON STREET PITT TOWN	R	GF	W	55	50	59	54	56	50	60	55	60	55	No	No	-3.9	-4	-4.8	-4.7	No	No	No
391	19 ELDON STREET PITT TOWN	R	GF	S	49	43	52	47	49	44	53	48	60	55	No	No	-3.2	-3.2	-3.7	-3.7	No	No	No
391	19 ELDON STREET PITT TOWN	R	GF	W	49	44	53	47	50	44	54	48	60	55	No	No	-3.3	-3.2	-3.9	-3.8	No	No	No
391	19 ELDON STREET PITT TOWN	R	GF	S	49	44	52	47	50	44	53	48	60	55	No	No	-2.9	-3	-3.5	-3.4	No	No	No
391	19 ELDON STREET PITT TOWN	R	GF	E	49	44	52	47	50	44	53	48	60	55	No	No	-3	-2.9	-3.6	-3.4	No	No	No
391	19 ELDON STREET PITT TOWN	R	GF	S	49	44	52	47	50	44	53	48	60	55	No	No	-3	-3	-3.5	-3.3	No	No	No
391	19 ELDON STREET PITT TOWN	R	GF	E	50	45	53	48	50	45	54	49	60	55	No	No	-3.2	-3.1	-4	-3.9	No	No	No
391	19 ELDON STREET PITT TOWN	R	GF	N	58	52	62	56	58	52	63	57	60	55	No	No	-4	-4.2	-4.9	-5.1	No	No	No
391	19 ELDON STREET PITT TOWN	R	GF	E	59	52	63	57	59	52	64	58	60	55	No	No	-4.2	-4.3	-4.8	-5.2	No	No	No
391	19 ELDON STREET PITT TOWN	R	GF	N	62	55	66	60	62	55	67	61	60	55	Yes	Yes	-4.1	-4.5	-4.9	-5.4	No	No	No
392	17 ELDON STREET PITT TOWN	R	GF	N	63	56	67	60	63	56	68	62	60	55	Yes	Yes	-4.3	-4.7	-4.8	-5.7	No	No	No
392	17 ELDON STREET PITT TOWN	R	GF	W	59	52	63	57	59	52	64	58	60	55	No	No	-4.1	-4.3	-4.8	-5.3	No	No	No
392	17 ELDON STREET PITT TOWN	R	GF	SW	56	50	60	54	57	50	61	55	60	55	No	No	-3.8	-4	-4.6	-4.8	No	No	No
392	17 ELDON STREET PITT TOWN	R	GF	W	52	46	55	50	52	46	56	51	60	55	No	No	-3.5	-3.5	-4.2	-4.2	No	No	No
392	17 ELDON STREET PITT TOWN	R	GF	N	50	45	53	48	50	45	54	49	60	55	No	No	-3.4	-3.4	-4.2	-4.1	No	No	No
392	17 ELDON STREET PITT TOWN	R	GF	W	49	44	53	47	50	44	54	48	60	55	No	No	-3.3	-3.2	-4	-3.9	No	No	No
392	17 ELDON STREET PITT TOWN	R	GF	S	48	42	51	46	48	43	52	47	60	55	No	No	-3.1	-3.1	-3.6	-3.6	No	No	No
392	17 ELDON STREET PITT TOWN	R	GF	S	47	42	50	45	48	42	51	46	60	55	No	No	-3.1	-3	-3.5	-3.5	No	No	No
392	17 ELDON STREET PITT TOWN	R	GF	S	48	42	51	45	48	43	52	46	60	55	No	No	-3	-3	-3.6	-3.4	No	No	No
392	17 ELDON STREET PITT TOWN	R	GF	E	57	51	61	55	57	51	62	56	60	55	No	No	-4	-4	-4.9	-4.7	No	No	No
392	17 ELDON STREET PITT TOWN	R	GF	NE	61	55	65	59	61	55	66	60	60	55	Yes	No	-4.3	-4.5	-5	-5.4	No	No	No
392	17 ELDON STREET PITT TOWN	R	GF	NE	61	54	65	59	61	54	66	60	60	55	Yes	No	-4.2	-4.5	-4.9	-5.5	No	No	No
392	17 ELDON STREET PITT TOWN	R	GF	NE	62	55	66	60	63	55	67	61	60	55	Yes	Yes	-4.3	-4.6	-4.8	-5.6	No	No	No
392	17 ELDON STREET PITT TOWN	R	GF	E	61	54	65	59	61	54	66	60	60	55	Yes	No	-4.4	-4.8	-5	-5.7	No	No	No
392	17 ELDON STREET PITT TOWN	R	GF	NW	61	54	65	59	61	54	66	60	60	55	Yes	No	-4.4	-4.8	-5	-5.7	No	No	No
392	17 ELDON STREET PITT TOWN	R	GF	E	62	55	66	60	63	55	67	61	60	55	Yes	Yes	-4.4	-4.7	-4.9	-5.6	No	No	No
393	2 WELLESLEY STREET PITT TOWN	R	GF	W	59	53	64	57	60	53	65	58	60	55	No	No	-4.2	-4.4	-4.9	-5.5	No	No	No
393	2 WELLESLEY STREET PITT TOWN	R	GF	S	48	42	52	46	48	42	52	47	60	55	No	No	-3.7	-3.7	-4.4	-4.5	No	No	No
393	2 WELLESLEY STREET PITT TOWN	R	GF	E	60	53	64	57	60	53	65	58	60	55	No	No	-4	-4.2	-4.6	-5.1	No	No	No
393	2 WELLESLEY STREET PITT TOWN	R	GF	N	65	57	70	62	66	58	71	64	60	55	Yes	Yes	-4.1	-5	-4.4	-6	No	No	No
394	4 WELLESLEY STREET PITT TOWN	R	GF	W	53	48	57	52	53	48	58	53	60	55	No	No	-3.7	-3.7	-4.7	-4.5	No	No	No
394	4 WELLESLEY STREET PITT TOWN	R	F 1	W	56	50	59	54	56	50	60	55	60	55	No	No	-3.6	-3.6	-4.6	-4.5	No	No	No
394	4 WELLESLEY STREET PITT TOWN	R	F 1	S	49	44	52	46	50	44	53	47	60	55	No	No	-2.7	-2.8	-3.2	-3	No	No	No

ID	Address	Class	Floor	Façade	2021 $L_{Aeq,\ period}$				2031 $L_{Aeq,\ period}$				NCG Criteria		Exceedance of NCG Criteria		Change in noise level				Equal to or above Cumulative Limit		Consider further additional noise mitigation
					Build		No Build		Build		No Build						2021		2031		2031		
					Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	
394	4 WELLESLEY STREET PITT TOWN	R	GF	E	53	47	56	51	53	47	57	52	60	55	No	No	-3.5	-3.6	-4.4	-4.3	No	No	No
394	4 WELLESLEY STREET PITT TOWN	R	F 1	E	55	49	58	53	55	49	59	54	60	55	No	No	-3.5	-3.5	-4.4	-4.2	No	No	No
394	4 WELLESLEY STREET PITT TOWN	R	GF	N	48	42	51	46	48	42	52	47	60	55	No	No	-3.7	-3.7	-4.5	-4.5	No	No	No
394	4 WELLESLEY STREET PITT TOWN	R	F 1	N	58	52	61	56	58	52	62	57	60	55	No	No	-3.5	-3.4	-4.6	-4.6	No	No	No
395	6 WELLESLEY STREET PITT TOWN	R	GF	W	51	45	55	49	51	46	56	50	60	55	No	No	-3.6	-3.6	-4.4	-4.2	No	No	No
395	6 WELLESLEY STREET PITT TOWN	R	GF	W	51	46	55	49	52	46	56	50	60	55	No	No	-3.6	-3.5	-4.2	-4.2	No	No	No
395	6 WELLESLEY STREET PITT TOWN	R	GF	W	51	46	55	49	52	46	56	50	60	55	No	No	-3.6	-3.6	-4.3	-4.1	No	No	No
395	6 WELLESLEY STREET PITT TOWN	R	GF	W	48	43	51	46	49	43	52	47	60	55	No	No	-3.2	-3.1	-3.6	-3.5	No	No	No
395	6 WELLESLEY STREET PITT TOWN	R	GF	W	51	45	54	49	51	45	55	50	60	55	No	No	-3.5	-3.6	-4.3	-4.2	No	No	No
395	6 WELLESLEY STREET PITT TOWN	R	GF	E	51	45	54	49	51	45	55	49	60	55	No	No	-3.4	-3.3	-4.2	-4	No	No	No
395	6 WELLESLEY STREET PITT TOWN	R	GF	N	51	46	55	49	51	46	55	50	60	55	No	No	-3.5	-3.4	-4.2	-4.1	No	No	No
396	8 WELLESLEY STREET PITT TOWN	R	GF	W	50	44	53	48	50	45	54	49	60	55	No	No	-3.3	-3.4	-4.1	-3.9	No	No	No
396	8 WELLESLEY STREET PITT TOWN	R	F 1	W	52	46	55	49	52	46	56	50	60	55	No	No	-3.3	-3.2	-4.1	-3.9	No	No	No
396	8 WELLESLEY STREET PITT TOWN	R	F 1	S	49	43	51	46	49	44	52	47	60	55	No	No	-2.4	-2.4	-2.7	-2.5	No	No	No
396	8 WELLESLEY STREET PITT TOWN	R	GF	E	49	43	52	46	49	43	52	47	60	55	No	No	-3.1	-3	-3.7	-3.7	No	No	No
396	8 WELLESLEY STREET PITT TOWN	R	F 1	E	51	45	54	48	51	46	55	49	60	55	No	No	-2.9	-2.8	-3.5	-3.4	No	No	No
396	8 WELLESLEY STREET PITT TOWN	R	F 1	N	52	47	56	50	52	47	57	51	60	55	No	No	-3.5	-3.4	-4.3	-4.2	No	No	No
397	10 WELLESLEY STREET PITT TOWN	R	GF	W	47	41	49	44	48	42	51	45	60	55	No	No	-2.5	-2.6	-3	-2.8	No	No	No
397	10 WELLESLEY STREET PITT TOWN	R	F 1	W	49	44	52	46	50	44	53	47	60	55	No	No	-2.5	-2.6	-3.1	-3	No	No	No
397	10 WELLESLEY STREET PITT TOWN	R	F 1	S	48	43	50	45	49	44	51	46	60	55	No	No	-2	-2	-2.3	-2.2	No	No	No
397	10 WELLESLEY STREET PITT TOWN	R	GF	NE	48	42	51	45	48	42	51	46	60	55	No	No	-2.8	-2.7	-3.6	-3.5	No	No	No
397	10 WELLESLEY STREET PITT TOWN	R	F 1	NE	50	45	53	47	50	45	54	48	60	55	No	No	-2.6	-2.5	-3.4	-3.2	No	No	No
397	10 WELLESLEY STREET PITT TOWN	R	GF	N	48	42	51	46	48	43	52	46	60	55	No	No	-3.2	-3.1	-4	-3.9	No	No	No
397	10 WELLESLEY STREET PITT TOWN	R	F 1	N	50	45	53	48	50	45	54	49	60	55	No	No	-3.1	-3	-3.9	-3.8	No	No	No
398	12 WELLESLEY STREET PITT TOWN	R	F 1	W	48	43	51	45	49	44	52	46	60	55	No	No	-2.4	-2.4	-2.7	-2.6	No	No	No
398	12 WELLESLEY STREET PITT TOWN	R	F 1	S	47	42	51	45	48	43	52	46	60	55	No	No	-3.3	-3.2	-3.5	-3.4	No	No	No
398	12 WELLESLEY STREET PITT TOWN	R	F 1	E	49	44	52	46	49	44	53	47	60	55	No	No	-2.5	-2.3	-3.1	-3	No	No	No
398	12 WELLESLEY STREET PITT TOWN	R	GF	NW	47	41	50	44	47	41	51	45	60	55	No	No	-2.9	-2.8	-3.9	-3.7	No	No	No
398	12 WELLESLEY STREET PITT TOWN	R	F 1	NW	49	44	52	47	49	44	53	47	60	55	No	No	-2.8	-2.7	-3.7	-3.6	No	No	No
399	14 WELLESLEY STREET PITT TOWN	R	F 1	N	47	42	50	45	48	42	51	46	60	55	No	No	-3.3	-3.3	-3.6	-3.6	No	No	No
399	14 WELLESLEY STREET PITT TOWN	R	F 1	W	48	43	51	45	49	44	52	46	60	55	No	No	-2.4	-2.5	-2.9	-2.7	No	No	No
399	14 WELLESLEY STREET PITT TOWN	R	F 1	S	48	43	51	45	49	44	52	46	60	55	No	No	-2.7	-2.6	-3	-2.8	No	No	No
399	14 WELLESLEY STREET PITT TOWN	R	F 1	NE	48	43	51	46	49	43	52	46	60	55	No	No	-2.7	-2.6	-3.4	-3.3	No	No	No
400	16 WELLESLEY STREET PITT TOWN	R	F 1	SW	48	43	50	45	49	44	51	46	60	55	No	No	-2.2	-2.2	-2.5	-2.4	No	No	No
400	16 WELLESLEY STREET PITT TOWN	R	F 1	NE	48	43	51	45	48	43	52	46	60	55	No	No	-2.6	-2.5	-3.5	-3.3	No	No	No
400	16 WELLESLEY STREET PITT TOWN	R	F 1	NW	48	43	51	45	48	43	52	46	60	55	No	No	-2.9	-2.8	-3.8	-3.7	No	No	No
400	16 WELLESLEY STREET PITT TOWN	R	F 1	NE	48	42	50	45	48	42	51	46	60	55	No	No	-2.9	-2.8	-3.8	-3.6	No	No	No
401	18 WELLESLEY STREET PITT TOWN	R	F 1	SW	49	43	51	45	49	44	52	46	60	55	No	No	-2	-2	-2.3	-2.1	No	No	No
401	18 WELLESLEY STREET PITT TOWN	R	F 1	NE	48	43	50	44	48	43	51	45	60	55	No	No	-1.8	-1.7	-2.4	-2.4	No	No	No
402	20 WELLESLEY STREET PITT TOWN	R	F 1	SW	48	43	50	45	49	44	51	46	60	55	No	No	-1.9	-1.9	-2.2	-2	No	No	No
403	22 WELLESLEY STREET PITT TOWN	R	F 1	SW	48	43	50	45	49	44	51	46	60	55	No	No	-1.8	-1.8	-2.1	-1.9	No	No	No
404	24 WELLESLEY STREET PITT TOWN	R	F 1	SW	48	43	50	44	49	43	51	45	60	55	No	No	-1.7	-1.6	-2	-1.9	No	No	No
404	24 WELLESLEY STREET PITT TOWN	R	F 1	NE	47	42	51	45	48	42	52	46	60	55	No	No	-3.7	-2.9	-3.8	-3.2	No	No	No
405	26 WELLESLEY STREET PITT TOWN	R	F 1	SW	48	43	50	44	49	44	51	45	60	55	No	No	-1.4	-1.4	-1.8	-1.7	No	No	No
406	28 WELLESLEY STREET PITT TOWN	R	F 1	SW	49	44	50	45	50	44	51	46	60	55	No	No	-1.4	-1.3	-1.6	-1.6	No	No	No
407	36 WELLESLEY STREET PITT TOWN	R	GF	NW	49	44	51	45	50	45	51	46	58	53	No	No	-1.4	-1	-1.2	-1	No	No	No
408	38 WELLESLEY STREET PITT TOWN	R	F 1	NW	50	45	51	46	51	46	52	46	58	53	No	No	-1.1	-0.8	-1.1	-0.9	No	No	No
408	38 WELLESLEY STREET PITT TOWN	R	F 1	SW	52	47	50	45	53	48	51	46	58	53	No	No	2	2.2	1.6	1.8	No	No	No
408	38 WELLESLEY STREET PITT TOWN	R	F 1	SE	54	48	50	44	54	49	51	45	58	53	No	No	3.7	4	3.4	3.6	No	No	No
408	38 WELLESLEY STREET PITT TOWN	R	F 1	NE	51	45	51	45	52	46	51	45	58	53	No	No	0.2	0.8	0.6	0.8	No	No	No
408	38 WELLESLEY STREET PITT TOWN	R	F 1	NW	50	44	51	45	51	45	51	46	58	53	No	No	-0.8	-0.3	-0.6	-0.3	No	No	No
408	38 WELLESLEY STREET PITT TOWN	R	F 1	NE	50	45	51	45	51	46	51	46	58	53	No	No	-0.2	0.3	-0.1	0.1	No	No	No
410	9 BUCKRIDGE STREET PITT TOWN	R	GF	NW	49	43	51	45	50	44	51	46	58	53	No	No	-1.9	-1.5	-1.5	-1.3	No	No	No
410	9 BUCKRIDGE STREET PITT TOWN	R	GF	SE	52	47	50	44	52	47	50	45	58	53	No	No	2.2	2.5	2	2.2	No	No	No
410	9 BUCKRIDGE STREET PITT TOWN	R	GF	SW	52	47	50	44	52	47	51	45	58	53	No	No	2.2	2.4	1.9	2.1	No	No	No
410	9 BUCKRIDGE STREET PITT TOWN	R	GF	SE	52	47	50	44	53	47	51	45	58	53	No	No	2.2	2.5	1.9	2.2	No	No	No
411	7 BUCKRIDGE STREET PITT TOWN	R	GF	NW	50	45	51	45	51	46	52	46	57	52	No	No	-1	-0.5	-0.7	-0.6	No	No	No
411	7 BUCKRIDGE STREET PITT TOWN	R	GF	NE	50	45	51	45	51	45	51	46	57	52	No	No	-0.8	-0.3	-0.5	-0.3	No	No	No
412	5 BUCKRIDGE STREET PITT TOWN	R	GF	NW	48	43	51	45	49	44	51	45	57	52	No	No	-2.3	-1.8	-1.9	-1.6	No	No	No
412	5 BUCKRIDGE STREET PITT TOWN	R	F 1	NW	51	46	52	46	52	47	53	47	57	52	No	No	-0.8	-0.3	-0.4	-0.2	No	No	No
412	5 BUCKRIDGE STREET PITT TOWN	R	F 1	SW	53	47	51	46	53	48	52	47	57	52	No	No	1.3	1.5	1	1.1	No	No	No
412	5 BUCKRIDGE STREET PITT TOWN	R	F 1	SE	54	49	51	46	55	49	52	47	57	52	No	No	2.5	2.8	2.3	2.5	No	No	No
412	5 BUCKRIDGE STREET PITT TOWN	R	F 1	NE	53	47	52	46	53	48	52	46	57	52	No	No	0.7	1.6	1.2	1.5	No	No	No
414	1 BUCKRIDGE STREET PITT TOWN	R	GF	NW	52	46	52	46	52	47	53	47	55	50	No	No	-0.6	0	-0.2	0.1	No	No	No
414	1 BUCKRIDGE STREET PITT TOWN	R	GF	NE	53	47	52	46	54	48	52	47	55	50	No	No	0.7	1.4	1.3	1.6	No	No	No
414	1 BUCKRIDGE STREET PITT TOWN	R	GF	NW	52	47	52	46	53	48	53	47	55	50	No	No	0.3	0.9	0.6	1	No	No	No
414	1 BUCKRIDGE STREET PITT TOWN	R	GF	NE	53	47	52	46	53	48	53	47	55	50	No	No	0.3	1	0.6	1	No	No	No
416	16 LAGOON ROAD PITT TOWN	R	GF	E	49	44	50	44	50	45	50	45	60	55	No	No	-0.4	-0.3	-0.7	-0.5	No	No	No
417	15 ELDON STREET PITT TOWN	R	GF	W	56	50	60	54	56	50	61	55	60	55	No	No	-4	-4.1	-4.8	-5	No	No	No
417	15 ELDON STREET PITT TOWN	R	F 1	W	58	52	62	56	58	52	63	57	60	55	No	No	-3.9	-4	-4.7	-4.8	No	No	No
417	15 ELDON STREET PITT TOWN	R	GF	N	55	49	59	53	55	49	60	54	60	55	No	No	-3.9	-3.9	-4.7	-4.8	No	No	No
417	15 ELDON STREET PITT TOWN	R	F 1	N	57	51	61	55	57	51	62	56	60	55	No	No	-3.8	-3.8	-4.6	-4.7	No	No	No
417	15 ELDON STREET PITT TOWN	R	GF	W	52	47	56	50	52	47	57	51	60	55	No	No	-3.6	-3.5	-4.5	-4.4	No	No	No
417	15 ELDON STREET PITT TOWN	R	F 1	W	55	49	58	53	55	49	59	53	60	55	No	No	-3.5	-3.4	-4.5	-4.3	No	No	No
417	15 ELDON STREET PITT TOWN	R	F 1	S	49	44	52	46	50	44	53	47	60	55	No	No	-2.6	-2.5	-3.2	-3	No	No	No
417	15 ELDON STREET PITT TOWN	R	F 1	S	48	43	51	45	49	43	52	46	60	55	No	No	-2.4	-2.3	-2.9	-2.7	No	No	No
417	15 ELDON STREET PITT TOWN	R	F 1	S	50	44	52	47	50	45	53	48	60	55	No	No	-2.7	-2.6	-3.3	-3.2	No	No	No
417	15 ELDON STREET PITT TOWN	R	GF	E	56	50	60	54	56	50	61	55	60	55	No	No	-3.9	-4	-4.7	-4.9	No	No	No
417	15 ELDON STREET PITT TOWN	R	F 1	E	59	54	63	58	60	54	64	58	60	55	No	No	-3.9	-4	-4.7	-4.7	No	No	No
417	15 ELDON STREET PITT TOWN	R	GF	N	61	55	65	59	61	55	66	60	60	55	Yes	No	-4.1	-4.3	-4.8	-5.3	No	No	No

ID	Address	Class	Floor	Façade	2021 $L_{Aeq, period}$				2031 $L_{Aeq, period}$				NCG Criteria		Exceedance of NCG Criteria		Change in noise level				Equal to or above Cumulative Limit		Consider further additional noise mitigation
					Build		No Build		Build		No Build						2021		2031		2031		
					Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	
417	15 ELDON STREET PITT TOWN	R	F 1	N	62	56	66	60	63	56	67	61	60	55	Yes	Yes	-4.2	-4.5	-4.7	-5.3	No	No	No
418	13 ELDON STREET PITT TOWN	R	GF	W	52	46	56	50	52	47	56	51	60	55	No	No	-3.6	-3.6	-4.4	-4.3	No	No	No
418	13 ELDON STREET PITT TOWN	R	GF	S	47	42	50	45	48	42	51	46	60	55	No	No	-2.7	-2.7	-3.4	-3.2	No	No	No
418	13 ELDON STREET PITT TOWN	R	GF	N	61	55	65	59	62	55	66	60	60	55	Yes	No	-3.9	-4.1	-4.6	-5.1	No	No	No
419	11 ELDON STREET PITT TOWN	R	GF	E	52	46	56	50	52	46	57	51	60	55	No	No	-3.8	-3.8	-4.5	-4.7	No	No	No
419	11 ELDON STREET PITT TOWN	R	GF	N	62	55	66	60	62	55	67	61	60	55	Yes	Yes	-3.9	-4.2	-4.5	-5.2	No	No	No
419	11 ELDON STREET PITT TOWN	R	GF	N	61	55	65	59	62	55	66	60	60	55	Yes	No	-3.9	-4.2	-4.6	-5.1	No	No	No
419	11 ELDON STREET PITT TOWN	R	GF	N	62	55	66	60	62	55	67	61	60	55	Yes	Yes	-3.9	-4.3	-4.5	-5.2	No	No	No
420	9 ELDON STREET PITT TOWN	R	GF	W	49	43	52	47	49	44	53	48	60	55	No	No	-3.4	-3.4	-4.3	-4.1	No	No	No
420	9 ELDON STREET PITT TOWN	R	F 1	W	54	48	57	51	54	48	58	52	60	55	No	No	-3.2	-3.2	-4.3	-4.2	No	No	No
420	9 ELDON STREET PITT TOWN	R	F 1	S	49	43	51	45	49	44	51	46	60	55	No	No	-2	-1.8	-2.1	-1.9	No	No	No
420	9 ELDON STREET PITT TOWN	R	GF	E	53	48	57	52	53	48	58	52	60	55	No	No	-3.7	-3.6	-4.5	-4.4	No	No	No
420	9 ELDON STREET PITT TOWN	R	F 1	E	55	49	58	53	55	50	59	54	60	55	No	No	-3.6	-3.5	-4.4	-4.3	No	No	No
420	9 ELDON STREET PITT TOWN	R	GF	N	61	55	65	59	62	55	66	60	60	55	Yes	No	-3.9	-4.2	-4.6	-5.2	No	No	No
420	9 ELDON STREET PITT TOWN	R	F 1	N	62	56	67	60	63	56	67	61	60	55	Yes	Yes	-4.1	-4.4	-4.6	-5.2	No	No	No
421	7 ELDON STREET PITT TOWN	R	GF	W	54	48	57	52	54	48	58	53	60	55	No	No	-3.7	-3.6	-4.5	-4.5	No	No	No
421	7 ELDON STREET PITT TOWN	R	F 1	W	55	50	59	53	55	50	60	54	60	55	No	No	-3.7	-3.6	-4.4	-4.3	No	No	No
421	7 ELDON STREET PITT TOWN	R	F 1	S	49	44	51	45	50	45	52	46	60	55	No	No	-1.8	-1.4	-1.7	-1.5	No	No	No
421	7 ELDON STREET PITT TOWN	R	GF	E	52	46	56	50	52	46	56	51	60	55	No	No	-3.8	-3.8	-4.6	-4.6	No	No	No
421	7 ELDON STREET PITT TOWN	R	F 1	E	53	48	57	51	54	48	58	52	60	55	No	No	-3.7	-3.7	-4.4	-4.4	No	No	No
421	7 ELDON STREET PITT TOWN	R	GF	N	63	56	66	60	63	56	67	61	60	55	Yes	Yes	-3.9	-4.2	-4.4	-5.2	No	No	No
421	7 ELDON STREET PITT TOWN	R	F 1	N	63	56	67	61	64	57	68	62	60	55	Yes	Yes	-4.1	-4.5	-4.6	-5.3	No	No	No
422	5 ELDON STREET PITT TOWN	R	GF	W	53	47	57	51	54	47	58	52	60	55	No	No	-3.9	-4.1	-4.7	-4.9	No	No	No
422	5 ELDON STREET PITT TOWN	R	F 1	W	55	49	59	53	55	49	60	54	60	55	No	No	-3.9	-4.1	-4.7	-4.8	No	No	No
422	5 ELDON STREET PITT TOWN	R	F 1	S	49	43	51	45	49	44	51	46	60	55	No	No	-1.8	-1.7	-2.2	-2	No	No	No
422	5 ELDON STREET PITT TOWN	R	GF	E	53	47	57	51	53	47	58	52	60	55	No	No	-3.9	-4	-4.7	-4.9	No	No	No
422	5 ELDON STREET PITT TOWN	R	F 1	E	55	49	58	53	55	49	59	53	60	55	No	No	-3.9	-4	-4.5	-4.7	No	No	No
422	5 ELDON STREET PITT TOWN	R	GF	N	63	56	67	60	63	56	68	61	60	55	Yes	Yes	-3.9	-4.3	-4.4	-5.2	No	No	No
422	5 ELDON STREET PITT TOWN	R	F 1	N	63	56	67	61	64	57	68	62	60	55	Yes	Yes	-4.1	-4.6	-4.6	-5.4	No	No	No
423	3 ELDON STREET PITT TOWN	R	GF	W	53	47	57	51	53	47	58	52	60	55	No	No	-4	-4	-4.7	-5	No	No	No
423	3 ELDON STREET PITT TOWN	R	F 1	W	55	48	58	53	55	49	59	53	60	55	No	No	-3.9	-4.1	-4.6	-4.8	No	No	No
423	3 ELDON STREET PITT TOWN	R	F 1	S	49	43	51	45	49	44	52	46	60	55	No	No	-2	-1.8	-2.3	-2.2	No	No	No
423	3 ELDON STREET PITT TOWN	R	GF	E	54	48	58	52	54	48	59	53	60	55	No	No	-3.9	-3.9	-4.5	-4.7	No	No	No
423	3 ELDON STREET PITT TOWN	R	F 1	E	59	53	62	56	59	53	63	57	60	55	No	No	-3.6	-3.7	-4.2	-4.4	No	No	No
423	3 ELDON STREET PITT TOWN	R	GF	N	62	55	66	60	62	56	67	61	60	55	Yes	Yes	-3.8	-4.1	-4.4	-5	No	No	No
423	3 ELDON STREET PITT TOWN	R	F 1	N	63	56	67	60	63	56	68	62	60	55	Yes	Yes	-4	-4.3	-4.5	-5.1	No	No	No
423	3 ELDON STREET PITT TOWN	R	GF	N	61	55	65	59	62	55	66	60	60	55	Yes	No	-3.9	-4.1	-4.4	-5.1	No	No	No
423	3 ELDON STREET PITT TOWN	R	F 1	N	62	56	66	60	63	56	67	61	60	55	Yes	Yes	-4.1	-4.3	-4.5	-5.1	No	No	No
423	3 ELDON STREET PITT TOWN	R	GF	N	62	56	66	60	63	56	67	61	60	55	Yes	Yes	-3.9	-4.2	-4.4	-5.2	No	No	No
423	3 ELDON STREET PITT TOWN	R	F 1	N	63	56	67	61	64	57	68	62	60	55	Yes	Yes	-4.1	-4.5	-4.5	-5.3	No	No	No
424	1 ELDON STREET PITT TOWN	R	GF	W	55	49	59	53	55	49	60	54	60	55	No	No	-3.9	-4	-4.6	-4.9	No	No	No
424	1 ELDON STREET PITT TOWN	R	GF	S	48	43	51	45	49	43	52	46	60	55	No	No	-2.8	-2.7	-3.2	-3.1	No	No	No
424	1 ELDON STREET PITT TOWN	R	GF	E	59	53	62	56	59	53	63	57	60	55	No	No	-3.6	-3.5	-4.2	-4.3	No	No	No
424	1 ELDON STREET PITT TOWN	R	GF	N	62	56	66	60	63	56	67	61	60	55	Yes	Yes	-3.8	-4	-4.3	-5	No	No	No
425	9 SOMERSET STREET PITT TOWN	R	GF	NW	57	51	61	55	57	51	62	56	60	55	No	No	-3.7	-3.7	-4.5	-4.6	No	No	No
425	9 SOMERSET STREET PITT TOWN	R	GF	SW	48	43	51	45	48	43	52	46	60	55	No	No	-2.8	-2.8	-3.5	-3.3	No	No	No
425	9 SOMERSET STREET PITT TOWN	R	GF	SE	50	44	52	46	51	45	53	47	60	55	No	No	-2.5	-1.7	-2.1	-1.7	No	No	No
425	9 SOMERSET STREET PITT TOWN	R	GF	SW	47	42	50	45	48	42	51	46	60	55	No	No	-2.9	-2.8	-3.4	-3.2	No	No	No
425	9 SOMERSET STREET PITT TOWN	R	GF	SE	54	49	58	52	55	49	58	53	60	55	No	No	-3.3	-2.9	-3.5	-3.1	No	No	No
425	9 SOMERSET STREET PITT TOWN	R	GF	NE	59	53	63	57	59	54	64	58	60	55	No	No	-3.5	-3.4	-4.1	-4.1	No	No	No
426	13 MAWSON PLACE PITT TOWN	R	GF	NW	55	50	59	53	55	50	60	54	60	55	No	No	-3.5	-3.4	-4.4	-4.2	No	No	No
426	13 MAWSON PLACE PITT TOWN	R	F 1	NW	57	52	61	55	57	52	62	56	60	55	No	No	-3.5	-3.5	-4.4	-4.2	No	No	No
426	13 MAWSON PLACE PITT TOWN	R	F 1	SW	48	43	51	45	48	43	51	46	60	55	No	No	-2.3	-2.2	-3.1	-3	No	No	No
426	13 MAWSON PLACE PITT TOWN	R	GF	SE	53	47	56	50	54	48	57	51	60	55	No	No	-3.4	-2.9	-3.2	-2.8	No	No	No
426	13 MAWSON PLACE PITT TOWN	R	F 1	SE	54	48	58	51	55	49	58	52	60	55	No	No	-3.6	-3.1	-3.3	-3	No	No	No
426	13 MAWSON PLACE PITT TOWN	R	GF	NE	58	52	61	55	58	53	62	56	60	55	No	No	-3.5	-3.2	-3.9	-3.6	No	No	No
426	13 MAWSON PLACE PITT TOWN	R	F 1	NE	59	53	62	57	59	54	63	58	60	55	No	No	-3.6	-3.3	-4.1	-3.9	No	No	No
427	12 MAWSON PLACE PITT TOWN	R	GF	NW	49	43	52	47	49	43	53	47	60	55	No	No	-3.3	-3.3	-4.2	-4.1	No	No	No
427	12 MAWSON PLACE PITT TOWN	R	F 1	NW	52	46	55	49	52	46	56	50	60	55	No	No	-3.1	-3	-4	-3.9	No	No	No
427	12 MAWSON PLACE PITT TOWN	R	GF	SE	51	45	55	48	52	46	55	49	60	55	No	No	-3.6	-3	-3.2	-2.9	No	No	No
427	12 MAWSON PLACE PITT TOWN	R	F 1	SE	52	47	56	50	53	48	56	51	60	55	No	No	-3.6	-3.1	-3.3	-3	No	No	No
427	12 MAWSON PLACE PITT TOWN	R	F 1	NE	49	44	52	46	49	44	53	47	60	55	No	No	-2.5	-2.3	-3.5	-3.3	No	No	No
428	1 MAWSON PLACE PITT TOWN	R	GF	NW	51	45	54	49	51	46	55	50	60	55	No	No	-3.6	-3.6	-4.2	-4	No	No	No
428	1 MAWSON PLACE PITT TOWN	R	F 1	NW	52	47	56	50	53	47	57	51	60	55	No	No	-3.6	-3.5	-4.1	-3.9	No	No	No
428	1 MAWSON PLACE PITT TOWN	R	GF	SE	51	45	54	48	51	46	54	48	60	55	No	No	-3.7	-2.6	-3	-2.4	No	No	No
428	1 MAWSON PLACE PITT TOWN	R	F 1	SE	53	47	56	50	54	48	57	50	60	55	No	No	-3.4	-2.4	-2.8	-2.2	No	No	No
428	1 MAWSON PLACE PITT TOWN	R	GF	NE	54	48	58	52	54	49	58	52	60	55	No	No	-4.2	-3.5	-4.2	-3.6	No	No	No
428	1 MAWSON PLACE PITT TOWN	R	F 1	NE	55	50	59	53	56	50	60	54	60	55	No	No	-3.8	-3.2	-3.6	-3.2	No	No	No
429	2 MAWSON PLACE PITT TOWN	R	GF	NW	49	43	52	47	49	44	53	48	60	55	No	No	-3.6	-3.5	-4.1	-3.9	No	No	No
429	2 MAWSON PLACE PITT TOWN	R	F 1	NW	51	45	54	48	51	46	55	49	60	55	No	No	-3.5	-3.4	-3.8	-3.7	No	No	No
429	2 MAWSON PLACE PITT TOWN	R	F 1	SE	51	46	54	48	53	47	55	48	60	55	No	No	-2.9	-1.7	-2	-1.4	No	No	No
430	3 MAWSON PLACE PITT TOWN	R	GF	SE	50	44	52	46	51	45	52	47	60	55	No	No	-1.9	-1.2	-1.5	-1.1	No	No	No
430	3 MAWSON PLACE PITT TOWN	R	F 1	SE	52	46	54	47	52	47	54	48	60	55	No	No	-2.1	-1.4	-1.6	-1.3	No	No	No
430	3 MAWSON PLACE PITT TOWN	R	GF	NE	50	44	51	44	51	45	51	45	60	55	No	No	-1.3	-0.3	-0.6	0	No	No	No
430	3 MAWSON PLACE PITT TOWN	R	F 1	NE	51	46	54	48	52	47	55	49	60	55	No	No	-3	-2.2	-2.3	-1.9	No	No	No
431	4 MAWSON PLACE PITT TOWN	R	F 1	SE	51	45	51	44	51	46	51	46	59	54	No	No	0	0.6	0	0.3	No	No	No
431	4 MAWSON PLACE PITT TOWN	R	GF	NE	49	43	51	44	50	44	51	45	59	54	No	No	-1.7	-1	-1.4	-1.1	No	No	No
431	4 MAWSON PLACE PITT TOWN	R	F 1	NE	51	45	53	46	52	46	53	47	59	54	No	No	-2	-1.3	-1.5	-1.2	No	No	No
432	6 MAWSON PLACE PITT TOWN	R	F 1	N	48	42	50	44	48	43	51	45	59	54	No	No	-2.1	-2	-2.4	-2.2	No	No	No
434	7 MAWSON PLACE PITT TOWN	R	F 1	NW	48	43	51	46	49	43	52	47	60	55	No	No	-3.4	-3.2	-3.6	-3.3	No	No	No

ID	Address	Class	Floor	Façade	2021 $L_{Aeq,\ period}$				2031 $L_{Aeq,\ period}$				NCG Criteria		Exceedance of NCG Criteria		Change in noise level				Equal to or above Cumulative Limit		Consider further additional noise mitigation
					Build		No Build		Build		No Build						2021		2031		2031		
					Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	
434	7 MAWSON PLACE PITT TOWN	R	F 1	SE	49	44	51	45	50	44	51	46	60	55	No	No	-1.6	-1.3	-1.7	-1.4	No	No	No
434	7 MAWSON PLACE PITT TOWN	R	F 1	E	48	43	51	45	49	44	51	46	60	55	No	No	-2.4	-2	-2.3	-2.1	No	No	No
434	7 MAWSON PLACE PITT TOWN	R	F 1	SE	49	43	51	45	49	44	52	46	60	55	No	No	-2.4	-2.1	-2.4	-2.1	No	No	No
434	7 MAWSON PLACE PITT TOWN	R	GF	NE	47	41	53	46	47	42	53	47	60	55	No	No	-5.8	-5	-5.8	-5.2	No	No	No
434	7 MAWSON PLACE PITT TOWN	R	F 1	NE	49	44	54	48	50	44	54	48	60	55	No	No	-4.7	-4	-4.7	-4.3	No	No	No
435	8 MAWSON PLACE PITT TOWN	R	GF	NW	46	41	51	45	47	42	52	46	60	55	No	No	-4.8	-4.3	-4.6	-4.4	No	No	No
435	8 MAWSON PLACE PITT TOWN	R	F 1	NW	49	43	53	47	49	44	54	48	60	55	No	No	-4.3	-3.9	-4.2	-4	No	No	No
435	8 MAWSON PLACE PITT TOWN	R	F 1	SE	48	42	52	45	48	43	52	46	60	55	No	No	-4	-2.9	-3.7	-3	No	No	No
435	8 MAWSON PLACE PITT TOWN	R	GF	NE	47	42	52	46	48	43	53	47	60	55	No	No	-4.5	-3.9	-4.4	-4	No	No	No
435	8 MAWSON PLACE PITT TOWN	R	F 1	NE	49	44	53	47	50	45	54	48	60	55	No	No	-4.1	-3.4	-4	-3.6	No	No	No
436	9 MAWSON PLACE PITT TOWN	R	F 1	NW	49	43	51	46	49	43	52	46	60	55	No	No	-2.5	-2.4	-3.3	-3.2	No	No	No
436	9 MAWSON PLACE PITT TOWN	R	F 1	NE	48	42	50	44	48	42	51	45	60	55	No	No	-2.1	-2	-2.8	-2.6	No	No	No
437	10 MAWSON PLACE PITT TOWN	R	F 1	NW	48	43	51	45	48	43	52	46	60	55	No	No	-2.5	-2.4	-3.2	-3.1	No	No	No
437	10 MAWSON PLACE PITT TOWN	R	F 1	SE	49	44	51	44	50	45	51	45	60	55	No	No	-1.3	-0.4	-0.7	-0.3	No	No	No
438	11 MAWSON PLACE PITT TOWN	R	F 1	NW	49	44	52	46	49	44	53	47	60	55	No	No	-2.7	-2.6	-3.7	-3.5	No	No	No
438	11 MAWSON PLACE PITT TOWN	R	F 1	SE	50	44	51	46	50	44	52	47	60	55	No	No	-1.8	-1.6	-2.2	-2.1	No	No	No
438	11 MAWSON PLACE PITT TOWN	R	GF	NE	48	42	51	45	48	42	52	46	60	55	No	No	-3.1	-3	-3.9	-3.8	No	No	No
438	11 MAWSON PLACE PITT TOWN	R	F 1	NE	51	45	53	48	51	45	54	49	60	55	No	No	-2.8	-2.7	-3.6	-3.6	No	No	No
439	2 OLD PITT TOWN ROAD PITT TOWN	R	GF	NW	54	48	58	52	54	49	58	53	60	55	No	No	-4.5	-3.9	-4.4	-4.2	No	No	No
439	2 OLD PITT TOWN ROAD PITT TOWN	R	GF	SW	49	43	51	45	49	44	51	46	60	55	No	No	-2.2	-1.8	-2.3	-2.2	No	No	No
439	2 OLD PITT TOWN ROAD PITT TOWN	R	GF	SE	53	47	56	50	54	48	56	50	60	55	No	No	-3.5	-2.3	-2.6	-2.1	No	No	No
439	2 OLD PITT TOWN ROAD PITT TOWN	R	GF	NE	56	50	59	53	56	51	60	54	60	55	No	No	-3.7	-2.9	-3.4	-3	No	No	No
440	408 PITT TOWN ROAD PITT TOWN	R	F 1	W	51	46	50	44	51	46	50	45	60	55	No	No	1.2	1.4	0.6	0.8	No	No	No
441	402 PITT TOWN ROAD PITT TOWN	R	F 1	W	51	46	50	45	51	46	51	46	60	55	No	No	0.8	1	0.4	0.6	No	No	No
441	402 PITT TOWN ROAD PITT TOWN	R	F 1	N	51	46	50	45	51	46	51	46	60	55	No	No	0.9	1.1	0.5	0.6	No	No	No
441	402 PITT TOWN ROAD PITT TOWN	R	GF	W	50	45	50	44	51	46	50	45	60	55	No	No	0.9	1	0.4	0.6	No	No	No
441	402 PITT TOWN ROAD PITT TOWN	R	F 1	W	51	46	50	45	51	46	51	46	60	55	No	No	0.7	0.9	0.3	0.5	No	No	No
441	402 PITT TOWN ROAD PITT TOWN	R	F 1	SW	50	45	50	44	51	46	51	45	60	55	No	No	0.7	0.9	0.2	0.4	No	No	No
441	402 PITT TOWN ROAD PITT TOWN	R	F 1	NW	50	45	50	44	51	45	51	45	60	55	No	No	0.6	0.8	0	0.2	No	No	No
441	402 PITT TOWN ROAD PITT TOWN	R	F 1	SW	50	45	50	44	50	45	50	45	60	55	No	No	0.7	0.7	0	0.1	No	No	No
441	402 PITT TOWN ROAD PITT TOWN	R	F 1	N	51	45	50	44	51	46	51	45	60	55	No	No	0.9	1.1	0.3	0.5	No	No	No
442	396 PITT TOWN ROAD PITT TOWN	R	GF	W	51	46	51	46	52	46	52	47	60	55	No	No	-0.3	-0.2	-0.7	-0.6	No	No	No
442	396 PITT TOWN ROAD PITT TOWN	R	F 1	W	51	46	52	46	52	47	53	47	60	55	No	No	-0.2	-0.1	-0.6	-0.4	No	No	No
442	396 PITT TOWN ROAD PITT TOWN	R	GF	N	50	45	50	45	51	46	51	46	60	55	No	No	-0.2	-0.1	-0.4	-0.2	No	No	No
442	396 PITT TOWN ROAD PITT TOWN	R	F 1	N	51	45	51	45	51	46	52	46	60	55	No	No	-0.3	-0.1	-0.3	-0.2	No	No	No
442	396 PITT TOWN ROAD PITT TOWN	R	GF	W	50	45	50	45	51	46	51	46	60	55	No	No	0	0.1	-0.6	-0.4	No	No	No
442	396 PITT TOWN ROAD PITT TOWN	R	F 1	W	51	45	51	45	51	46	52	46	60	55	No	No	0	0.2	-0.5	-0.3	No	No	No
442	396 PITT TOWN ROAD PITT TOWN	R	GF	N	51	45	51	45	51	46	51	46	60	55	No	No	0	0.1	-0.5	-0.3	No	No	No
442	396 PITT TOWN ROAD PITT TOWN	R	F 1	N	51	46	51	45	51	46	52	46	60	55	No	No	0	0.1	-0.5	-0.3	No	No	No
443	390 PITT TOWN ROAD PITT TOWN	R	GF	W	51	45	51	45	51	46	52	46	60	55	No	No	0	0.1	-0.5	-0.3	No	No	No
443	390 PITT TOWN ROAD PITT TOWN	R	F 1	W	51	46	51	46	52	46	52	47	60	55	No	No	-0.1	0	-0.5	-0.2	No	No	No
443	390 PITT TOWN ROAD PITT TOWN	R	GF	N	50	45	50	45	51	45	51	46	60	55	No	No	0.1	0.3	-0.4	-0.3	No	No	No
443	390 PITT TOWN ROAD PITT TOWN	R	F 1	N	51	45	50	45	51	46	51	46	60	55	No	No	0.2	0.3	-0.3	-0.2	No	No	No
444	384 PITT TOWN ROAD PITT TOWN	R	GF	W	50	45	50	44	50	45	51	45	60	55	No	No	0.2	0.4	-0.1	0	No	No	No
444	384 PITT TOWN ROAD PITT TOWN	R	F 1	W	50	45	50	45	51	46	51	46	60	55	No	No	0.2	0.3	-0.1	0	No	No	No
444	384 PITT TOWN ROAD PITT TOWN	R	GF	N	49	44	50	44	50	45	51	45	60	55	No	No	-0.2	0	-0.7	-0.5	No	No	No
444	384 PITT TOWN ROAD PITT TOWN	R	F 1	N	50	45	50	45	51	45	51	46	60	55	No	No	-0.2	0	-0.6	-0.5	No	No	No
446	377 PITT TOWN ROAD PITT TOWN	R	GF	W	54	49	53	48	55	50	54	49	60	55	No	No	1.1	1.1	1.4	1.4	No	No	No
446	377 PITT TOWN ROAD PITT TOWN	R	GF	SE	58	53	57	52	59	53	58	53	60	55	No	No	1.1	1.1	0.9	0.8	No	No	No
446	377 PITT TOWN ROAD PITT TOWN	R	GF	E	57	52	56	51	58	53	57	52	60	55	No	No	1.1	1.1	1	1	No	No	No
446	377 PITT TOWN ROAD PITT TOWN	R	GF	E	58	53	57	52	59	54	58	53	60	55	No	No	1.1	1	1	1	No	No	No
446	377 PITT TOWN ROAD PITT TOWN	R	GF	S	60	54	58	53	60	55	59	54	60	55	Yes	No	1.3	1.3	0.9	1	No	No	No
446	377 PITT TOWN ROAD PITT TOWN	R	GF	E	62	57	61	55	63	57	62	56	60	55	Yes	Yes	1.1	1.2	1.1	1	No	No	No
446	377 PITT TOWN ROAD PITT TOWN	R	GF	N	61	56	60	55	62	57	61	56	60	55	Yes	Yes	0.9	0.9	0.8	0.8	No	No	No
446	377 PITT TOWN ROAD PITT TOWN	R	GF	W	57	51	56	51	58	52	57	51	60	55	No	No	0.8	0.8	0.8	0.8	No	No	No
446	377 PITT TOWN ROAD PITT TOWN	R	GF	N	57	52	57	51	58	53	58	52	60	55	No	No	0.6	0.6	0.5	0.5	No	No	No
464	23 OLD PITT TOWN ROAD PITT TOWN	R	GF	W	57	51	55	48	58	52	56	49	60	55	No	No	1.4	2.1	1.4	2.1	No	No	No
464	23 OLD PITT TOWN ROAD PITT TOWN	R	GF	S	59	51	58	50	60	52	59	51	60	55	No	No	0.4	1	0.4	0.9	No	No	No
464	23 OLD PITT TOWN ROAD PITT TOWN	R	GF	E	55	48	55	47	56	49	56	49	60	55	No	No	0.3	0.3	0.3	0.2	No	No	No
464	23 OLD PITT TOWN ROAD PITT TOWN	R	GF	E	52	45	52	44	53	46	53	46	60	55	No	No	0.4	0.5	0.3	0.4	No	No	No
464	23 OLD PITT TOWN ROAD PITT TOWN	R	GF	N	54	48	53	46	55	49	53	47	60	55	No	No	1.2	1.5	1.4	1.4	No	No	No
465	49 OLD PITT TOWN ROAD PITT TOWN	R	F 1	SW	51	44	51	44	52	45	52	45	60	55	No	No	-0.1	0.1	0	0	No	No	No
467	71 BATHURST STREET PITT TOWN	C	GF	NW	52	47	56	51	53	47	57	52	0	0	N/A	N/A	-3.8	-3.9	-4.7	-4.5	No	No	No
467	71 BATHURST STREET PITT TOWN	C	GF	SW	55	49	58	52	56	50	59	54	0	0	N/A	N/A	-2.8	-3	-3.3	-3.1	No	No	No
467	71 BATHURST STREET PITT TOWN	C	GF	SE	60	54	63	58	61	55	65	59	0	0	N/A	N/A	-3.5	-4	-4.3	-4.5	No	No	No
467	71 BATHURST STREET PITT TOWN	C	GF	NE	61	54	64	58	61	55	66	60	0	0	N/A	N/A	-3.6	-4.2	-4.6	-5	No	No	No
467	71 BATHURST STREET PITT TOWN	C	GF	SE	60	54	64	58	61	55	66	60	0	0	N/A	N/A	-3.5	-4.1	-4.5	-4.8	No	No	No
467	71 BATHURST STREET PITT TOWN	C	GF	NE	60	53	63	58	60	54	65	59	0	0	N/A	N/A	-3.7	-4.2	-4.6	-4.8	No	No	No
468	71 BATHURST STREET PITT TOWN	C	GF	SW	51	45	53	47	52	46	54	48	0	0	N/A	N/A	-2.1	-2.2	-2.3	-2.2	No	No	No
468	71 BATHURST STREET PITT TOWN	C	GF	S	51	46	53	48	52	47	54	49	0	0	N/A	N/A	-2.2	-2.3	-2.4	-2.3	No	No	No
468	71 BATHURST STREET PITT TOWN	C	GF	SE	51	46	53	48	52	47	54	49	0	0	N/A	N/A	-2.3	-2.4	-2.5	-2.4	No	No	No
468	71 BATHURST STREET PITT TOWN	C	GF	S	51	45	53	48	52	46	54	49	0	0	N/A	N/A	-2.5	-2.6	-2.7	-2.6	No	No	No
468	71 BATHURST STREET PITT TOWN	C	GF	W	48	42	51	45	48	43	52	46	0	0	N/A	N/A	-3.1	-3.2	-3.5	-3.4	No	No	No
468	71 BATHURST STREET PITT TOWN	C	GF	S	51	45	53	48	52	46	55	49	0	0	N/A	N/A	-2.6	-2.7	-3	-2.9	No	No	No
468	71 BATHURST STREET PITT TOWN	C	GF	E	49	43	52	46	49	44	53	48	0	0	N/A	N/A	-3.2	-3.3	-3.6	-3.5	No	No	No
468	71 BATHURST STREET PITT TOWN	C	GF	S	47	41	50	45	48	42	51	46	0	0	N/A	N/A	-3.1	-3.2	-3.7	-3.5	No	No	No
468	71 BATHURST STREET PITT TOWN	C	GF	W	49	43	52	47	50	44	53	48	0	0	N/A	N/A	-3	-3.1	-3.4	-3.3	No	No	No
468	71 BATHURST STREET PITT TOWN	C	GF	S	50	45	53	48	51	46	55	49	0	0	N/A	N/A	-3	-3.1	-3.6	-3.4	No	No	No
468	71 BATHURST STREET PITT TOWN	C	GF	SE	56	50	59	54	57	51	61	55	0	0	N/A	N/A	-3.4	-3.5	-4.2	-4.1	No	No	No
468	71 BATHURST STREET PITT TOWN	C	GF	E	59	53	62	57	59	54	64	58	0	0	N/A	N/A	-3.8	-4	-4.6	-4.6	No	No	No

ID	Address	Class	Floor	Façade	2021 $L_{Aeq,\ period}$				2031 $L_{Aeq,\ period}$				NCG Criteria		Exceedance of NCG Criteria		Change in noise level				Equal to or above Cumulative Limit		Consider further additional noise mitigation
					Build		No Build		Build		No Build						2021		2031		2031		
					Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	
469	80 BATHURST STREET PITT TOWN	R	GF	SE	55	49	57	52	56	50	59	53	60	55	No	No	-2.4	-2.6	-2.8	-2.7	No	No	No
469	80 BATHURST STREET PITT TOWN	R	F 1	SE	56	51	59	53	57	52	60	55	60	55	No	No	-2.5	-2.6	-2.9	-2.8	No	No	No
469	80 BATHURST STREET PITT TOWN	R	GF	NE	56	50	58	52	57	51	59	54	60	55	No	No	-1.7	-2	-2	-2.1	No	No	No
469	80 BATHURST STREET PITT TOWN	R	F 1	NE	57	51	59	53	58	52	60	54	60	55	No	No	-1.9	-2.2	-2.3	-2.3	No	No	No
470	80A BATHURST STREET PITT TOWN	R	GF	SE	47	41	49	44	48	42	51	45	60	55	No	No	-2.6	-2.6	-3	-2.9	No	No	No
470	80A BATHURST STREET PITT TOWN	R	F 1	SE	50	44	52	47	50	45	54	48	60	55	No	No	-2.6	-2.8	-3.2	-3	No	No	No
470	80A BATHURST STREET PITT TOWN	R	F 1	NE	49	44	51	46	50	45	53	47	60	55	No	No	-2.4	-2.6	-2.8	-2.6	No	No	No
471	82 BATHURST STREET PITT TOWN	R	GF	NE	55	49	56	50	56	50	57	52	60	55	No	No	-1.4	-1.7	-1.7	-1.8	No	No	No
471	82 BATHURST STREET PITT TOWN	R	GF	SE	55	49	56	50	56	50	57	52	60	55	No	No	-1.3	-1.7	-1.5	-1.7	No	No	No
471	82 BATHURST STREET PITT TOWN	R	GF	NE	55	48	56	50	56	50	57	51	60	55	No	No	-0.7	-1.4	-1	-1.2	No	No	No
472	84 BATHURST STREET PITT TOWN	R	GF	NE	54	48	54	49	55	49	55	50	60	55	No	No	-0.3	-0.6	-0.6	-0.6	No	No	No
474	88 BATHURST STREET PITT TOWN	R	F 1	NE	49	43	50	44	50	44	51	45	60	55	No	No	-1.1	-1.4	-1.5	-1.5	No	No	No
474	88 BATHURST STREET PITT TOWN	R	F 1	E	49	43	50	45	50	44	52	46	60	55	No	No	-0.9	-1.3	-1.2	-1.2	No	No	No
475	81 BATHURST STREET PITT TOWN	C	F 1	SE	51	46	53	48	52	46	54	49	0	0	N/A	N/A	-2.1	-2.2	-2.4	-2.3	No	No	No
475	81 BATHURST STREET PITT TOWN	C	GF	SE	39	34	54	48	40	34	55	49	0	0	N/A	N/A	-14.3	-14.2	-14.9	-14.5	No	No	No
475	81 BATHURST STREET PITT TOWN	C	F 1	SE	45	39	55	50	45	40	56	51	0	0	N/A	N/A	-10.5	-10.4	-11	-10.8	No	No	No
475	81 BATHURST STREET PITT TOWN	C	GF	NE	53	46	59	53	53	46	60	54	0	0	N/A	N/A	-6.5	-6.8	-7.1	-7.8	No	No	No
475	81 BATHURST STREET PITT TOWN	C	F 1	NE	53	47	60	53	54	47	61	55	0	0	N/A	N/A	-6.8	-6.9	-7.3	-7.9	No	No	No
476	29 ELDON STREET PITT TOWN	C	F 1	S	50	45	53	48	51	46	54	49	0	0	N/A	N/A	-2.9	-3	-3.4	-3.2	No	No	No
476	29 ELDON STREET PITT TOWN	C	GF	E	59	54	64	58	60	54	65	59	0	0	N/A	N/A	-4.2	-4.3	-5.1	-5	No	No	No
476	29 ELDON STREET PITT TOWN	C	F 1	E	60	55	65	59	61	55	66	60	0	0	N/A	N/A	-4.3	-4.4	-5.1	-5	No	No	No
476	29 ELDON STREET PITT TOWN	C	GF	N	57	51	65	59	57	51	66	60	0	0	N/A	N/A	-8.1	-8.2	-8.9	-9.1	No	No	No
476	29 ELDON STREET PITT TOWN	C	F 1	N	58	51	66	60	58	52	67	61	0	0	N/A	N/A	-8.2	-8.3	-8.9	-9.1	No	No	No
476	29 ELDON STREET PITT TOWN	C	GF	W	38	32	58	52	38	33	59	53	0	0	N/A	N/A	-19.9	-19.8	-20.4	-20.1	No	No	No
476	29 ELDON STREET PITT TOWN	C	F 1	W	44	38	59	53	44	39	60	54	0	0	N/A	N/A	-15.3	-15.2	-15.8	-15.5	No	No	No
476	29 ELDON STREET PITT TOWN	C	GF	N	42	36	59	53	42	37	60	54	0	0	N/A	N/A	-16.8	-16.7	-17.6	-17.4	No	No	No
476	29 ELDON STREET PITT TOWN	C	F 1	N	45	40	60	54	46	40	61	55	0	0	N/A	N/A	-14.6	-14.5	-15.2	-15.1	No	No	No
476	29 ELDON STREET PITT TOWN	C	GF	E	50	44	59	53	50	44	60	54	0	0	N/A	N/A	-9	-8.9	-10	-10	No	No	No
476	29 ELDON STREET PITT TOWN	C	F 1	E	51	45	60	54	52	46	61	55	0	0	N/A	N/A	-8.9	-8.9	-9.7	-9.7	No	No	No
476	29 ELDON STREET PITT TOWN	C	GF	N	53	46	60	54	53	47	61	55	0	0	N/A	N/A	-7.2	-7.3	-8	-8.3	No	No	No
476	29 ELDON STREET PITT TOWN	C	F 1	N	54	48	61	55	54	48	62	56	0	0	N/A	N/A	-7.4	-7.5	-8.1	-8.3	No	No	No
477	25 ELDON STREET PITT TOWN	R	GF	W	55	50	59	53	55	50	60	54	60	55	No	No	-3.7	-3.7	-4.6	-4.4	No	No	No
477	25 ELDON STREET PITT TOWN	R	GF	S	52	46	55	49	52	47	56	51	60	55	No	No	-3.3	-3.4	-4	-3.8	No	No	No
477	25 ELDON STREET PITT TOWN	R	GF	E	56	51	60	54	56	51	61	55	60	55	No	No	-3.7	-3.7	-4.6	-4.4	No	No	No
477	25 ELDON STREET PITT TOWN	R	GF	N	62	55	66	60	62	55	67	61	60	55	Yes	Yes	-4.1	-4.3	-4.8	-5.3	No	No	No
478	27 ELDON STREET PITT TOWN	R	GF	W	62	55	66	60	63	56	68	62	60	55	Yes	Yes	-4.1	-4.7	-5	-5.7	No	No	No
478	27 ELDON STREET PITT TOWN	R	GF	S	57	50	60	55	58	51	62	56	60	55	No	No	-3.8	-4.4	-4.7	-5	No	No	No
478	27 ELDON STREET PITT TOWN	R	GF	E	60	53	63	57	60	53	64	58	60	55	No	No	-3.9	-4	-4.6	-4.9	No	No	No
478	27 ELDON STREET PITT TOWN	R	GF	N	64	57	68	62	65	57	70	63	60	55	Yes	Yes	-4.5	-4.8	-5.1	-6.1	No	No	No
479	22 CHATHAM STREET PITT TOWN	R	GF	W	61	55	65	59	62	55	67	61	60	55	Yes	Yes	-3.8	-4.5	-4.7	-5.2	No	No	No
479	22 CHATHAM STREET PITT TOWN	R	GF	S	57	51	60	55	58	52	62	56	60	55	No	No	-3.5	-3.8	-4.3	-4.2	No	No	No
479	22 CHATHAM STREET PITT TOWN	R	GF	E	52	47	56	50	53	47	57	51	60	55	No	No	-3.4	-3.5	-4.2	-4.1	No	No	No
479	22 CHATHAM STREET PITT TOWN	R	GF	N	55	50	59	53	55	50	60	54	60	55	No	No	-3.8	-3.7	-4.7	-4.5	No	No	No
479	22 CHATHAM STREET PITT TOWN	R	GF	E	56	50	59	54	56	50	60	55	60	55	No	No	-3.7	-3.7	-4.6	-4.4	No	No	No
479	22 CHATHAM STREET PITT TOWN	R	GF	N	56	50	59	54	56	50	61	55	60	55	No	No	-3.8	-3.9	-4.7	-4.7	No	No	No
480	24 CHATHAM STREET PITT TOWN	R	GF	W	59	53	62	57	60	54	64	58	60	55	No	No	-3.6	-3.9	-4.5	-4.5	No	No	No
480	24 CHATHAM STREET PITT TOWN	R	GF	S	56	51	59	54	57	51	61	55	60	55	No	No	-3.4	-3.6	-4.1	-4	No	No	No
480	24 CHATHAM STREET PITT TOWN	R	GF	E	50	45	53	48	51	45	54	49	60	55	No	No	-3	-3	-3.4	-3.3	No	No	No
480	24 CHATHAM STREET PITT TOWN	R	GF	S	51	45	53	48	51	46	55	49	60	55	No	No	-2.8	-2.9	-3.3	-3.1	No	No	No
480	24 CHATHAM STREET PITT TOWN	R	GF	E	51	46	54	49	52	46	55	50	60	55	No	No	-3	-2.9	-3.6	-3.5	No	No	No
480	24 CHATHAM STREET PITT TOWN	R	GF	N	54	48	58	52	55	49	59	54	60	55	No	No	-3.7	-3.8	-4.5	-4.4	No	No	No
481	94 BATHURST STREET PITT TOWN	R	GF	SE	49	43	52	45	49	43	53	46	60	55	No	No	-2.7	-2.4	-3.2	-2.9	No	No	No
481	94 BATHURST STREET PITT TOWN	R	GF	NE	48	42	50	44	49	43	52	46	60	55	No	No	-2.5	-2.5	-3.1	-3	No	No	No
484	98 BATHURST STREET PITT TOWN	R	F 1	SE	50	44	52	46	51	45	53	47	60	55	No	No	-2.3	-2.6	-2.6	-2.8	No	No	No
484	98 BATHURST STREET PITT TOWN	R	F 1	NE	49	43	51	45	50	44	52	46	60	55	No	No	-1.8	-2.1	-2.1	-2.2	No	No	No
495	8 CATTAI ROAD PITT TOWN	R	GF	NW	58	52	57	52	59	53	58	53	60	55	No	No	0.5	0.6	0.4	0.5	No	No	No
495	8 CATTAI ROAD PITT TOWN	R	F 1	NW	59	54	58	53	60	55	59	54	60	55	No	No	0.8	0.8	0.7	0.7	No	No	No
495	8 CATTAI ROAD PITT TOWN	R	GF	S	56	50	53	47	57	51	54	48	60	55	No	No	2.4	2.7	2.5	2.6	No	No	No
495	8 CATTAI ROAD PITT TOWN	R	F 1	S	57	51	55	49	58	52	55	50	60	55	No	No	2.5	2.7	2.6	2.7	No	No	No
495	8 CATTAI ROAD PITT TOWN	R	F 1	E	49	44	51	46	50	45	52	47	60	55	No	No	-1.9	-2.1	-1.9	-2.2	No	No	No
495	8 CATTAI ROAD PITT TOWN	R	GF	NE	53	48	56	50	54	49	57	51	60	55	No	No	-2.5	-2.3	-2.5	-2.3	No	No	No
495	8 CATTAI ROAD PITT TOWN	R	F 1	NE	55	50	57	52	56	51	58	53	60	55	No	No	-2	-1.9	-2	-1.8	No	No	No
496	30 CATTAI ROAD PITT TOWN	R	GF	NW	55	50	58	53	56	51	59	54	60	55	No	No	-3.3	-3.3	-3.3	-3.3	No	No	No
496	30 CATTAI ROAD PITT TOWN	R	F 1	NW	57	51	60	54	58	52	60	55	60	55	No	No	-2.8	-2.8	-2.8	-2.8	No	No	No
496	30 CATTAI ROAD PITT TOWN	R	GF	SW	53	47	55	49	54	48	55	50	60	55	No	No	-1.7	-1.6	-1.7	-1.6	No	No	No
496	30 CATTAI ROAD PITT TOWN	R	F 1	SW	55	49	56	50	55	50	57	51	60	55	No	No	-1.4	-1.2	-1.3	-1.3	No	No	No
496	30 CATTAI ROAD PITT TOWN	R	F 1	SE	51	45	50	44	51	46	51	45	60	55	No	No	0.7	0.9	0.8	0.8	No	No	No
496	30 CATTAI ROAD PITT TOWN	R	GF	NE	51	45	56	51	51	46	57	52	60	55	No	No	-5.3	-5.2	-5.3	-5.3	No	No	No
496	30 CATTAI ROAD PITT TOWN	R	F 1	NE	53	47	57	52	53	48	58	53	60	55	No	No	-4.7	-4.6	-4.7	-4.6	No	No	No
497	38 CATTAI ROAD PITT TOWN	R	GF	NW	53	47	57	52	54	49	58	53	60	55	No	No	-4.7	-4.6	-4.7	-4.6	No	No	No
497	38 CATTAI ROAD PITT TOWN	R	F 1	NW	54	49	59	53	55	50	60	54	60	55	No	No	-4.4	-4.3	-4.4	-4.3	No	No	No
497	38 CATTAI ROAD PITT TOWN	R	GF	SW	50	45	54	48	51	46	55	49	60	55	No	No	-3.5	-3.4	-3.6	-3.6	No	No	No
497	38 CATTAI ROAD PITT TOWN	R	F 1	SW	52	46	55	50	53	47	56	51	60	55	No	No	-3.3	-3.3	-3.3	-3.4	No	No	No
497	38 CATTAI ROAD PITT TOWN	R	GF	NE	50	44	55	50	50	45	56	51	60	55	No	No	-5.3	-5.3	-5.3	-5.3	No	No	No
497	38 CATTAI ROAD PITT TOWN	R	F 1	NE	52	46	56	51	52	47	57	52	60	55	No	No	-4.7	-4.8	-4.7	-4.8	No	No	No
498	46 CATTAI ROAD PITT TOWN	R	GF	NW	58	53	60	55	59	54	61	56	60	55	No	No	-2.1	-2.1	-2.1	-2.1	No	No	No
498	46 CATTAI ROAD PITT TOWN	R	GF	SW	55	49	59	53	55	50	60	55	60	55	No	No	-4.1	-4.1	-4.2	-4.2	No	No	No
498	46 CATTAI ROAD PITT TOWN	R	GF	NW	54	49	59	53	55	50	60	54	60	55	No	No	-4.3	-4.1	-4.3	-4.2	No	No	No
498	46 CATTAI ROAD PITT TOWN	R	GF	SW	54	49	59	53	55	50	59	54	60	55	No	No	-4.3	-4.3	-4.4	-4.3	No	No	No
498	46 CATTAI ROAD PITT TOWN	R	GF	NW	55	50	59	53	56	51	60	54	60	55	No	No	-3.8	-3.8	-3.8	-3.8	No	No	No

ID	Address	Class	Floor	Façade	2021 $L_{Aeq,\ period}$				2031 $L_{Aeq,\ period}$				NCG Criteria		Exceedance of NCG Criteria		Change in noise level				Equal to or above Cumulative Limit		Consider further additional noise mitigation
					Build		No Build		Build		No Build						2021		2031		2031		
					Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	
498	46 CATTAI ROAD PITT TOWN	R	GF	SW	52	46	56	51	53	47	57	52	60	55	No	No	-4.5	-4.6	-4.5	-4.6	No	No	No
498	46 CATTAI ROAD PITT TOWN	R	GF	SE	51	45	50	45	51	46	51	46	60	55	No	No	0.4	0.4	0.4	0.3	No	No	No
498	46 CATTAI ROAD PITT TOWN	R	GF	NE	56	51	57	52	57	52	58	53	60	55	No	No	-0.8	-0.9	-0.8	-0.8	No	No	No
499	54 CATTAI ROAD PITT TOWN	R	GF	NW	54	48	55	49	54	49	56	51	60	55	No	No	-1.3	-1.2	-1.2	-1.3	No	No	No
499	54 CATTAI ROAD PITT TOWN	R	GF	SW	50	45	52	47	51	46	53	48	60	55	No	No	-2.3	-2.4	-2.3	-2.4	No	No	No
499	54 CATTAI ROAD PITT TOWN	R	GF	NE	52	47	52	47	53	48	53	48	60	55	No	No	-0.1	-0.1	-0.1	-0.2	No	No	No
500	29 CATTAI ROAD PITT TOWN	R	GF	NW	49	43	50	45	50	44	51	46	60	55	No	No	-1.5	-1.5	-1.5	-1.4	No	No	No
500	29 CATTAI ROAD PITT TOWN	R	GF	SW	56	50	59	53	57	51	60	54	60	55	No	No	-2.9	-3	-2.9	-3	No	No	No
500	29 CATTAI ROAD PITT TOWN	R	GF	SE	63	57	63	57	63	58	64	59	60	55	Yes	Yes	-0.7	-0.8	-0.6	-0.8	No	No	No
501	29 CATTAI ROAD PITT TOWN	R	GF	NW	50	44	50	45	50	45	51	46	60	55	No	No	-0.4	-0.2	-0.4	-0.2	No	No	No
501	29 CATTAI ROAD PITT TOWN	R	F 1	NW	54	48	54	48	55	49	54	49	60	55	No	No	0.4	0.3	0.2	0.3	No	No	No
501	29 CATTAI ROAD PITT TOWN	R	F 1	SW	56	50	58	53	57	52	59	54	60	55	No	No	-2.1	-2.3	-2	-2.2	No	No	No
501	29 CATTAI ROAD PITT TOWN	R	GF	SE	62	56	63	57	63	58	64	58	60	55	Yes	Yes	-0.6	-0.7	-0.6	-0.7	No	No	No
501	29 CATTAI ROAD PITT TOWN	R	F 1	SE	64	58	64	59	65	59	65	60	60	55	Yes	Yes	-0.4	-0.6	-0.5	-0.5	No	No	No
501	29 CATTAI ROAD PITT TOWN	R	GF	NE	59	54	58	53	60	55	59	54	60	55	No	No	0.8	0.8	0.9	0.8	No	No	No
501	29 CATTAI ROAD PITT TOWN	R	F 1	NE	60	55	60	54	61	56	60	55	60	55	Yes	Yes	0.4	0.4	0.5	0.4	No	No	No
502	53 CATTAI ROAD PITT TOWN	R	GF	SW	50	44	51	46	51	45	52	47	60	55	No	No	-1.7	-1.8	-1.6	-1.9	No	No	No
502	53 CATTAI ROAD PITT TOWN	R	GF	SE	52	46	53	48	52	47	54	49	60	55	No	No	-1.3	-1.4	-1.3	-1.4	No	No	No
502	53 CATTAI ROAD PITT TOWN	R	GF	S	52	46	53	47	52	47	54	48	60	55	No	No	-1.2	-1.3	-1.3	-1.4	No	No	No
502	53 CATTAI ROAD PITT TOWN	R	GF	SE	52	46	53	48	53	48	54	49	60	55	No	No	-0.9	-1.2	-0.8	-1	No	No	No
502	53 CATTAI ROAD PITT TOWN	R	GF	NE	50	45	50	45	51	46	51	46	60	55	No	No	0.2	0.2	0.2	0.2	No	No	No
503	53 CATTAI ROAD PITT TOWN	R	GF	SW	56	51	56	51	57	52	57	52	60	55	No	No	0.1	0.1	0.1	0	No	No	No
503	53 CATTAI ROAD PITT TOWN	R	GF	SE	60	55	59	54	61	56	60	55	60	55	Yes	Yes	0.9	0.8	0.9	0.8	No	No	No
503	53 CATTAI ROAD PITT TOWN	R	GF	NE	56	51	55	50	57	52	56	51	60	55	No	No	1	1	1	1	No	No	No
504	59 CATTAI ROAD PITT TOWN	R	F 1	NW	51	45	50	45	52	46	51	46	60	55	No	No	0.2	0.2	0.3	0.3	No	No	No
504	59 CATTAI ROAD PITT TOWN	R	GF	SW	54	48	54	48	54	49	55	50	60	55	No	No	-0.1	-0.1	-0.2	-0.2	No	No	No
504	59 CATTAI ROAD PITT TOWN	R	F 1	SW	55	50	55	50	56	51	56	51	60	55	No	No	-0.2	-0.2	-0.2	-0.3	No	No	No
504	59 CATTAI ROAD PITT TOWN	R	GF	SE	57	52	57	52	58	53	58	53	60	55	No	No	0.1	-0.1	0.1	0	No	No	No
504	59 CATTAI ROAD PITT TOWN	R	F 1	SE	59	53	59	53	59	54	59	54	60	55	No	No	0.1	0.1	0.1	0	No	No	No
504	59 CATTAI ROAD PITT TOWN	R	GF	SE	57	51	57	51	57	52	57	52	60	55	No	No	0	-0.1	0	-0.1	No	No	No
504	59 CATTAI ROAD PITT TOWN	R	F 1	SE	58	53	58	53	59	54	59	54	60	55	No	No	0	0	0	0	No	No	No
504	59 CATTAI ROAD PITT TOWN	R	GF	SE	57	52	57	52	58	53	58	53	60	55	No	No	0	-0.1	0	-0.1	No	No	No
504	59 CATTAI ROAD PITT TOWN	R	F 1	SE	59	53	59	53	60	54	59	54	60	55	No	No	0.1	0.1	0.1	0	No	No	No
504	59 CATTAI ROAD PITT TOWN	R	GF	NE	54	49	54	49	55	50	55	50	60	55	No	No	0.4	0.3	0.4	0.3	No	No	No
504	59 CATTAI ROAD PITT TOWN	R	F 1	NE	56	51	56	50	57	52	57	51	60	55	No	No	0.6	0.4	0.5	0.5	No	No	No
504	59 CATTAI ROAD PITT TOWN	R	F 1	NE	52	47	51	46	53	48	52	47	60	55	No	No	0.6	0.4	0.6	0.4	No	No	No
505	65 CATTAI ROAD PITT TOWN	C	GF	NW	51	46	51	45	52	47	51	46	0	0	N/A	N/A	0.7	0.7	0.7	0.7	N/A	N/A	No
505	65 CATTAI ROAD PITT TOWN	C	GF	SW	58	53	58	53	59	54	59	54	0	0	N/A	N/A	0	-0.1	0	-0.1	No	No	No
505	65 CATTAI ROAD PITT TOWN	C	GF	SE	64	58	63	58	65	59	64	59	0	0	N/A	N/A	0.4	0.3	0.4	0.3	N/A	N/A	No
505	65 CATTAI ROAD PITT TOWN	C	GF	NE	59	54	59	53	60	55	59	54	0	0	N/A	N/A	0.5	0.4	0.5	0.4	N/A	N/A	No
506	62 CATTAI ROAD PITT TOWN	E	GF	NW	61	55	60	55	61	56	61	56	55	0	Yes	N/A	0.2	0.2	0.2	0.1	No*	N/A	No*
506	62 CATTAI ROAD PITT TOWN	E	GF	SW	53	48	54	49	54	49	55	50	55	0	No	N/A	-0.7	-0.7	-0.8	-0.8	No	No	No
506	62 CATTAI ROAD PITT TOWN	E	GF	NE	52	47	52	46	53	48	52	47	55	0	No	N/A	0.4	0.2	0.4	0.2	No	N/A	No
507	68 CATTAI ROAD PITT TOWN	R	GF	NW	58	52	57	52	58	53	58	53	60	55	No	No	0.5	0.4	0.4	0.3	No	No	No
507	68 CATTAI ROAD PITT TOWN	R	GF	SW	53	47	52	47	53	48	53	48	60	55	No	No	0.4	0.3	0.4	0.2	No	No	No
507	68 CATTAI ROAD PITT TOWN	R	GF	NE	52	47	51	46	53	48	52	47	60	55	No	No	0.7	0.7	0.7	0.7	No	No	No
507	68 CATTAI ROAD PITT TOWN	R	GF	NE	56	51	56	50	57	52	56	51	60	55	No	No	0.6	0.6	0.6	0.5	No	No	No
508	62 CATTAI ROAD PITT TOWN	R	GF	NW	60	55	60	54	61	56	60	55	60	55	Yes	Yes	0.3	0.2	0.2	0.1	No	No	No
508	62 CATTAI ROAD PITT TOWN	R	F 1	NW	62	56	61	56	62	57	62	57	60	55	Yes	Yes	0.4	0.4	0.4	0.3	No	No	No
508	62 CATTAI ROAD PITT TOWN	R	F 1	SW	56	50	56	51	56	51	57	52	60	55	No	No	-0.4	-0.4	-0.4	-0.4	No	No	No
508	62 CATTAI ROAD PITT TOWN	R	GF	SE	50	45	49	44	51	46	50	45	60	55	No	No	0.9	0.9	0.9	0.9	No	No	No
508	62 CATTAI ROAD PITT TOWN	R	F 1	SE	52	47	51	46	53	48	52	47	60	55	No	No	0.8	0.8	0.8	0.8	No	No	No
508	62 CATTAI ROAD PITT TOWN	R	GF	NE	58	52	57	52	59	53	58	53	60	55	No	No	0.4	0.3	0.4	0.3	No	No	No
508	62 CATTAI ROAD PITT TOWN	R	F 1	NE	59	54	59	53	60	55	59	54	60	55	No	No	0.6	0.5	0.5	0.5	No	No	No
509	62 CATTAI ROAD PITT TOWN	CC	GF	NW	60	55	60	54	61	56	60	55	55	0	Yes	N/A	0.3	0.3	0.3	0.2	No*	N/A	No*
509	62 CATTAI ROAD PITT TOWN	CC	GF	SW	57	52	57	51	58	53	57	52	55	0	Yes	N/A	0.3	0.2	0.3	0.2	No	N/A	No
509	62 CATTAI ROAD PITT TOWN	CC	GF	NW	58	52	57	52	58	53	58	53	55	0	Yes	N/A	0.3	0.2	0.3	0.2	No	N/A	No
509	62 CATTAI ROAD PITT TOWN	CC	GF	SW	53	47	52	47	53	48	53	48	55	0	No	N/A	0.3	0.2	0.3	0.2	No	N/A	No
510	62 CATTAI ROAD PITT TOWN	CC	GF	NW	51	46	51	45	52	47	52	47	55	0	No	N/A	0.5	0.5	0.4	0.4	No	N/A	No
510	62 CATTAI ROAD PITT TOWN	CC	GF	SW	50	44	50	45	50	45	51	46	55	0	No	N/A	-0.8	-0.8	-0.8	-1	No	No	No
510	62 CATTAI ROAD PITT TOWN	CC	GF	NE	51	46	51	46	52	47	52	47	55	0	No	N/A	0.4	0.3	0.4	0.3	No	N/A	No
520	86 CATTAI ROAD PITT TOWN	R	GF	NW	58	53	58	52	59	54	58	53	60	55	No	No	0.7	0.7	0.7	0.6	No	No	No
520	86 CATTAI ROAD PITT TOWN	R	GF	N	58	53	58	52	59	54	58	53	60	55	No	No	0.7	0.7	0.7	0.6	No	No	No
520	86 CATTAI ROAD PITT TOWN	R	GF	NW	59	53	58	53	59	54	59	54	60	55	No	No	0.6	0.6	0.6	0.6	No	No	No
520	86 CATTAI ROAD PITT TOWN	R	GF	SW	55	50	55	49	56	51	56	50	60	55	No	No	0.5	0.5	0.5	0.5	No	No	No
520	86 CATTAI ROAD PITT TOWN	R	GF	NW	55	50	54	49	56	51	55	50	60	55	No	No	0.5	0.5	0.5	0.4	No	No	No
520	86 CATTAI ROAD PITT TOWN	R	GF	SW	54	49	53	48	55	50	54	49	60	55	No	No	0.5	0.5	0.5	0.5	No	No	No
520	86 CATTAI ROAD PITT TOWN	R	GF	NE	52	47	51	46	53	48	52	47	60	55	No	No	0.8	0.7	0.7	0.7	No	No	No
520	86 CATTAI ROAD PITT TOWN	R	GF	SE	51	46	51	45	52	47	51	46	60	55	No	No	0.8	0.8	0.8	0.7	No	No	No
520	86 CATTAI ROAD PITT TOWN	R	GF	NE	56	51	55	50	57	52	56	51	60	55	No	No	0.7	0.7	0.7	0.6	No	No	No
521	94 CATTAI ROAD PITT TOWN	R	GF	NW	59	54	58	53	60	55	59	54	60	55	No	No	0.8	0.6	0.7	0.7	No	No	No
521	94 CATTAI ROAD PITT TOWN	R	GF	SW	56	51	55	50	57	52	56	51	60	55	No	No	0.6	0.6	0.6	0.5	No	No	No
521	94 CATTAI ROAD PITT TOWN	R	GF	NE	56	50	55	50	57	51	56	51	60	55	No	No	0.7	0.6	0.7	0.6	No	No	No
522	77 CATTAI ROAD PITT TOWN	R	GF	W	56	51	55	50	57	52	56	51	60	55	No	No	0.7	0.6	0.7	0.6	No	No	No
522	77 CATTAI ROAD PITT TOWN	R	GF	S	61	55	60	55	61	56	61	56	60	55	Yes	Yes	0.7	0.7	0.7	0.6	No	No	No
522	77 CATTAI ROAD PITT TOWN	R	GF	E	57	52	57	51	58	53	57	52	60	55	No	No	0.6	0.6	0.6	0.5	No	No	No
523	99 CATTAI ROAD PITT TOWN	R	GF	SW	52	46	51	46	52	47	52	47	60	55	No	No	0.7	0.7	0.7	0.6	No	No	No
523	99 CATTAI ROAD PITT TOWN	R	GF	SW	59	54	59	53	60	55	59	54	60	55	Yes	No	0.7	0.6	0.7	0.6	No	No	No
523	99 CATTAI ROAD PITT TOWN	R	GF	SE	62	57	61	56	63	58	62	57	60	55	Yes	Yes	0.8	0.7	0.9	0.7	No	No	No
523	99 CATTAI ROAD PITT TOWN	R	GF	NE	55	50	54	49	56	51	55	50	60	55	No	No	0.7	0.7	0.7	0.6	No	No	No

ID	Address	Class	Floor	Façade	2021 $L_{Aeq, period}$				2031 $L_{Aeq, period}$				NCG Criteria		Exceedance of NCG Criteria		Change in noise level				Equal to or above Cumulative Limit		Consider further additional noise mitigation
					Build		No Build		Build		No Build						2021		2031		2031		
					Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	
524	102 CATTAI ROAD PITT TOWN	R	GF	NW	53	48	53	47	54	49	53	48	60	55	No	No	0.7	0.7	0.7	0.7	No	No	No
524	102 CATTAI ROAD PITT TOWN	R	GF	SW	53	48	52	47	54	49	53	48	60	55	No	No	0.7	0.6	0.6	0.6	No	No	No
525	110 CATTAI ROAD PITT TOWN	R	GF	NW	50	45	50	44	51	46	50	45	60	55	No	No	0.5	0.4	0.4	0.3	No	No	No
525	110 CATTAI ROAD PITT TOWN	R	GF	SW	50	45	50	44	51	46	50	45	60	55	No	No	0.5	0.4	0.5	0.4	No	No	No
543	61 BUCKINGHAM STREET PITT TOWN	R	GF	S	48	42	50	44	49	43	51	45	60	55	No	No	-1.8	-1.8	-1.8	-1.8	No	No	No

Note: No* denotes a sensitive receiver that is not eligible for further consideration of noise mitigation because it is located outside the project extents and the noise level at the receiver location is controlled by the existing road not the project road.

Appendix F

Construction – Sound power levels per stage of work

Plant item	Sound power level, L_w dB(A)	Number	Operating time, minutes in a 15-minute assessment period	Operational sound power level, L_w dB(A)
Stage 1 – Pre-construction work				
1a) Installation of sediment controls				
Light vehicle	103	3	10	106
Hand tools	94	3	10	97
Traffic management devices	103	1	15	103
Backhoe	111	1	8	108
Total				**111**
1b) Adjustment and relocation of utilities and farm infrastructure				
Excavator	110	1	10	108
Dump truck	110	1	12	109
Mobile crane	94	1	8	91
Light vehicle	103	1	10	101
Total				**112**
1c) Temporary relocation of bus stops				
Light vehicle	103	2	15	106
Hand tools	94	2	15	97
Total				**107**
1d) Installation of boundary fencing				
Light vehicle	130	1	15	103
Hand tools	94	1	15	94
Traffic management devices	103	1	15	103
Backhoe	111	1	15	111
Total				**112**
1e) Site surveys				
Light vehicle	103	1	15	103
Hand tools	94	1	15	94
Total				**104**
1f) Upgrade of minor access roads				
Excavator	110	1	10	108
Traffic management devices	103	1	15	103
Backhoe	111	1	10	109
Compactor	106	1	15	106
Hand-held compactor and small tooling	98	1	15	98
Total				**113**

Plant item	Sound power level, L_w dB(A)	Number	Operating time, minutes in a 15-minute assessment period	Operational sound power level, L_w dB(A)
1g) Vegetation clearing and grubbing				
Chainsaw	118	1	8	115
Light vehicle	103	1	10	101
Elevated work platform	98	1	8	95
Excavator	110	1	10	108
Bulldozer	116	1	10	114
Chipper/mulcher	116	1	15	116
Total				**120**
1h) Demolition of existing drainage structures				
Concrete saw	118	1	8	115
Jackhammer	121	1	7	118
Dump truck	110	1	10	108
Front end loader	112	1	10	110
Excavator	110	1	10	108
Traffic management vehicles	103	1	15	103
Total				**121**
1i) Demolition of redundant existing roads				
Concrete saw	118	1	8	115
Jackhammer	121	1	7	118
Dump truck	110	1	10	108
Front end loader	112	1	10	110
Excavator	110	1	10	108
Traffic management vehicles	103	1	15	103
Total				**121**
1j) Removal of existing signage				
Light vehicle	103	1	15	103
Hand tools	94	1	10	92
Backhoe	111	1	10	109
Excavator	110	1	10	108
Total				**112**
Stage 2 – Site establishment				
2a) Temporary removal of fencing				
Front end loader	112	1	10	110
Excavator	110	1	10	108

Plant item	Sound power level, L_w dB(A)	Number	Operating time, minutes in a 15-minute assessment period	Operational sound power level, L_w dB(A)
Light vehicle	103	1	15	103
Total				**113**
2b) Set up of stockpile and ancillary facilities				
Dump truck	110	1	10	108
Road truck	108	1	10	106
Backhoe	111	1	10	109
Excavator	110	1	10	108
Light vehicle	103	1	12	102
Hand tools	94	1	10	92
Hand-held compactor and small tooling	98	1	10	96
Mulcher	116	1	15	116
Total				**118**
2c) Temporary traffic management				
Light vehicle	103	1	15	103
Traffic management devices	103	1	15	103
Hand tools	94	1	15	94
Total				**106**
2d) Construction of access roads				
Excavator	110	1	10	108
Water cart	107	1	8	104
Light vehicle	103	1	12	102
Hand tools	94	1	10	92
Bulldozer	116	1	10	114
Total				**116**
2e) Progressive installation of environmental controls				
Light vehicles	103	1	15	103
Hand tools	94	1	15	94
Total				**104**
2f) Other activities determined at a later date				
*To be determined at a later date				
2g) Construction of diversion drains and sedimentation controls				
Excavator	110	1	10	108
Water cart	107	1	8	104
Light vehicle	103	1	10	101

Plant item	Sound power level, L_w dB(A)	Number	Operating time, minutes in a 15-minute assessment period	Operational sound power level, L_w dB(A)
Hand tools	94	1	10	92
Total				**110**
2h) Clearing of vegetation and processing materials				
Mulcher	116	1	15	116
Chainsaw	118	1	8	115
Bulldozer	116	1	8	113
Light vehicle	103	1	10	101
Total				**120**
2i) Temporary upgrade work for existing local roads and intersections				
Bulldozer	116	1	8	113
Dump truck	110	1	10	108
Grader	113	1	8	110
Light vehicle	103	1	15	103
Total				**116**
Stage 3 – Drainage upgrade and drainage structures construction				
3a) Establishment of erosion and sediment controls and specific water quality controls				
Front end loader	112	1	10	110
Excavator	110	1	10	108
Hand-held compactor and small tooling	98	1	5	93
Light vehicle	103	1	10	101
Total				**113**
3b) Establishment of construction work zones				
Concrete agitator	113	1	15	113
Excavator	110	1	10	108
Vibratory roller	109	1	8	106
Light vehicle	103	1	10	101
Hand tools	94	1	10	92
Mobile crane	94	1	8	91
Concrete vibrator	113	1	10	111
Total				**117**
3c) Earthworks for creek diversion				
Excavator	110	1	10	108
Backhoe	111	1	10	109
Front end loader	112	1	10	110

Plant item	Sound power level, L_w dB(A)	Number	Operating time, minutes in a 15-minute assessment period	Operational sound power level, L_w dB(A)
Dump truck	110	1	10	108
Light vehicle	103	1	10	101
Hand-held compactor and small tooling	98	1	10	96
Total				**115**
3d) Establishment of traffic control measures				
Light vehicle	103	1	10	101
Traffic management device	103	1	15	103
Hand tools	94	1	10	92
Total				**105**
3e) Demolition and removal of existing structures				
Concrete saw	118	1	8	115
Jackhammer	121	1	7	118
Excavator	110	1	10	108
Road truck	108	1	10	106
Dump truck	110	1	10	108
Light vehicle	103	1	10	101
Traffic management device	103	1	15	103
Total				**121**
3f) Construction of extension of culverts, including channel diversions				
Concrete agitator	113	1	15	113
Road truck	108	1	10	106
Mobile crane	94	1	8	91
Traffic management device	103	1	15	103
Vibratory roller	109	1	10	107
Concrete plant	108	1	15	108
Concrete pump	113	1	10	111
Total				**117**
3g) Installation of scour protection, as required				
Dump truck	110	1	10	108
Excavator	110	1	10	108
Front end loader	112	1	10	110
Light vehicle	103	1	12	102
Total				**114**
Stage 4 – Earthworks and pavement construction				

Plant item	Sound power level, L_w dB(A)	Number	Operating time, minutes in a 15-minute assessment period	Operational sound power level, L_w dB(A)
4a) Clearing and grubbing of topsoil, stripping, ripping and compaction of subgrade				
Front end loader	112	1	10	110
Excavator	110	1	10	108
Bulldozer	116	1	10	114
Dump truck	110	1	10	108
Light vehicle	103	1	12	102
Vibratory roller	109	1	10	107
Hand-held compactor and small tooling	98	1	5	93
Compactor	106	1	10	104
Road truck	108	1	8	105
Light vehicle	103	1	12	102
Total				**118**
4b) Construction of road formation and embankments				
Concrete agitator	113	1	15	113
Excavator	110	1	10	108
Concrete mixer	106	1	15	106
Dump truck	110	1	10	108
Light vehicle	103	1	12	102
Vibratory roller	109	1	8	106
Hand-held compactor and small tooling	98	1	8	95
Compactor	106	1	8	103
Vibratory roller	109	1	10	107
Concrete pump	113	1	15	113
Total				**119**
4c) Select material and sub-base layers preparation and compaction				
Front end loader	112	1	10	110
Excavator	110	1	10	108
Compactor	106	1	8	103
Vibratory roller	109	1	10	107
Light vehicle	103	1	12	102
Generator	103	1	15	103
Hand-held compactor and small tooling	98	1	8	95
Road truck	108	1	10	106
Total				**115**

Plant item	Sound power level, L_w dB(A)	Number	Operating time, minutes in a 15-minute assessment period	Operational sound power level, L_w dB(A)
4d) Laying of asphalt layers, including surfacing				
Asphalt plant	103	1	10	101
Asphalt profiler	117	1	10	115
Asphalt truck	103	1	10	101
Asphalt paver	114	1	10	112
Grader	113	1	10	111
Vibratory roller	109	1	10	107
Spray seal truck	103	1	8	100
Total				**119**
4e) Construction of verges and batters				
Road truck	108	1	10	106
Excavator	110	1	10	108
Backhoe	111	1	10	109
Bulldozer	116	1	10	114
Truck	103	1	10	101
Compactor	106	1	8	103
Hand-held compactor and small tooling	98	1	8	95
Total				**117**
Stage 5 – Bridge construction works				
5a) Earthworks and construction of foundations				
Piling rig	112	1	10	110
Backhoe	111	1	10	109
Excavator	110	1	10	108
Road truck	108	1	8	105
Dump truck	110	1	8	107
Water cart	107	1	8	104
Concrete pavers	114	1	7	110
Concrete agitator	113	1	15	113
Concrete vibrator	113	1	15	113
Concrete plant	108	1	10	106
Concrete pump	113	1	10	111
Concrete mixer	106	1	10	104
Total				**120**
5b) Construction of bridge and abutments				

Plant item	Sound power level, L_w dB(A)	Number	Operating time, minutes in a 15-minute assessment period	Operational sound power level, L_w dB(A)
Backhoe	111	1	10	109
Excavator	110	1	10	108
Road truck	108	1	8	105
Dump truck	110	1	8	107
Water cart	107	1	8	104
Concrete paver	114	1	7	110
Concrete agitator	113	1	15	113
Concrete vibrator	113	1	15	113
Concrete plant	108	1	10	106
Concrete pump	113	1	10	111
Concrete mixer	106	1	10	104
Mobile crane	94	1	8	91
Crane	98	1	8	95
Curing machine	114	1	12	113
Total				**121**
5c) Installation of two-span plank bridge				
Excavator	110	1	10	108
Road truck	108	1	10	106
Dump truck	110	1	10	108
Water cart	107	1	8	104
Concrete paver	114	1	7	110
Concrete agitator	113	1	15	113
Concrete vibrator	113	1	10	111
Concrete plant	108	1	10	106
Concrete pump	113	1	10	111
Concrete mixer	106	1	10	104
Mobile crane	94	1	8	91
Crane	98	1	8	95
Total				**119**
Stage 6 – Property access amendments				
6a) Subgrade improvements and embankment earthworks				
Backhoe	111	1	10	109
Excavator	110	1	10	108
Bulldozer	116	1	10	114

Plant item	Sound power level, L_w dB(A)	Number	Operating time, minutes in a 15-minute assessment period	Operational sound power level, L_w dB(A)
Front end loader	112	1	10	110
Hand tools	94	1	8	91
Compactor	106	1	10	104
Hand-held compactor and small tooling	98	1	8	95
Total				**117**
6b) Pavement construction, including asphalt layers				
Concrete agitator	113	1	15	113
Concrete mixer	106	1	8	103
Compressor	109	1	7	106
Curing machine	114	1	12	113
Asphalt paver	114	1	8	111
Asphalt plant	103	1	8	100
Asphalt profiler	117	1	10	115
Asphalt truck	103	1	10	101
Grader	113	1	8	110
Generator	103	1	15	103
Road truck	108	1	10	106
Slip form plant	114	1	10	112
Spray seal truck	103	1	8	100
Milling machine	117	1	12	116
Total				**122**
6c) Removal of existing redundant accesses				
Backhoe	111	1	10	109
Bulldozer	116	1	10	114
Concrete saw	118	1	8	115
Front end loader	112	1	10	110
Road truck	108	1	10	106
Total				**119**
Stage 7 – Finishing work				
7a) Installation of pavement markings, signposting and other road furniture				
Line marking equipment	108	1	8	105
Hand tools	94	1	10	92
Light vehicle	103	1	10	101
Hand-held compactor and small tooling	98	1	8	95

Plant item	Sound power level, L_w dB(A)	Number	Operating time, minutes in a 15-minute assessment period	Operational sound power level, L_w dB(A)
Generator	103	1	15	103
Total				**109**
7b) Progressive landscaping and tree planting				
Backhoe	111	1	10	109
Bulldozer	116	1	10	114
Excavator	110	1	10	108
Truck	103	1	8	100
Light vehicle	103	1	12	102
Hand tools	94	1	15	94
Total				**116**
7c) Reinstatement of fencing				
Light vehicle	103	1	12	102
Concrete mixer	106	1	10	104
Hand tools	94	1	10	92
Hand-held compactor and small tooling	98	1	8	95
Total				**107**
7d) Site clean-up and demobilisation, including restoration of ancillary facilities and access roads, where required				
Road sweeper	108	1	12	107
Light vehicle	103	1	12	102
Hand tools	94	1	8	91
Backhoe	11	1	10	109
Front end loader	112	1	10	110
Total				**114**

Appendix G

Predicted noise levels – Construction

Receiver ID	Receiver type	Floor	Direction	Predicted noise level		
				Low intensity work	Medium intensity work	High intensity work
1	R	GF	E	43	51	58
2	R	GF	S	42	50	57
3	R	GF	E	43	51	58
4	R	GF	E	44	52	59
5	R	GF	E	46	54	61
6	R	GF	E	47	55	62
7	R	GF	E	53	61	68
8	R	GF	S	76	84	91
9	R	GF	N	72	80	87
10	R	F 1	N	68	76	83
11	R	GF	S	79	87	94
12	R	F 1	E	67	75	82
13	R	GF	S	50	58	65
14	R	GF	E	46	54	61
15	R	GF	E	47	55	62
16	R	GF	SE	45	53	60
17	R	F 1	E	44	52	59
18	R	GF	E	41	49	56
19	R	GF	S	47	55	62
20	R	GF	E	38	46	53
21	R	GF	S	37	45	52
22	R	F 1	S	41	49	56
23	R	F 1	E	42	50	57
24	R	GF	N	39	47	54
25	R	F 1	S	44	52	59
26	R	GF	E	39	47	54
27	R	GF	S	39	47	54
28	R	GF	E	38	46	53
29	R	GF	S	39	47	54
30	R	GF	S	29	37	44
31	R	F 1	E	30	38	45
32	R	F 1	S	32	40	47
33	R	GF	S	30	38	45
34	R	GF	S	29	37	44

Receiver ID	Receiver type	Floor	Direction	Predicted noise level		
				Low intensity work	Medium intensity work	High intensity work
35	R	GF	E	29	37	44
36	R	GF	W	26	34	41
37	R	GF	E	24	32	39
38	R	GF	S	26	34	41
39	R	GF	E	27	35	42
40	R	GF	E	33	41	48
41	R	GF	S	31	39	46
42	R	GF	E	32	40	47
43	R	GF	S	32	40	47
44	R	F 1	S	33	41	48
45	R	GF	S	33	41	48
46	R	GF	E	31	39	46
47	R	GF	E	32	40	47
48	R	GF	SW	31	39	46
49	R	GF	S	33	41	48
50	R	GF	E	31	39	46
51	R	GF	S	34	42	49
52	R	GF	S	34	42	49
53	R	F 1	E	31	39	46
54	R	GF	S	27	35	42
55	R	GF	E	29	37	44
56	R	GF	N	27	35	42
57	R	GF	S	28	36	43
58	R	GF	S	28	36	43
59	R	F 1	E	31	39	46
60	R	GF	S	28	36	43
61	R	GF	E	34	42	49
62	R	GF	S	30	38	45
63	R	GF	S	33	41	48
64	R	GF	S	29	37	44
65	R	GF	E	27	35	42
66	R	GF	S	33	41	48
67	R	GF	S	29	37	44
68	R	GF	S	30	38	45

Receiver ID	Receiver type	Floor	Direction	Predicted noise level		
				Low intensity work	Medium intensity work	High intensity work
69	R	GF	S	30	38	45
70	R	F 1	S	33	41	48
71	R	F 1	E	31	39	46
72	R	GF	E	32	40	47
73	R	GF	S	33	41	48
74	R	GF	S	33	41	48
75	R	GF	E	33	41	48
76	R	GF	N	29	37	44
77	R	GF	E	34	42	49
78	R	GF	S	31	39	46
79	R	GF	E	27	35	42
80	R	GF	S	31	39	46
81	R	GF	S	26	34	41
82	R	GF	S	31	39	46
83	R	GF	S	26	34	41
84	R	GF	S	31	39	46
85	R	GF	E	29	37	44
86	R	GF	E	32	40	47
87	R	GF	E	31	39	46
88	R	GF	S	31	39	46
89	R	GF	S	32	40	47
90	R	GF	E	34	42	49
91	R	GF	S	29	37	44
92	R	GF	S	27	35	42
93	R	GF	S	29	37	44
94	R	GF	S	33	41	48
95	R	F 1	S	34	42	49
96	R	GF	E	31	39	46
97	R	GF	S	34	42	49
98	R	GF	E	30	38	45
99	R	GF	E	32	40	47
100	R	GF	E	32	40	47
101	R	GF	E	31	39	46
102	R	GF	E	32	40	47

Receiver ID	Receiver type	Floor	Direction	Predicted noise level		
				Low intensity work	Medium intensity work	High intensity work
103	R	GF	E	32	40	47
104	R	GF	E	29	37	44
105	R	GF	S	28	36	43
106	R	GF	E	31	39	46
107	R	F 1	E	32	40	47
108	R	GF	S	31	39	46
109	R	GF	E	34	42	49
110	R	GF	S	32	40	47
111	R	GF	S	35	43	50
112	R	GF	S	34	42	49
113	R	GF	E	31	39	46
114	R	GF	E	33	41	48
115	R	GF	S	33	41	48
116	R	GF	N	31	39	46
117	R	GF	E	32	40	47
118	R	GF	S	32	40	47
119	R	GF	S	32	40	47
120	R	F 1	S	35	43	50
121	R	GF	E	34	42	49
122	R	F 1	E	33	41	48
123	R	GF	S	30	38	45
124	R	GF	E	32	40	47
125	R	GF	S	29	37	44
126	R	GF	E	33	41	48
127	R	GF	S	35	43	50
128	R	F 1	S	33	41	48
129	R	GF	E	33	41	48
130	R	GF	S	36	44	51
131	R	GF	S	31	39	46
132	R	GF	E	33	41	48
133	R	GF	S	35	43	50
134	R	GF	E	34	42	49
135	R	GF	E	34	42	49
136	R	GF	S	36	44	51

Receiver ID	Receiver type	Floor	Direction	Predicted noise level		
				Low intensity work	Medium intensity work	High intensity work
137	R	GF	E	32	40	47
138	R	GF	E	34	42	49
139	R	GF	S	36	44	51
140	R	GF	S	34	42	49
141	R	GF	E	34	42	49
142	R	GF	S	36	44	51
143	R	GF	E	35	43	50
144	R	GF	E	34	42	49
145	R	GF	S	36	44	51
146	R	GF	S	35	43	50
147	R	GF	E	35	43	50
148	R	GF	E	37	45	52
149	R	GF	SE	37	45	52
150	R	GF	E	34	42	49
151	R	F 1	E	32	40	47
152	R	GF	E	29	37	44
153	R	GF	S	33	41	48
154	R	GF	S	31	39	46
155	R	GF	S	27	35	42
156	R	F 1	E	33	41	48
157	R	GF	S	32	40	47
158	R	GF	S	32	40	47
159	R	GF	E	32	40	47
160	R	GF	E	31	39	46
161	R	GF	S	33	41	48
162	R	GF	E	33	41	48
163	R	F 1	E	33	41	48
164	R	F 1	S	35	43	50
165	R	GF	S	29	37	44
166	R	GF	S	30	38	45
167	R	GF	E	33	41	48
168	R	GF	S	29	37	44
169	R	GF	E	30	38	45
170	R	GF	S	32	40	47

Receiver ID	Receiver type	Floor	Direction	Predicted noise level		
				Low intensity work	Medium intensity work	High intensity work
171	R	GF	S	32	40	47
172	R	F 1	S	36	44	51
173	R	GF	S	32	40	47
174	R	GF	N	33	41	48
175	R	GF	S	34	42	49
176	R	GF	E	36	44	51
177	R	GF	E	35	43	50
178	R	GF	S	38	46	53
179	R	GF	S	33	41	48
180	R	GF	S	37	45	52
181	R	GF	SW	37	45	52
182	R	GF	S	32	40	47
183	R	GF	E	32	40	47
184	R	GF	S	37	45	52
185	R	GF	W	32	40	47
186	R	GF	S	37	45	52
187	R	GF	S	37	45	52
188	R	GF	W	32	40	47
189	R	GF	E	30	38	45
190	R	GF	S	37	45	52
191	R	GF	S	30	38	45
192	R	GF	S	34	42	49
193	R	GF	E	34	42	49
194	R	GF	S	36	44	51
195	R	GF	E	34	42	49
196	R	GF	S	38	46	53
197	R	GF	E	38	46	53
198	R	GF	S	38	46	53
199	R	GF	S	34	42	49
200	R	F 1	S	38	46	53
201	R	GF	S	38	46	53
202	R	GF	E	36	44	51
203	R	GF	E	36	44	51
204	R	GF	S	35	43	50

Receiver ID	Receiver type	Floor	Direction	Predicted noise level		
				Low intensity work	Medium intensity work	High intensity work
205	R	GF	S	35	43	50
206	R	GF	E	36	44	51
207	R	GF	S	39	47	54
208	R	GF	E	36	44	51
209	R	F 1	E	36	44	51
210	R	GF	S	39	47	54
211	R	GF	S	39	47	54
212	R	GF	S	34	42	49
213	R	GF	S	35	43	50
214	R	GF	E	31	39	46
215	R	GF	S	33	41	48
216	R	GF	S	32	40	47
217	R	GF	E	33	41	48
218	R	GF	S	33	41	48
219	R	GF	E	33	41	48
220	R	GF	E	32	40	47
221	R	GF	E	33	41	48
222	R	GF	E	34	42	49
223	R	GF	S	33	41	48
224	R	GF	NE	31	39	46
225	R	GF	E	30	38	45
226	R	GF	S	36	44	51
227	CC	GF	E	34	42	49
228	R	GF	S	32	40	47
229	E	GF	S	37	45	52
230	R	GF	E	36	44	51
231	E	GF	E	34	42	49
232	E	GF	N	33	41	48
233	E	GF	S	37	45	52
234	E	GF	S	33	41	48
235	E	GF	S	33	41	48
236	E	GF	W	29	37	44
237	E	GF	N	32	40	47
238	E	GF	E	37	45	52

Receiver ID	Receiver type	Floor	Direction	Predicted noise level		
				Low intensity work	Medium intensity work	High intensity work
239	R	GF	E	38	46	53
240	E	GF	E	36	44	51
241	R	GF	E	41	49	56
242	R	GF	E	40	48	55
243	R	GF	S	46	54	61
244	R	GF	E	51	59	66
245	W	GF	E	33	41	48
246	R	GF	SE	33	41	48
247	W	GF	NE	33	41	48
248	W	GF	SE	36	44	51
249	R	GF	SE	34	42	49
250	R	GF	NE	34	42	49
251	R	GF	NE	37	45	52
252	C	GF	NE	35	43	50
253	R	GF	NE	35	43	50
254	R	GF	S	36	44	51
255	R	GF	E	37	45	52
256	R	GF	E	37	45	52
257	R	GF	E	37	45	52
258	R	GF	S	35	43	50
259	R	GF	S	38	46	53
260	R	GF	S	33	41	48
261	R	GF	E	36	44	51
262	R	GF	S	36	44	51
263	R	GF	E	39	47	54
264	R	GF	E	35	43	50
265	R	GF	S	37	45	52
266	R	GF	E	39	47	54
267	R	GF	S	33	41	48
268	R	GF	S	34	42	49
269	R	GF	S	35	43	50
270	R	GF	S	37	45	52
271	R	GF	E	31	39	46
272	R	GF	S	31	39	46

Receiver ID	Receiver type	Floor	Direction	Predicted noise level		
				Low intensity work	Medium intensity work	High intensity work
273	R	GF	E	34	42	49
274	R	GF	S	41	49	56
275	R	GF	N	37	45	52
276	R	GF	SE	38	46	53
277	R	GF	E	38	46	53
278	R	GF	E	40	48	55
279	R	GF	S	40	48	55
280	R	GF	S	40	48	55
281	R	GF	E	38	46	53
282	R	GF	E	38	46	53
283	R	GF	E	38	46	53
284	R	GF	S	40	48	55
285	R	GF	S	37	45	52
286	R	GF	S	40	48	55
287	R	GF	S	40	48	55
288	R	GF	E	38	46	53
289	R	GF	E	38	46	53
290	R	GF	E	38	46	53
291	R	GF	E	39	47	54
292	R	GF	E	39	47	54
293	R	GF	S	39	47	54
294	R	GF	S	39	47	54
295	R	GF	E	40	48	55
296	R	GF	E	41	49	56
297	R	GF	E	42	50	57
298	R	GF	S	42	50	57
299	R	GF	E	42	50	57
300	R	GF	S	42	50	57
301	R	GF	E	42	50	57
302	R	GF	E	41	49	56
303	R	GF	E	42	50	57
304	R	GF	S	40	48	55
305	R	GF	E	40	48	55
306	R	GF	S	37	45	52

Receiver ID	Receiver type	Floor	Direction	Predicted noise level		
				Low intensity work	Medium intensity work	High intensity work
307	R	GF	E	39	47	54
308	R	GF	S	41	49	56
309	R	GF	S	37	45	52
310	R	GF	S	36	44	51
311	R	GF	E	36	44	51
312	R	GF	S	38	46	53
313	R	GF	S	36	44	51
314	R	GF	S	37	45	52
315	R	GF	S	37	45	52
316	R	GF	S	39	47	54
317	R	GF	S	37	45	52
318	R	GF	S	37	45	52
319	R	GF	S	38	46	53
320	R	GF	SE	76	84	91
321	R	GF	SW	65	73	80
322	R	F 1	SE	62	70	77
323	R	GF	S	58	66	73
324	R	GF	SW	53	61	68
325	R	F 1	SW	48	56	63
326	R	GF	SE	50	58	65
327	R	GF	SW	47	55	62
328	R	GF	SW	44	52	59
329	R	GF	SW	44	52	59
330	R	GF	SW	46	54	61
331	R	GF	SW	43	51	58
332	R	GF	SE	71	79	86
333	R	F 1	NE	65	73	80
334	R	GF	SE	60	68	75
335	R	GF	SE	53	61	68
336	R	GF	NE	50	58	65
337	R	GF	NE	49	57	64
338	R	GF	NE	48	56	63
339	R	GF	NE	47	55	62
340	R	GF	SE	46	54	61

Receiver ID	Receiver type	Floor	Direction	Predicted noise level		
				Low intensity work	Medium intensity work	High intensity work
341	R	F 1	NE	46	54	61
342	R	GF	NE	44	52	59
343	R	F 1	NE	43	51	58
344	R	GF	SE	42	50	57
345	R	GF	NE	42	50	57
346	R	GF	NE	41	49	56
347	R	GF	NE	44	52	59
348	R	GF	N	41	49	56
349	R	GF	NE	44	52	59
350	R	GF	N	44	52	59
351	R	GF	NE	43	51	58
352	R	GF	NE	43	51	58
353	R	GF	SE	44	52	59
354	R	GF	SE	44	52	59
355	R	GF	NE	41	49	56
356	R	GF	SE	42	50	57
357	R	GF	NE	43	51	58
358	R	GF	NE	38	46	53
359	R	GF	NE	40	48	55
360	R	GF	SE	39	47	54
361	R	F 1	SE	41	49	56
362	R	GF	SE	42	50	57
363	R	GF	S	46	54	61
364	R	GF	NE	40	48	55
365	R	GF	E	49	57	64
366	R	GF	NE	46	54	61
367	R	GF	E	49	57	64
368	R	GF	E	57	65	72
369	R	GF	SW	58	66	73
370	R	GF	SW	58	66	73
371	R	GF	SW	57	65	72
372	R	GF	SE	55	63	70
373	R	F 1	SE	52	60	67
374	R	F 1	SE	54	62	69

Receiver ID	Receiver type	Floor	Direction	Predicted noise level		
				Low intensity work	Medium intensity work	High intensity work
375	R	F 1	SW	51	59	66
376	R	GF	SW	47	55	62
377	R	GF	SE	46	54	61
378	R	GF	SE	45	53	60
379	R	F 1	SE	45	53	60
380	R	F 1	NE	45	53	60
381	R	GF	NE	41	49	56
382	R	GF	NW	41	49	56
383	R	GF	NE	40	48	55
384	R	GF	NE	40	48	55
385	R	GF	N	46	54	61
386	C	GF	SE	44	52	59
387	R	GF	N	43	51	58
388	R	GF	E	41	49	56
389	R	GF	NE	40	48	55
390	R	GF	E	41	49	56
391	R	GF	N	38	46	53
392	R	GF	NE	43	51	58
393	R	GF	E	45	53	60
394	R	F 1	N	40	48	55
395	R	GF	S	42	50	57
396	R	F 1	N	45	53	60
397	R	F 1	S	46	54	61
398	R	F 1	E	47	55	62
399	R	F 1	NE	48	56	63
400	R	F 1	NE	49	57	64
401	R	F 1	NE	49	57	64
402	R	GF	NE	46	54	61
403	R	F 1	SE	46	54	61
404	R	F 1	SE	49	57	64
405	R	F 1	NW	47	55	62
406	R	F 1	NE	48	56	63
407	R	GF	NE	50	58	65
408	R	F 1	SE	52	60	67

Receiver ID	Receiver type	Floor	Direction	Predicted noise level		
				Low intensity work	Medium intensity work	High intensity work
409	R	GF	SW	56	64	71
410	R	GF	SW	56	64	71
411	R	GF	NE	57	65	72
412	R	GF	SE	57	65	72
413	R	GF	NE	61	69	76
414	R	GF	SE	60	68	75
415	R	GF	E	44	52	59
416	R	GF	E	45	53	60
417	R	F 1	E	47	55	62
418	R	GF	S	43	51	58
419	R	GF	E	49	57	64
420	R	GF	N	49	57	64
421	R	F 1	N	53	61	68
422	R	F 1	N	55	63	70
423	R	GF	E	59	67	74
424	R	GF	E	60	68	75
425	R	GF	NE	61	69	76
426	R	F 1	NE	67	75	82
427	R	GF	SE	58	66	73
428	R	GF	NW	61	69	76
429	R	GF	NW	58	66	73
430	R	GF	NE	54	62	69
431	R	F 1	NE	51	59	66
432	R	GF	N	53	61	68
433	R	F 1	NE	47	55	62
434	R	GF	NE	52	60	67
435	R	F 1	NE	52	60	67
436	R	F 1	NE	44	52	59
437	R	GF	SE	50	58	65
438	R	F 1	NE	56	64	71
439	R	GF	NW	62	70	77
440	R	GF	N	54	62	69
441	R	GF	N	53	61	68
442	R	GF	W	49	57	64

Receiver ID	Receiver type	Floor	Direction	Predicted noise level		
				Low intensity work	Medium intensity work	High intensity work
443	R	GF	N	44	52	59
444	R	GF	N	44	52	59
445	R	GF	W	41	49	56
446	R	GF	N	49	57	64
447	R	GF	W	40	48	55
448	R	GF	N	41	49	56
449	R	GF	W	42	50	57
450	R	GF	NW	38	46	53
451	R	GF	W	37	45	52
452	R	GF	NW	41	49	56
453	R	F 1	N	39	47	54
454	R	GF	NW	35	43	50
455	R	GF	NW	35	43	50
456	R	GF	N	43	51	58
457	R	GF	W	40	48	55
458	R	GF	W	38	46	53
459	R	GF	W	38	46	53
460	R	GF	W	36	44	51
461	R	GF	NE	33	41	48
462	R	GF	NE	35	43	50
463	R	GF	NE	32	40	47
464	R	GF	S	75	83	90
465	R	GF	NW	43	51	58
466	R	GF	NE	43	51	58
467	C	GF	SE	41	49	56
468	C	GF	E	38	46	53
469	R	GF	NE	37	45	52
470	R	F 1	SE	39	47	54
471	R	GF	SE	39	47	54
472	R	GF	NE	36	44	51
473	R	GF	NE	36	44	51
474	R	F 1	SE	35	43	50
475	C	GF	NE	37	45	52
476	C	GF	E	38	46	53

Receiver ID	Receiver type	Floor	Direction	Predicted noise level		
				Low intensity work	Medium intensity work	High intensity work
477	R	GF	N	40	48	55
478	R	GF	E	40	48	55
479	R	GF	N	37	45	52
480	R	GF	E	39	47	54
481	R	GF	NE	35	43	50
482	R	F 1	SE	31	39	46
483	R	GF	SE	33	41	48
484	R	F 1	SE	34	42	49
485	R	GF	SE	36	44	51
486	R	GF	SE	33	41	48
487	W	GF	NE	33	41	48
488	W	GF	E	33	41	48
489	R	GF	SE	32	40	47
490	R	GF	E	35	43	50
491	R	F 1	E	31	39	46
492	R	GF	E	31	39	46
493	R	GF	S	31	39	46
494	R	GF	E	30	38	45
495	R	GF	NW	71	79	86
496	R	GF	NW	70	78	85
497	R	F 1	NW	67	75	82
498	R	GF	NW	73	81	88
499	R	GF	NW	58	66	73
500	R	GF	SE	81	89	96
501	R	GF	SE	80	88	95
502	R	GF	S	57	65	72
503	R	GF	SE	63	71	78
504	R	GF	SW	58	66	73
505	C	GF	SW	50	58	65
506	E	GF	NW	53	61	68
507	R	GF	NW	44	52	59
508	R	F 1	SW	50	58	65
509	CC	GF	NW	50	58	65
510	CC	GF	SW	51	59	66

Receiver ID	Receiver type	Floor	Direction	Predicted noise level		
				Low intensity work	Medium intensity work	High intensity work
511	R	GF	SW	37	45	52
512	R	GF	SE	40	48	55
513	R	GF	E	43	51	58
514	R	GF	SE	46	54	61
515	R	GF	SW	43	51	58
516	R	GF	SE	40	48	55
517	R	GF	SW	35	43	50
518	R	GF	SW	34	42	49
519	R	GF	SE	33	41	48
520	R	GF	NW	42	50	57
521	R	GF	SW	37	45	52
522	R	GF	W	37	45	52
523	R	GF	SW	37	45	52
524	R	GF	SW	35	43	50
525	R	GF	SW	33	41	48
526	R	GF	SW	33	41	48
527	R	GF	NW	41	49	56
528	R	GF	NW	39	47	54
529	R	GF	NW	42	50	57
530	R	GF	N	38	46	53
531	R	GF	S	52	60	67
532	R	GF	W	49	57	64
533	R	GF	W	46	54	61
534	R	GF	S	44	52	59
535	R	GF	W	42	50	57
536	R	GF	W	40	48	55
537	R	F 1	W	41	49	56
538	R	GF	N	39	47	54
539	R	GF	NW	41	49	56
540	R	GF	NE	37	45	52
541	R	GF	NW	39	47	54
542	R	GF	W	39	47	54
543	R	GF	E	47	55	62
544	R	GF	S	44	52	59

Receiver ID	Receiver type	Floor	Direction	Predicted noise level		
				Low intensity work	Medium intensity work	High intensity work
545	R	GF	SW	43	51	58
546	R	GF	S	41	49	56
547	R	GF	S	32	40	47
548	R	GF	S	32	40	47
549	R	GF	E	35	43	50
550	R	GF	E	32	40	47
551	R	GF	S	35	43	50
552	R	GF	S	35	43	50
553	R	GF	S	34	42	49
554	R	GF	E	32	40	47
555	R	GF	S	32	40	47
556	R	GF	E	34	42	49
557	R	F 1	E	35	43	50
558	R	GF	E	28	36	43
559	R	GF	S	31	39	46
560	R	GF	SE	32	40	47
561	R	GF	S	33	41	48
562	R	GF	E	35	43	50
563	R	GF	E	35	43	50
564	R	GF	E	35	43	50
565	R	GF	S	33	41	48
566	R	GF	E	36	44	51
567	R	GF	S	32	40	47
568	R	GF	S	36	44	51
569	R	GF	SE	35	43	50
570	R	GF	S	33	41	48
571	R	GF	S	35	43	50
572	R	GF	E	38	46	53
573	R	GF	E	38	46	53
574	R	GF	E	36	44	51
575	R	GF	S	36	44	51
576	R	GF	NW	38	46	53
577	R	GF	NW	37	45	52
578	R	GF	NW	39	47	54

Receiver ID	Receiver type	Floor	Direction	Predicted noise level		
				Low intensity work	Medium intensity work	High intensity work
579	R	GF	SW	39	47	54
580	R	GF	NW	39	47	54
581	R	GF	N	37	45	52
582	R	GF	N	38	46	53

(1) R – Residential

(2) C – Commercial

(3) E – Educational

(4) CC – Child care centre

(5) W – Place of worship

Appendix H

Hydrology and Hydraulic Investigation

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ARCADIS Design & Consultancy for natural and built assets

PITT TOWN ROAD BYPASS

Hydrology and Hydraulic Investigation – Concept Design

31 JULY 2018



Incorporating Hyder

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ROADS AND MARITIME
PITT TOWN ROAD BYPASS

Hydrology and Hydraulic Investigation

Concept Design

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Report No 10014101-EFC0001-RPT

Date 31/07/2018

Revision Text 03

This report has been prepared for Roads and Maritime Services in accordance with the terms and conditions of appointment for Pitt Town Bypass between Pitt Town Road and Bathurst Street Concept Design and Review of Environment Factors dated 28 November 2017. Arcadis Australia Pacific Pty Limited (ABN 76 104 485 289) cannot accept any responsibility for any use of or reliance on the contents of this report by any third party.

REVISIONS

Revision	Date	Description	Prepared by	Approved by
01	30/01/2018	Revision 01	Wen Han Ooi	Luiz Segundo
02	01/06/2018	80% Concept Design	Wen Han Ooi	Luiz Segundo
03	31/07/2018	100% Concept Design	San Ng	Luiz Segundo

CONTENTS

1 INTRODUCTION 3
1.1 Project Location and Background 3
1.2 Previous Studies 3
1.3 Available Data 4
1.4 Project Objectives and Scope 5
1.5 Study Methodology 5
1.6 Changes from 20% to 80% Concept Design 6
1.7 Changes from 80% to 100% Concept Design 6

2 CATCHMENT DESCRIPTION 8
2.1 GENERAL 8
2.2 Local Catchment - Hortons Creek 8
2.3 Regional Catchment – Hawkesbury River 9
2.3.1 Regional Flooding Discussion 9

3 HYDROLOGY AND HYDRAULIC MODELLING 10
3.1 GENERAL 10
3.2 Software 10
3.1 Hydrology Modelling 10
3.1.1 General 10
3.1.2 Terrain 11
3.1.3 Model Extents 11
3.1.4 Model Resolution 11
3.1.5 Surface Roughness 11
3.1.6 Initial Water Level 12
3.1.7 Rainfall Data 13
3.1.8 Temporal Patterns and Storm Durations 14
3.2 Hydraulic Modelling 14
3.2.1 General 14
3.2.2 Terrain 14
3.2.3 Model Extents 15
3.2.4 Model Resolution and Calculation Time-step 15
3.2.5 Culverts 15
3.2.6 Inflows and Downstream Boundary Conditions 15
3.2.7 Initial Water Level 16
3.3 Hydrology Results 16
3.3.1 Critical Durations 16
3.3.2 Peak Flows 18
3.4 Hydraulic Results 18

3.4.1 Existing Flood Immunity 18

4 PROPOSED DESIGN 19
4.1 Design Criteria 19
4.2 Culverts 19
4.3 Proposed Bridge 21
4.4 Flood Level 21
4.5 Afflux 24

5 PROPOSED BRIDGE SCOUR ASSESSMENT 27
5.1 Assessment background 27
5.1.1 Geotechnical Input Data 27
5.2 Scour Depths Estimation 27
5.3 Design of Scour Protection to HEC-23 28
5.3.1 Abutment Scour Protection 28
5.3.2 Proposed Scour Protection Design 30

6 CONCLUSIONS 31

1 INTRODUCTION

1.1 Project Location and Background

Roads and Maritime Services (RMS) propose to connect Pitt Town Road and Cattai Road to bypass the town centre of Pitt Town. Pitt Town Bypass span approximately 1km between Buckingham Street and Pitt Town Road. The location of the project site is indicated in Figure 1-1.

The current road alignment area is generally rural residential, with urban development adjoining the town centre. The proposed design road alignment passes over Hortons Creek at two or three locations depending on the final adopted road alignment.

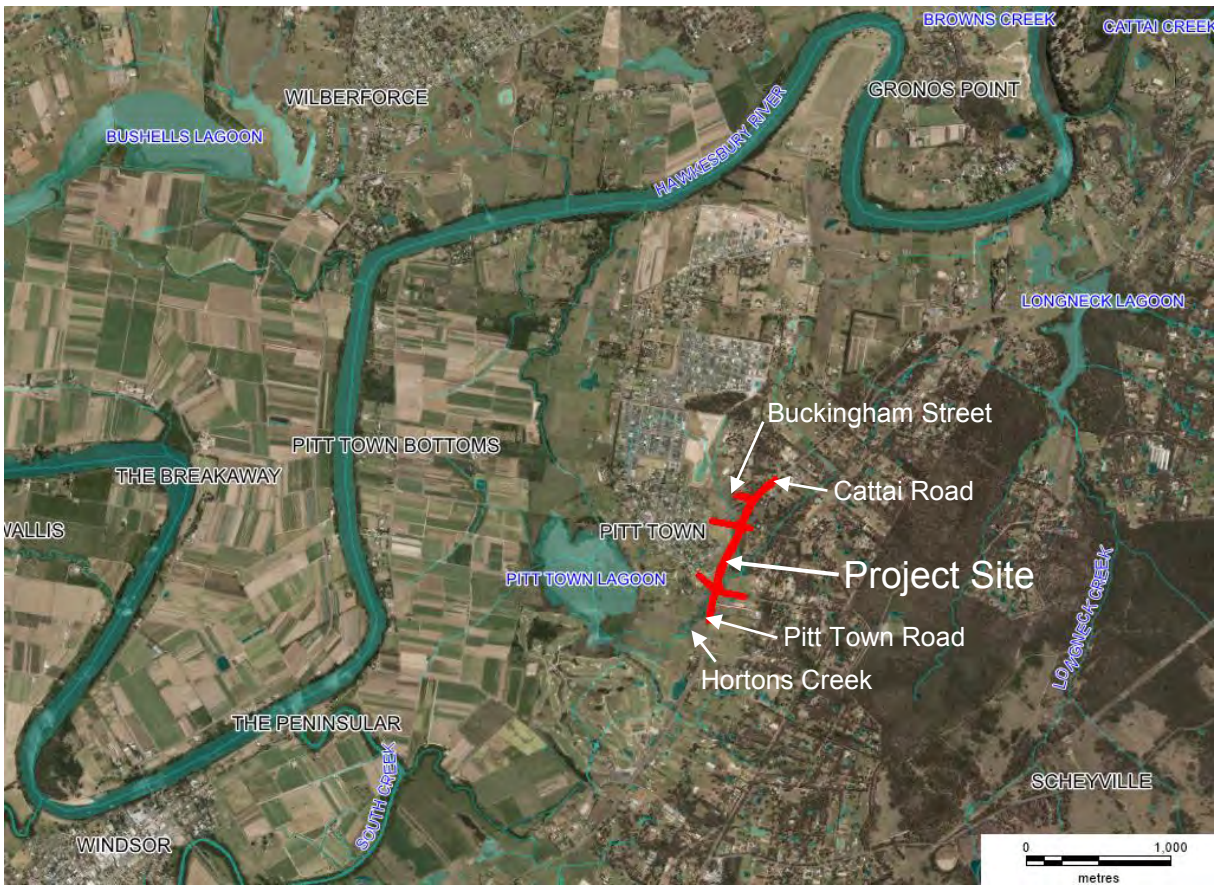


Figure 1-1 Locality Plan

1.2 Previous Studies

RMS has undertaken a preliminary hydrology and hydraulic assessment during the strategic design stage to estimate the required culvert size or bridge span at Hortons Creek crossings. The study has estimated the peak flows for the local catchment at the major creek crossings using RORB runoff and stream flow routing program. The peak flows were inputted into HEC-RAS (one-dimensional steady state) to analyse the existing flood conditions and sizing the hydraulic structures at the creek crossings. The culvert size proposed in this previous assessment was considered and refined in the current stage of assessment. This previously developed RORB and HEC-RAS models were not made available during the current design stage.

In addition to the RMS study conducted for the project, various council and regional flood studies have been conducted for the Hawkesbury-Nepean Valley floodplain. Hawkesbury Floodplain Risk Management Study & Plan (Bewsher, 2012) commissioned by Hawkesbury City Council collate flood behaviour information based on earlier investigations and reports. The study revised the Hawkesbury-Nepean Valley floodplain flood extent mapping for the 5 Year, 20 Year, 50 Year, 100 Year, 200 Year, 500 Year and 1000 Year ARI floods, and the Probable Maximum Flood (PMF), utilising the latest Airborne Laser Scanning (ALS) topographic data

available at the time of the study. The remapped flood extent is shown in Figure 1-2, with the current project site also marked in the figure.

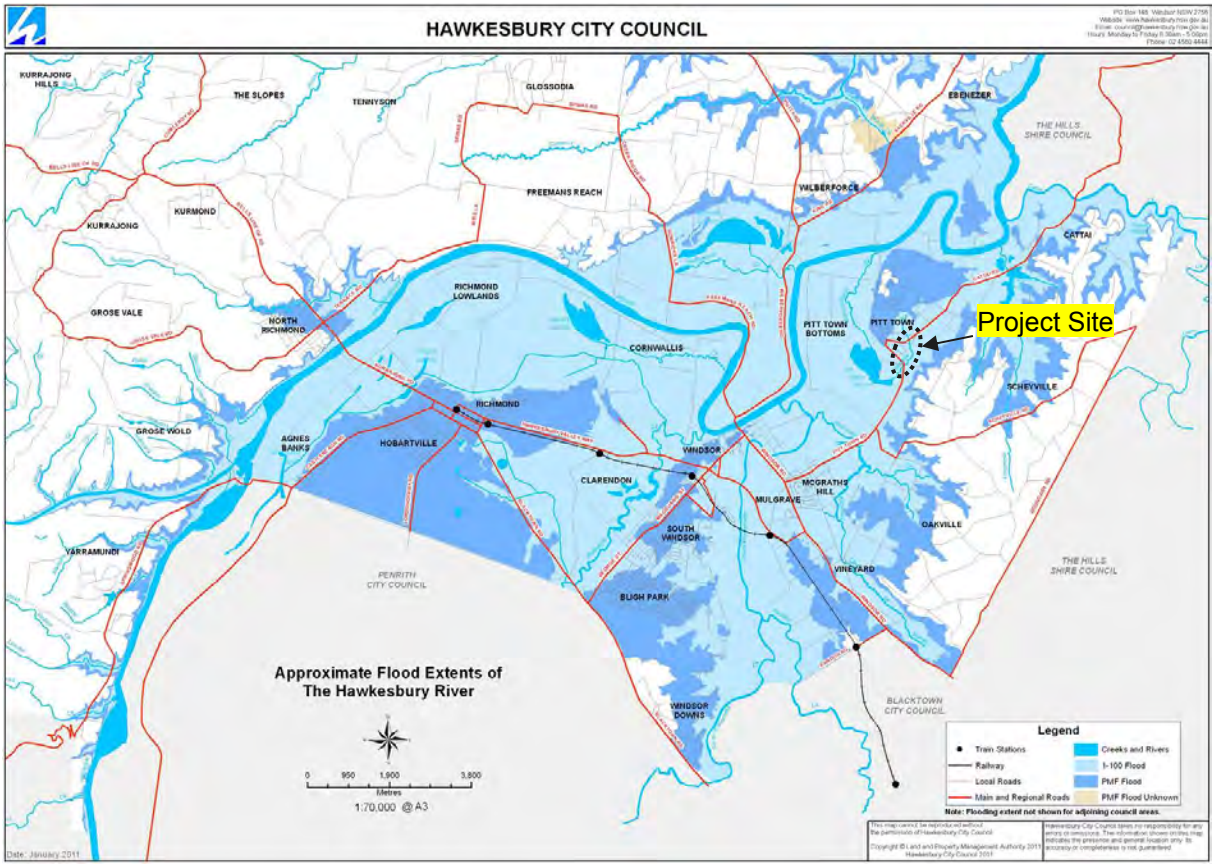


Figure 1-2 Hawkesbury-Nepean Valley flood extent (Extracted from Hawkesbury City Council's website: http://www.hawkesbury.nsw.gov.au/__data/assets/image/0018/31815/flood-extent-map-south-websm.jpg)

1.3 Available Data

The following information was made available for the project and was used to develop the hydraulic models for the purposes of hydraulic impact assessment. All the information listed was available in electronic format:

- Proposed Pitt Town Road Bypass Glebe Road to Buckingham Street, Pitt Town Hydrology and Hydraulic Investigation Report (RMS, March 2017). Note that the RORB and HECRAS models mentioned in this report are not made available.
- Ground survey undertaken by Jacobs issued on 10 October 2016 by RMS. The ground survey covers most of the project area except a property at the end of Wellesley Street.
- Base data such as 2m contour, lots, road, creeks, water features.
- 1m resolution LiDAR Digital Elevation Model (DEM) data which dates to approximately 2011 covers the entire local catchment area
- Aerial photography from public sources.

1.4 Project Objectives and Scope

The key hydrology and hydraulic objectives of the project is to establish the existing and post-upgrade flooding conditions for the waterways that cross the project area. The flood results were used to determine potential flood impacts, devise mitigation measures if required and determine cross drainage requirements. Flooding assessment was conducted based on the local catchment flows with the view to improve existing local catchment flood immunity where practical.

Regional flooding was not modelled in the current project because RMS has directed the flood modelling to consider only the local catchment assuming no backwater from the main Hawkesbury River, although RMS specification PS271 required the modelling of regional flooding. This is in line with RMS strategic design flood assessment.

The Hawkesbury-Nepean Valley is a very complex floodplain and has been studied extensively in the past. Based on the council's flood level information, the project site will be affected by very deep regional flood for ARI less than 5 Year. With substantial difference in the local Hortons Creek catchment area (424 Ha) and the Hawkesbury-Nepean Valley catchment area (2.2million Ha), the critical duration from the regional flooding would be substantially longer than the local catchment. Therefore, flood impacts from the project is deemed insignificant for regional flooding. Refer to Section 2.3 for further details.

1.5 Study Methodology

The following approach was adopted for the hydrology and hydraulic assessment:

1. Review and extract information from the previous Hydrology and Hydraulic Investigation Report conducted during the strategic design, "Proposed Pitt Town Road Bypass, Glebe Road to Buckingham Street, Pitt Town – Hydrology and Hydraulic Investigation (March 2017)"
2. Develop a rainfall on grid TUFLOW hydrology model for the whole local catchment of Hortons Creek to determine flow hydrographs and critical durations at the project site.
3. Build a TUFLOW hydraulic model for the project site.
4. Model existing flooding conditions
5. Extract the 100 Year ARI local catchment flood levels and provide advice to road designers regarding the Concept Design configurations and drainage requirements.
6. Undertake analysis of the preliminary sizing of structures at waterway crossings.
7. Model proposed Concept Design and confirm size of culverts and/or bridges at waterway crossings; and
8. Prepare a Hydrology and Hydraulics Assessment report (this report) outlining the methodology, analysis and results of the flood modelling.

1.6 Changes from 20% to 80% Concept Design

This is a list of key changes and modifications made from the 20% Concept design to the 80% Concept Design:

- TUFLOW Flood Model Setup
  - Initial water level: Initial water level at all basins, dams and localised depressions within the model extent were set as full.
  - Roughness map: The roughness map has been refined at the creeks and the inclusion of a new surface type of heavy weeds.
  - 2000 Year ARI: The 2000 Year ARI storm was included. Separate critical durations were established for the 2000 Year ARI.
  - 5 and 10 Year ARI: The proposed flood conditions for the 5 and 10 Year ARI were modelled in the TUFLOW models.
- Drainage Structures
  - General arrangement: Proposed culverts were rationalised to minimise crossing the main road alignment where possible. Example include Buck 1 (realigned) and PTB4 (removed).
  - PTB1: This culvert has been removed in consideration to its constructability. The proposed road alignment was lowered to match the existing road profile.
  - Southern Roundabout culverts: The culverts (Bathurst1, PTB3 and PTB2) near the southern roundabout was realigned such that these culverts are completely offline to the existing road alignment for ease of construction. In addition, these culverts were proposed to share the same outlet headwall.
  - PTB5: This has been modelled as a bridge (2D layered flow constriction) in the TUFLOW model.
  - Culvert invert levels and size: The invert levels were revised based on the revised road design alignment and the culverts size revised where applicable.
- Drainage Channels
  - Open channels: Earthworks of the open channels were modelled in 3D and included in the TUFLOW model.
  - Creek transitions: Creek transitions to PTB3 and PTB2 were modelled in 3D to divert creek flows to the proposed culverts and included in the TUFLOW model.
- Bridge Scour Assessment
  - Preliminary scour depth at the proposed PTB5 bridge was assessed in HEC-RAS (HEC18).
  - Preliminary requirements of scour protection at PTB5 was calculated based on HEC23.

1.7 Changes from 80% to 100% Concept Design

The changes and modifications made from the 80% to 100% Concept Design are listed below:

- Road Design
  - General arrangement: the shared path was removed from the 80% Concept Design
  - Vertical alignment: Pitt Town Road was raised near proposed bridge PTB5 to provide similar soffit level as the 80% Concept Design due to an increase in structure depth of the revised bulb-T bridge design.
- Drainage Structures
  - Culvert invert levels and size: The invert levels were revised slightly based on the revised road design alignment and the culvert size were revised where applicable.

  - PTB5: The bridge design has been revised from a two spans 18m wide plank bridge to a single span 36m wide bulb-T bridge. The skew angle of the proposed abutment has been reduced to improve the bridge constructability.
- Drainage Channels:
  - Open channels: earthworks of all open channels and creek/ culvert transitions were modelled in 3D and included in the TUFLOW model. The alignments of the open channels were modified slightly to suit the road geometry changes.

2 CATCHMENT DESCRIPTION

2.1 GENERAL

The proposed project site is located within the Hortons Creek catchment and forms part of the Hawkesbury-Nepean Valley floodplain.

2.2 Local Catchment - Hortons Creek

For the local catchment at Horton Creek, terrain data was analysed to produce catchment boundary to cover the project site. An overview of the boundary (green outline) can be seen in Figure 2-1, covering an area of 424Ha.

The north-west corner of the catchment is generally flat and the area is predominantly urban residential. From the aerial photographs, it was observed that a new development project spanning between Buckingham Street and Johnston Street has been constructed. This new development includes multiple diversion channels diverting stormwater into a new detention basin.

The south-east corner of the catchment is undulating and generally forest area that forms part of the Scheyville National Park.

The project site is located in between the National Park and the urban residential area, generally along the banks of Hortons Creeks and its tributaries. The land surrounding the project site is generally rural residential or farmland.

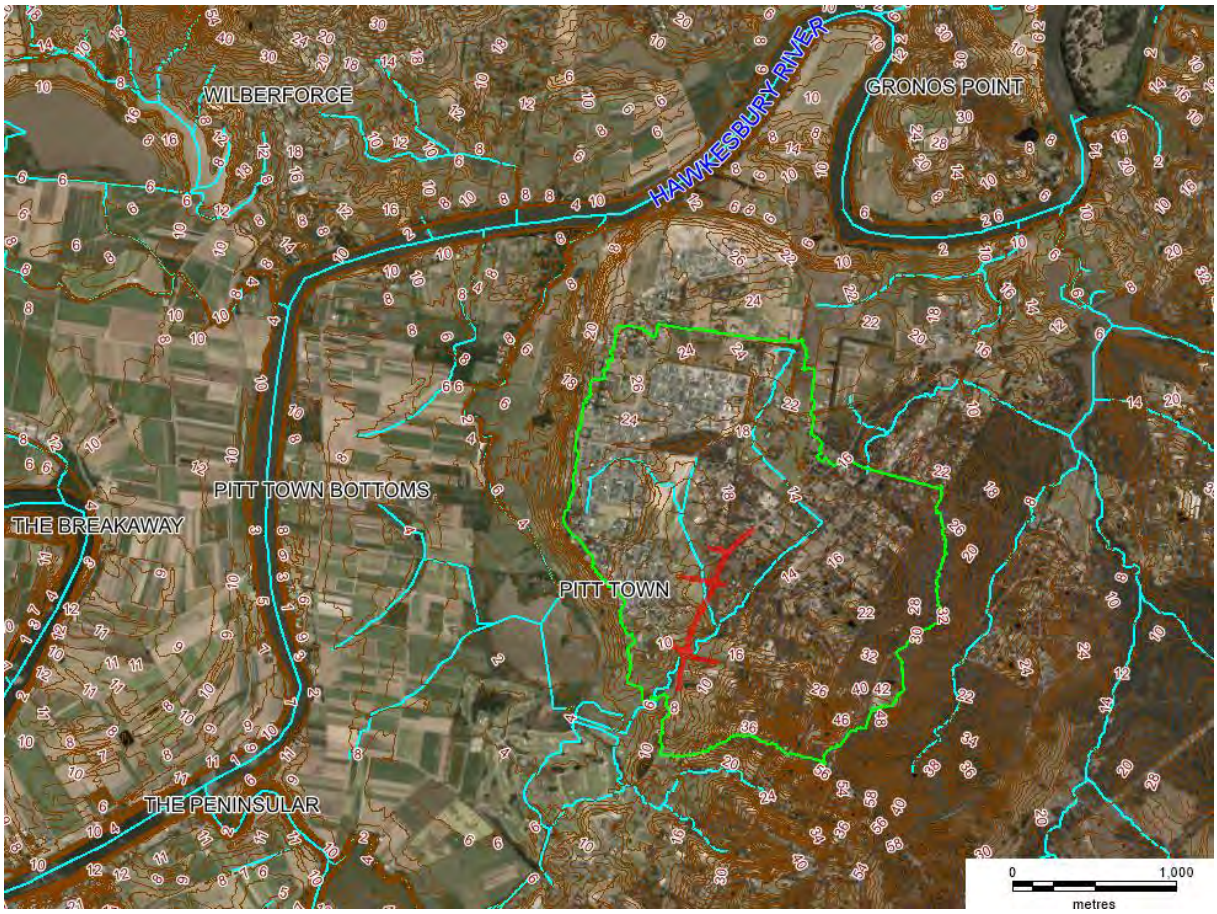


Figure 2-1 Local catchment boundary for Horton Creek

2.3 Regional Catchment – Hawkesbury River

Hawkesbury-Nepean Valley catchment covers an area of approximately 22,000km^2 (2.2 million Ha). The catchment has been studied extensively in the past and Hawkesbury City Council has mapped flood levels for the local government area. Flood levels from the flood level contour maps available in Hawkesbury Floodplain Risk Management Study & Plan: Volume 3 – Flood Maps and Annotated Bibliography (December 2012) are summarised in Table 2-1.

Table 2-1 Approximate flood level at project site based on council's flood mapping

ARI	Approximate Flood Level (m AHD)
5	10.6 to 10.8
20	13.6 to 13.7
50	15.6 to 15.7
100	17.2 to 17.3
200	18.6 to 18.7
500	20.1 to 20.2
1000	21.7 to 21.8
PMF	26.3 to 26.8

2.3.1 Regional Flooding Discussion

Based on the council's flood level contour maps, the regional flood gradient around the vicinity of the project site is very flat across all ARIs, suggesting that the project site is impacted by the backwater flooding of main Hawkesbury River.

The existing road level at the southern end of the project site at Pitt Town Road is at approximately RL 7m AHD while the northern end of the project site at Cattai Road is at a higher elevation of 16m. Based on the council's flood level information, the southern end of the project site is affected by regional flood for ARI less than 5 Year, while the northern end is inundated during regional flood events between 50 and 100 Year ARI.

The project site is therefore subjected to main river flooding during relatively frequent flood events, with a flood depth of approximately 3.6m to 3.8m near Pitt Town Road during the regional 5 Year ARI event. As such, it is not practical to address flood immunity based on main river flood levels because it would result in large embankments and significant increase in project footprint and costs. It is also noted that providing regional flood immunity to the project would have a very significant cost for very small benefits as the sections of road to the north and south of the project would still be severely impacted by flooding.

Due to the substantial difference of the local Hortons Creek catchment area (424 Ha) and the Hawkesbury-Nepean Valley catchment area (2.2million Ha), flood impacts from the project are deemed insignificant.

Therefore, in line with the direction of RMS, backwater from the main Hawkesbury River was not considered for the local catchment hydraulic modelling as the backwater effect will result in widespread inundation at the project site.

3 HYDROLOGY AND HYDRAULIC MODELLING

3.1 GENERAL

Flood models were generally developed to take rainfall, terrain, and surface roughness data to derive flood levels and flow distributions for existing and proposed scenarios. Existing-scenario flood surfaces were compared to proposed-scenario flood surfaces. Where flood level differences were deemed excessive the proposed hydraulic structures configurations were refined to bring the flood surfaces closer within a small tolerance.

3.2 Software

The digital terrain, photos of the project areas and catchments indicate that overland flow could potentially move in two-dimensional flow patterns, especially near the proposed roundabout at Glebe Road and Bathurst Street. Complex flood storage and routing within the catchments required a consistent and efficient modelling approach due to the number of modelling runs required during design iterations.

The favoured hydraulic modelling tool was therefore a two-dimensional flood modelling software package that takes full account for flood storage effects in a floodplain and has a dynamically coupled linkage between 2D and 1D domains.

The software package TUFLOW was used for both the hydrology and hydraulic modelling. TUFLOW is a hydrodynamic finite difference modelling package that was developed (and is still being expanded upon) in Queensland. It is a trusted software package in Australia and has been used extensively for Public Works and Private Development projects. TUFLOW is also a trusted tool in the UK and has been introduced into the US market with increasing acceptance.

TUFLOW is an acronym for Two-dimensional Unsteady FLOW. The two-dimensional aspect comes from the finite difference grid method used for the above-ground hydraulic calculations; the unsteady aspect comes from its ability to calculate results that vary with time. TUFLOW incorporates the ESTRY 1D network modelling system for modelling of culverts and pipe networks.

The capability of modelling 1D structures within 2D domains is particularly useful for modelling cross drainage structures for transport infrastructure design.

The TUFLOW release used throughout the project was the most current at the modelling start date; Build 201 7-09-AC (64 bit). For the hydrology modelling, the Single Precision ‘GPU’ module was used. For the hydraulic modelling, the Double Precision ‘Classic’ module was used.

3.1 Hydrology Modelling

3.1.1 General

Hydrology modelling converts inputs of rainfall, terrain, and surface roughness into runoff. There is a hydraulic component to the flood routing.

The TUFLOW rainfall-on-grid feature was used to take rainfall data and apply it to a 2D domain of the entire catchment. Rainfall losses were applied to account for rainfall that does not reach the creek-lines due to soil infiltration, small-scale terrain storage, and wetting of vegetation.

Due to the large size of the catchments and the large number of storm durations, the GPU module of TUFLOW was used for the hydrology models.

A range of standard storm durations ranging from 5 minutes to 18 hours were simulated for the 20 and 100 Year ARI events to establish the catchment critical durations at the project site.

Outputs of flow hydrographs were used as inputs into the hydraulic models.

3.1.2 Terrain

A 1m resolution LiDAR DEM data was obtained for the full local catchment. 1m LiDAR data was used for both hydrology and hydraulic models. Ground survey surfaces, where available, were used as an override.

Thin pilot channels were used in creeks where LiDAR data was patchy due to dense vegetation. Levels of the pilot channels were derived from the LiDAR elevations where the data was visually deemed as acceptable quality.

LiDAR picks up surface features only, not culverts. At roads where culverts are present, the terrain follows the road. Left unedited and if no culverts are input into the model, the LiDAR terrain at these locations would effectively be a dam, artificially storing runoff. Due to the limitation of TUFLOW GPU module where 1D component cannot be included in the modelling, LiDAR embankments were locally lowered to let flow through with minimal flood attenuation. This is a valid conservative approach to estimate the peak flows.

From the aerial photographs, it was identified that a new detention basin has been constructed just north of the project site and Buckingham Street. Multiple diversion channels have been constructed to divert flows from a new development project spanning between Buckingham Street and Johnston Street into the detention basin. The significant size of the basin and diversion channels can have a substantial influence on peak flows at the project site. As built plans were requested from Hawkesbury City Council but were not made available in time for the flood assessment of the project. As a result, additional site survey of the basin and diversion channels has been requested and incorporated in the current model.

3.1.3 Model Extents

For hydrology modelling, the TUFLOW model extents covered the full local catchment area upstream of the project site (red outline in Figure 3-1).

Downstream boundaries were set at locations sufficiently downstream of the site such that the modelled flow behaviour at the project site was not influenced by the boundary conditions. Downstream boundary conditions were set as TUFLOW types ‘HQ’, approximately 200m downstream of the project site.

‘HQ’ boundaries are a TUFLOW feature producing flow versus elevation data from an input of flood surface slope and a cross section location. TUFLOW derives a flow versus time curve based on the cross-section geometry and the water surface slope. This is equivalent to the HEC-RAS ‘normal depth flow’ boundary condition. Flood surface slope values were approximated from the ground surface slope.

3.1.4 Model Resolution

The hydrology model used a 4m cell size.

3.1.5 Surface Roughness

Aerial photographs were used to derive surface roughness distributions. The surface roughness was classified into seven categories and the distribution is shown in Figure 3-1. Table 3-1 provides details of the adopted roughness for varying types of surface.

For surface types such as buildings at ground level and urban blocks with roughness values dependent on computed water depth, ‘spline n’ interpolation was used in TUFLOW to calculate the roughness values between water depths listed in Table 3-1. ‘Spline n’ used a curved fit to transition the roughness value gradually between water depths.

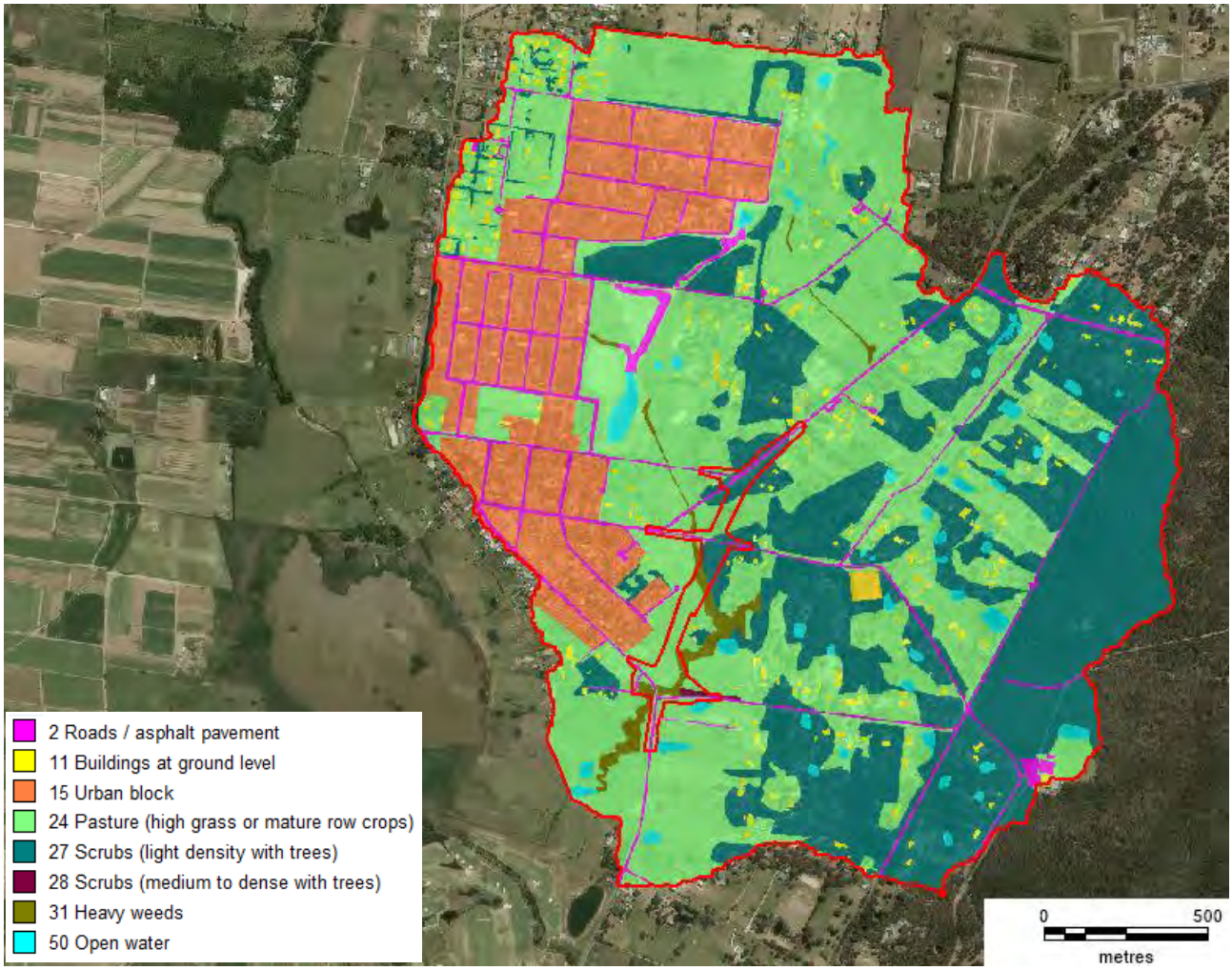


Figure 3-1 Surface Roughness Distribution

Table 3-1 Roughness Type and Value

Surface Type	Roughness (n)
Roads / asphalt pavement	0.018
Buildings at ground level	0.015 at shallow depth (<0.03m deep) 1 at deeper flow (>0.1m deep)
Urban block	0.1 at shallow depth (<0.03m deep) 0.2 at deeper flow (>0.1m deep)
Pasture (high grass or mature row crops)	0.035
Scrubs (light density with trees)	0.055
Scrubs (medium to dense with trees)	0.07
Heavy weeds	0.07 at shallow depth (<0.3m deep) 0.04 at deeper flow (>0.5m deep)
Open water	0.022

3.1.6 Initial Water Level

Initial water level at all basins, dams and localised depressions within the model extent were set as full.

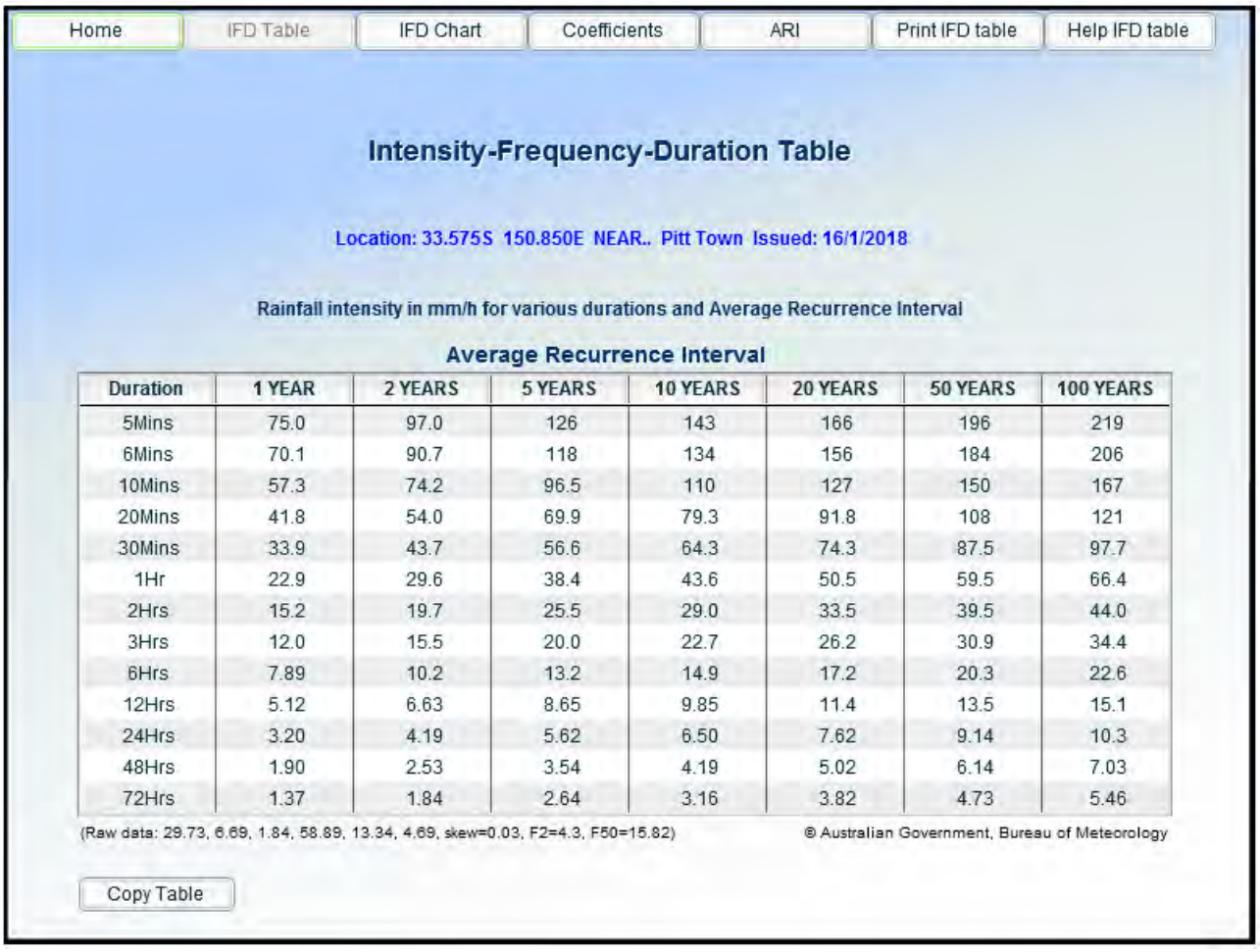
3.1.7 Rainfall Data

Design storm rainfall data was obtained from the BoM on-line IFD service at the following link. These are for use with the 1987 version of Australian Rainfall and Runoff (ARR87) which was the adopted method for this study for events up to the 100 Year ARI. The IFD table adopted for the project are provided in Figure 3-2.

http://www.bom.gov.au/hydro/has/cdirswebx/cdirswebx.shtml

The rare rainfall of 2000 Year ARI was obtained from the BoM on-line IFD service (2016 update) at the following link. The 2000 Year ARI design rainfall adopted for the project are provided in Figure 3-3. For short duration storm lesser than 24 Hour, rainfall intensities were estimated by extrapolation in accordance with the methodology set out in ARR87 Book VI Section 3.7.4. The extrapolation was based on the 100 Year ARI intensities (ARR87) multiplied by the calculated scaling variable of 1.44.

http://www.bom.gov.au/water/designRainfalls/revised-ifd/?year=2016



Duration	1 YEAR	2 YEARS	5 YEARS	10 YEARS	20 YEARS	50 YEARS	100 YEARS
5Mins	75.0	97.0	126	143	166	196	219
6Mins	70.1	90.7	118	134	156	184	206
10Mins	57.3	74.2	96.5	110	127	150	167
20Mins	41.8	54.0	69.9	79.3	91.8	108	121
30Mins	33.9	43.7	56.6	64.3	74.3	87.5	97.7
1Hr	22.9	29.6	38.4	43.6	50.5	59.5	66.4
2Hrs	15.2	19.7	25.5	29.0	33.5	39.5	44.0
3Hrs	12.0	15.5	20.0	22.7	26.2	30.9	34.4
6Hrs	7.89	10.2	13.2	14.9	17.2	20.3	22.6
12Hrs	5.12	6.63	8.65	9.85	11.4	13.5	15.1
24Hrs	3.20	4.19	5.62	6.50	7.62	9.14	10.3
48Hrs	1.90	2.53	3.54	4.19	5.02	6.14	7.03
72Hrs	1.37	1.84	2.64	3.16	3.82	4.73	5.46

Figure 3-2 IFD Table (ARR87)

	Annual Exceedance Probability (1 in x)				
Duration	**1 in 100**	**1 in 200**	**1 in 500**	**1 in 1000**	**1 in 2000**
24 hour	9.66	10.4	11.8	12.8	13.9
48 hour	6.50	7.43	8.60	9.54	10.5
72 hour	4.92	5.54	6.34	6.96	7.61
96 hour	3.93	4.36	4.93	5.38	5.83
120 hour	3.23	3.57	4.02	4.36	4.71
144 hour	2.73	3.01	3.39	3.68	3.97
168 hour	2.34	2.60	2.93	3.19	3.45

Figure 3-3 IFD Table for rare rainfall (ARR16)

3.1.8 Temporal Patterns and Storm Durations

Rainfall temporal patterns distribute the average rainfall intensity values over time. Temporal patterns were taken from ARR87 and were applied to the average rainfall intensity for ARIs up to and including 100 Year.

For 2000 Year ARI, temporal pattern from Generalised Short-Duration Method (GSDM) was applied to the average rainfall intensity.

No areal reduction was applied which is a slightly conservative approach. This conservatism was deemed acceptable in the context of all the other hydrological factors such as storage within catchment and surface roughness that influence runoff.

A range of standard storm durations ranging from 5 minutes to 18 hours were simulated for the 20 and 100 Year ARI events to establish the catchment critical durations at the project site. Standard storm durations between 30 minutes to 12 Hour were simulated for the 2000 Year ARI.

For other ARI events, only the critical duration storms are simulated for the TUFLOW hydraulic model boundary conditions inputs.

3.2 Hydraulic Modelling

3.2.1 General

The same parameters from the TUFLOW hydrology model were used for the TUFLOW hydraulic model where refinements were not required. This included surface roughness, rainfall data and temporal patterns, and downstream boundary conditions. The following subsections summarise the refinements and changes made to the TUFLOW hydraulic model from the hydrology model.

The hydraulic model was only simulated for the critical duration storms for the 5, 10, 20 and 100 Year ARI events. The same critical duration storms as the 20 Year ARI were assumed for the 5 and 10 Year ARI events because these design events have the same design temporal pattern.

3.2.2 Terrain

1m LiDAR DEMs were used as base terrain for all hydraulic models. Ground survey was used as overriding terrain.

Where the 1m LiDAR provided less than ideal representation of the terrain, such as in vegetated creeks, pilot channels were cut into the LiDAR terrain to better define the true geometry.

Break-lines were incorporated in the TUFLOW model to supplement the 1m LiDAR and ground survey at road embankment crests acting as flow controls. Road levels were taken from the crest of the ground survey.

Proposed channels and transitions upstream and downstream of proposed culverts were represented in the terrain as z-shape break-lines. The width of the break-lines at the proposed culverts matched the proposed culvert width to represent the earthworks required at the proposed culvert transitions.

3.2.3 Model Extents

The hydraulic model extents (Figure 3-4) were positioned close to the site locations with enough upstream and downstream extent such that all potential flood level increase areas were covered and downstream boundaries were far enough away to not adversely influence the results at the sites.

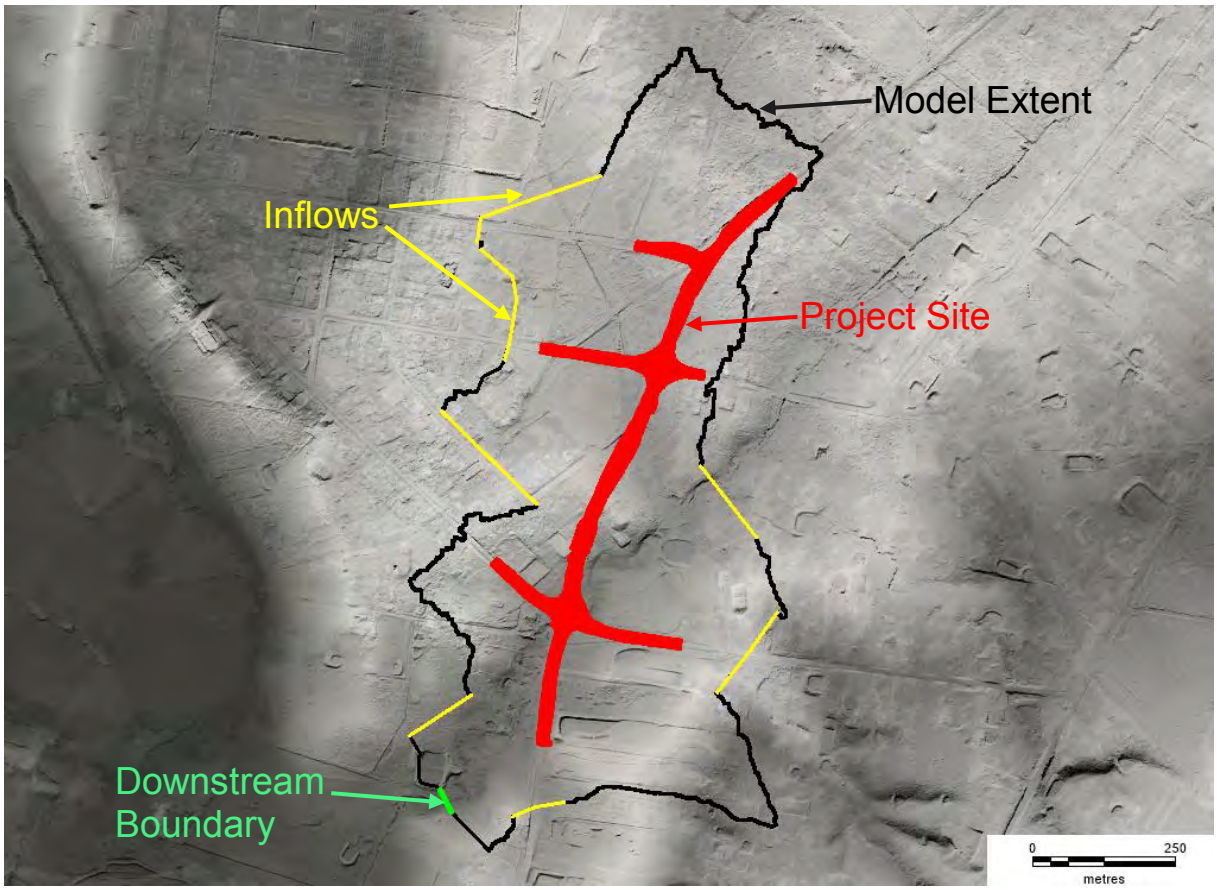


Figure 3-4 TUFLOW hydraulic model extent

3.2.4 Model Resolution and Calculation Time-step

The hydraulic TUFLOW model used a 2m cell size and 1 second calculation time-step.

3.2.5 Culverts

Culverts information were based on the site survey and included as a one-dimensional component in TUFLOW.

3.2.6 Inflows and Downstream Boundary Conditions

Inflow data used hydrographs from the critical duration storms from the hydrological modelling results.

Downstream boundary conditions were the same as the hydrologic model at Hortons Creek.

3.2.7 Initial Water Level

Initial water level at all basins, dams and localised depressions within the model extent were set as full.

3.3 Hydrology Results

3.3.1 Critical Durations

The critical duration maps for the 20, 100 and 2000 Year ARI are shown in Figure 3-5, Figure 3-6 and Figure 3-7 respectively. The project site is shown as the red outline in the figures. From the results, the critical duration adopted are summarised below:

- 20 Year ARI: 2 and 12 hour
- 100 Year ARI: 2 and 9 hour
- 2000 Year ARI: 1 and 2 hour

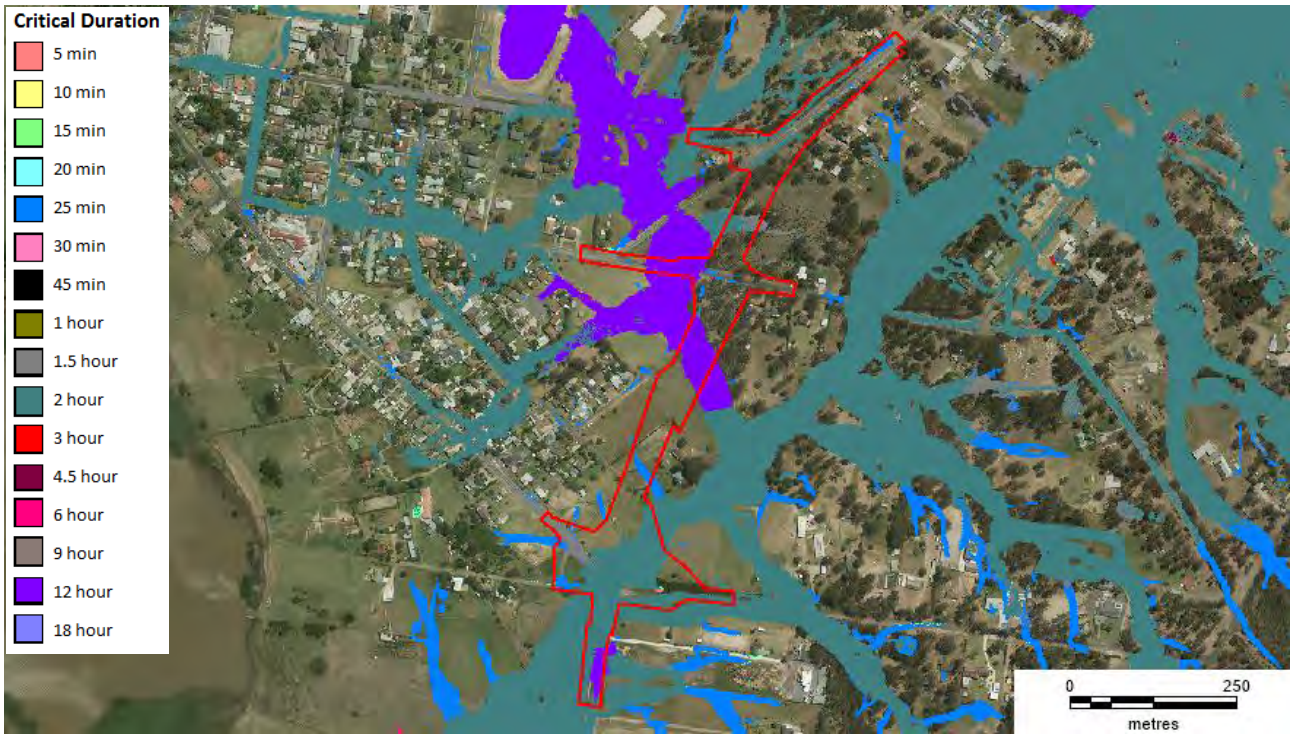


Figure 3-5 20 Year ARI Critical Duration Map

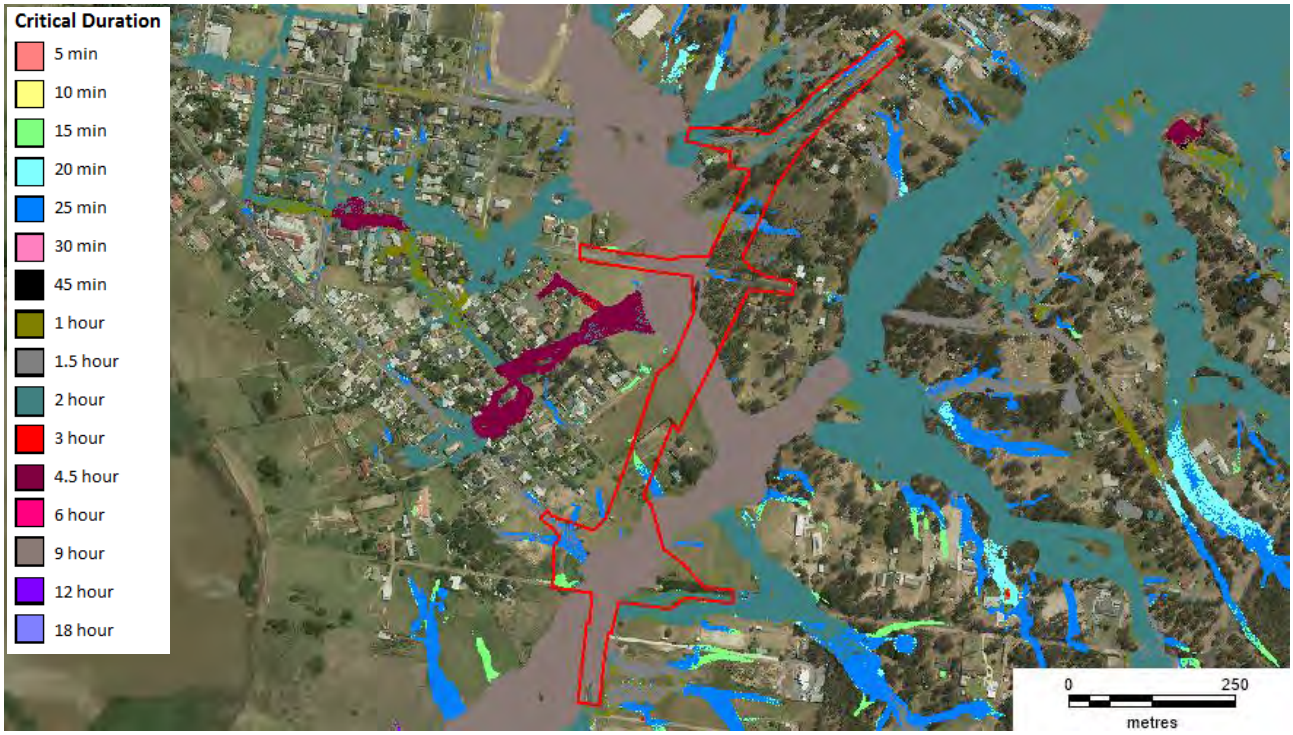


Figure 3-6 100 Year ARI Critical Duration Map

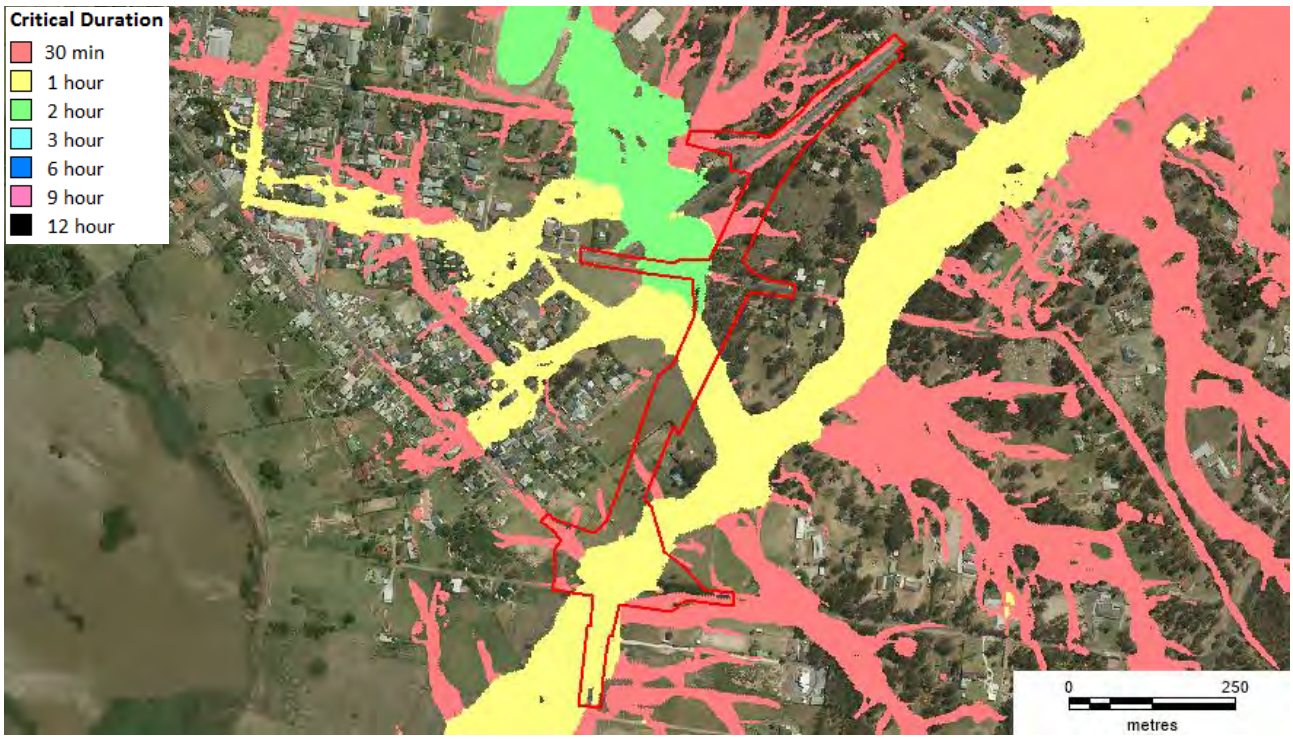


Figure 3-7 2000 Year ARI Critical Duration Map

3.3.2 Peak Flows

The estimated peak flow rate at the existing Hortons Creek Bridge is summarised in Table 3-2. Comparison with the RMS' Strategic Design flood assessment is also provided in the table below.

Table 3-2 Peak flow rate at existing Hortons Creek Bridge (near the intersection of Pitt Town Road and Glebe Road)

ARI (Year)	Peak Flow (m^3/s)	RMS Strategic Design Peak Flow (m^3/s)	Difference (%)
5	18.5	18.9	-2
10	22.4	23.4	-4
20	30.7	29.5	+4
100	45.4	43.5	+4
2000	67.0	-	-

The peak flows for this study shows good correlation with the peak flow rates estimated during the strategic design.

3.4 Hydraulic Results

3.4.1 Existing Flood Immunity

The existing flood immunity for the local catchment flows at the existing roads near the project site are summarised below:

- Cattai Road: Between 10 and 20 Year ARI
- Causeway at Old Pitt Town Road: Below 5 Year ARI
- Bathurst Street: Approximately 20 Year ARI
- Pitt Town Road: Below 5 Year ARI

4 PROPOSED DESIGN

4.1 Design Criteria

The project site is subjected to main river flooding during relatively frequent flood events of less than 5 Year ARI, with the flood depth of 3.6m to 3.8m near Pitt Town Road during the regional 5 Year ARI event. Therefore, it is not practical to address flood immunity based on main river flood levels because it would result in very large embankments and significant increase in project footprint and costs.

Flood immunity adopted by RMS during the strategic design phase is the 20 Year ARI local catchment peak flows, except at transitions to existing road and the causeway at Old Pitt Town Road. Initially, the same immunity as the strategic design was proposed to be adopted during the concept design phase because the flood immunity of the existing road in the vicinity of the project site generally ranges between 5 and 20 Year ARI and the higher end is adopted. However, further analyses indicated that adopting a 100 Year ARI flood immunity for local catchment peak levels is practical. The proposed road alignment and cross drainage infrastructure were designed to provide flood immunity for the 100 Year ARI.

Minimum cover requirements and culvert blockage criteria was adopted as per RMS specification PS271. A summary of the key criteria is provided below:

- Blockage factor of 50% is applied for culverts less than or equal to 600mm diameter, or 600mm height for box culverts.
- Minimum 450mm diameter pipe size for transverse drainage pipes.
- The depth of pipes or culverts must be such that the top of the pipe is a minimum 300mm below the bottom of the selected material zone.

4.2 Culverts

Drainage culverts were provided at locations such that disruptions to existing flow paths were minimised. The proposed locations of cross drainage are shown in Figure 4-1 as pink lines and the details are summarised in Table 4-1. The red-orange-yellow-cyan gradient background in the figure represents velocity multiplied by depth (Z0) for the 20 Year ARI flood event.

The cross drainage structures were sized for the 100 Year ARI local catchment flows and to minimise afflux (flood level changes) for the 100 Year ARI event.

Due to the increase in proposed road levels at the existing causeway at Old Pitt Town Road (OTB5), the existing culverts need to be upgraded to reduce upstream afflux.

There is an existing footbridge on the downstream end of this culvert. Due to the proximity of this footbridge to the proposed culvert outlet, it is recommended that the footpath be relocated to reduce risks of pedestrian being swept into the creek.

Opportunities exist to reduce the height of PTB3 culvert from 1.5m to 1.2m but this is conditional on the ability to reduce the culvert invert levels by approximately 0.3m. Currently there is limited survey in the creek downstream of this culvert. Additional survey in this area was previously requested but the surveyors could not access the area due to thick vegetation. Therefore, it is recommended that further survey is conducted downstream of PTB3 to the site boundary to ensure that the proposed invert levels can tie in with the existing creek inverts further downstream if there is need to reduce the size of this culvert to lower the road alignment in this vicinity.

Table 4-1 Proposed Culverts

Name	Upstream Invert	Downstream Invert	Number of Culverts	Culvert/Bridge Size
Bathurst1	6.46	6.20	1	0.9m diameter RCP
Buck1	11.81	11.74	1	0.9m x 0.6m RCBC
Lagoon1	7.37	7.24	1	1.2m x 0.45m RCBC
OPT5	9.40	9.34	6	0.675m diameter RCP
PA1	6.25	6.19	3	0.9m x 0.45m RCBC
PA2	12.52	12.44	1	0.6m x 0.45m RCBC
PA3	13.21	13.13	1	0.6m x 0.45m RCBC
PA4	13.66	13.60	1	0.6m x 0.45m RCBC
PTB2	6.04	5.93	1	2.4m x 0.75m RCBC
PTB3	6.25	5.93	5	3.6m x 1.5m RCBC
PTB6	9.98	9.76	3	0.675m diameter RCP

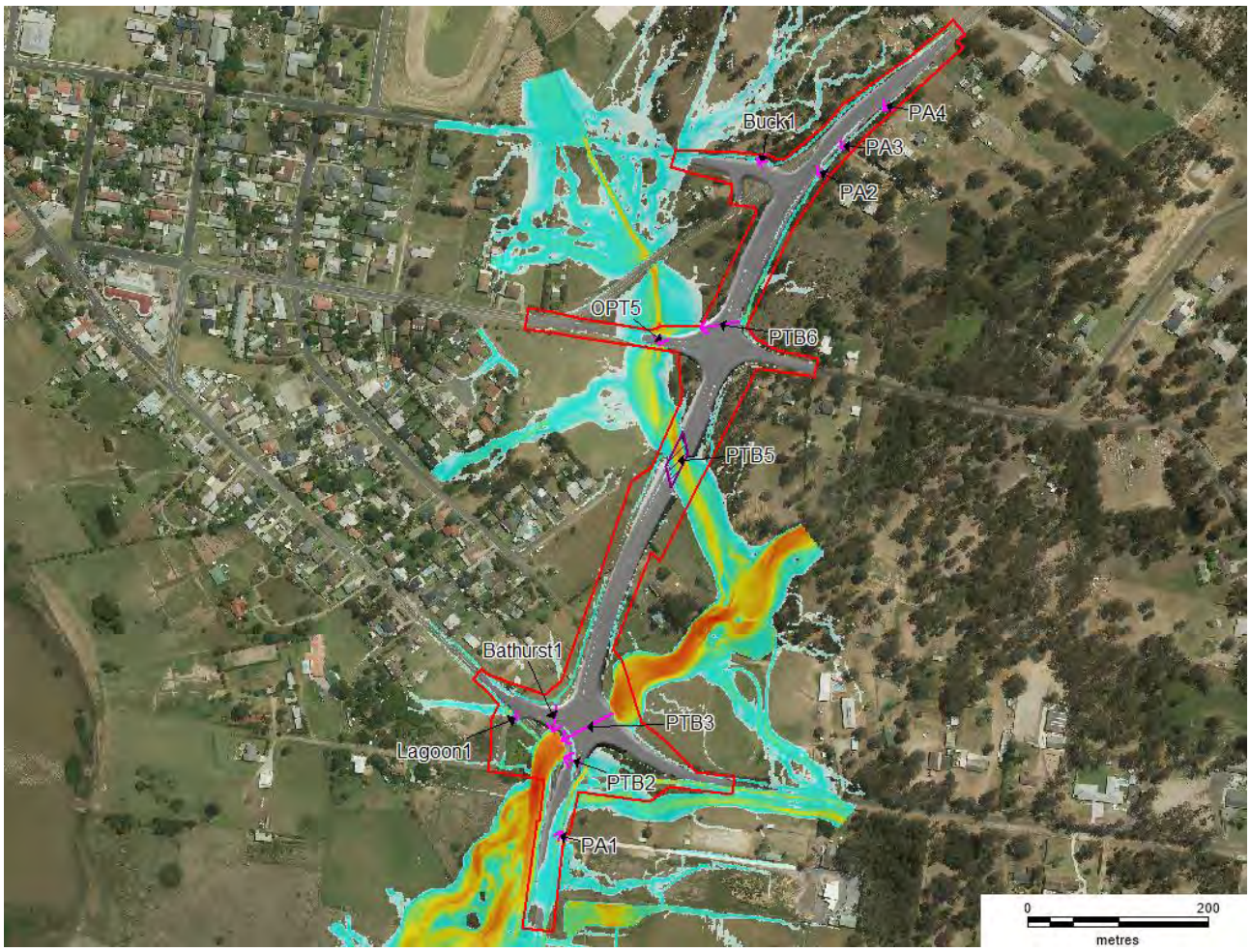


Figure 4-1 Proposed culvert and bridge locations

4.3 Proposed Bridge

The preliminary design of PTB5 bridge for the 80% design phase is summarised below:

- Bridge deck thickness: 0.96m (700mm deep plank girder, 80mm thick slab and 75mm pavement)
- Bridge spans: 2 x 18m (36m total length) plank bridge
- Bridge piers: 5 x 700 diameter cast-in-place reinforced concrete columns

The design of the bridge was revised in the 100% Concept Design Stage. The revised bridge design has a reduced skew angle to the direction of flow to improve the bridge constructability. The road vertical alignment has been raised to provide a similar soffit level to the preliminary bridge design at 80% Concept Design. The creek will be realigned marginally to avoid clashing with the proposed bridge abutments. The revised bridge design at 100% Concept Design is summarised below:

- Bridge deck thickness: 1.78m (1500mm deep bulb T girder, 200mm thick slab and 75mm pavement)
- Bridge spans: Single 35m span with no piers

The proposed bridge at PTB5 was modelled using TUFLOW layered flow constrictions. The layered flow constriction provides the opportunity to model the flow under and over a bridge deck. Each layer can be assigned with its own percentage blockage and form loss coefficient. The layers of the bridge structures were defined as follows. TUFLOW “cumulate” method was adopted for the computation of bridge form loss.

- Layer 1: Bridge opening area beneath the bridge soffit. No additional form loss was added since the revised design is a single span bridge and there will be no piers. The hydraulic losses from the horizontal changes at the abutments were accounted for in the TUFLOW 2D cells.
- Layer 2: Bridge Deck. It is assumed to be 100% blocked from the deck structure. The form loss coefficients would be high due to the additional energy losses associated with flow surcharging the deck. A form loss coefficient of 1.48 was adopted such that the total sum of form loss between Layer 1 and 2 is 1.56.
- Layer 3: Hand Rail. A 100% blockage is assumed for the handrail (0.82m high) on the proposed bridges No additional form loss coefficient was adopted as it was accounted in Layer 2.
- Layer 4: Flow over the top of the rails is assumed to be unimpeded.

The peak velocity and headwater elevation upstream of proposed PTB5 bridge are summarised in Table 4-2. The results show that the peak levels for up to 2000 Year ARI event is below the bridge deck soffit level of approximately 11.27m.

Table 4-2 PTB5 hydraulic summary

ARI (Year)	Upstream Water Level (m RL)	Peak Velocity (m/s)
5	9.51	1.1
10	9.53	1.2
20	9.71	1.4
100	9.83	1.7
2000	9.93	1.8

4.4 Flood Level

The flood level contour in 0.2m intervals overlaid with water depth shading for the 20 and 100 Year ARI is shown in Figure 4-2 and Figure 4-3 respectively. The flood results show that the proposed Pitt Town Road generally have 100 Year ARI local catchment flood immunity except at transitions to existing road and the causeway at Old Pitt Town Road.

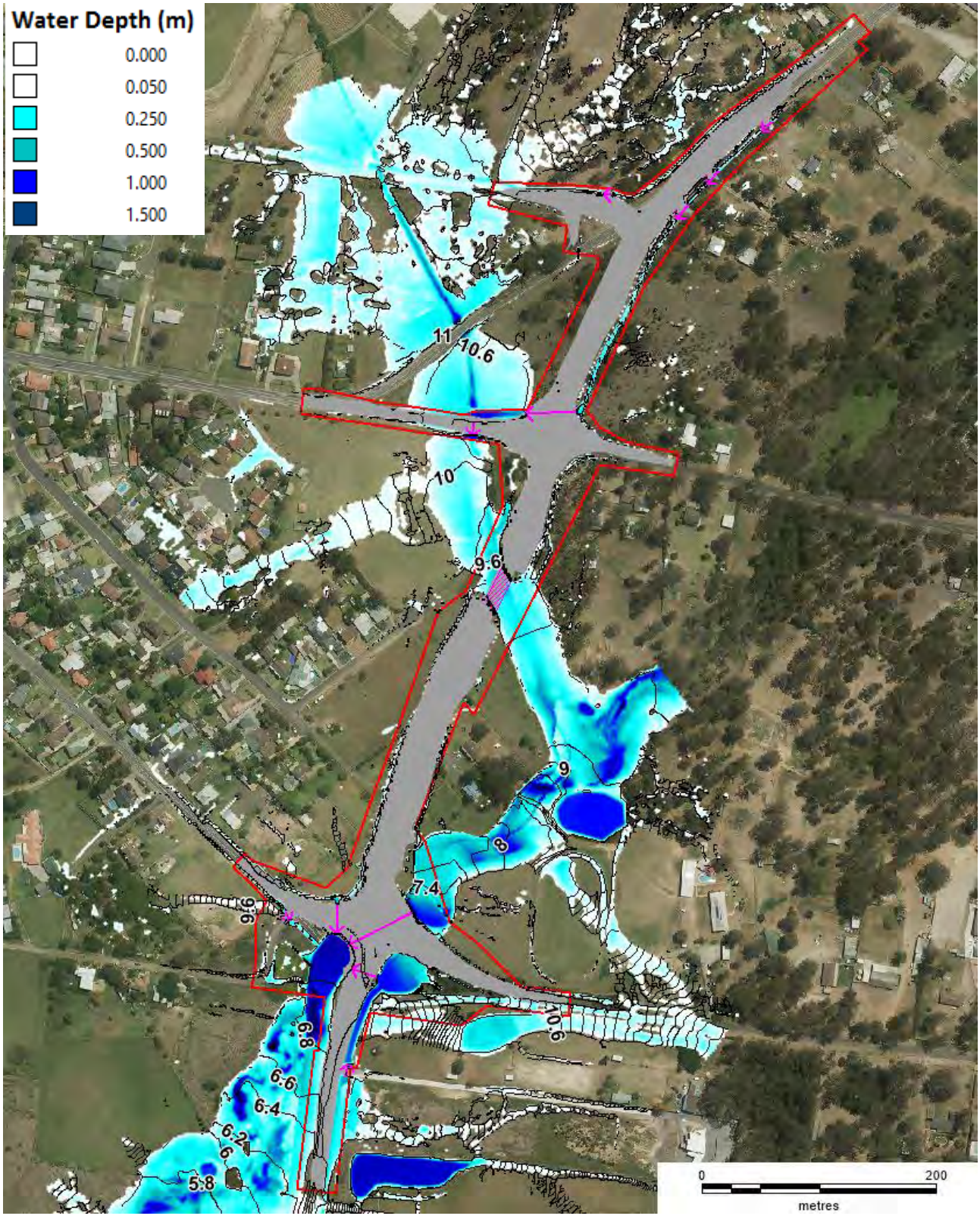


Figure 4-2 Water depth and flood level contour – 20 Year ARI

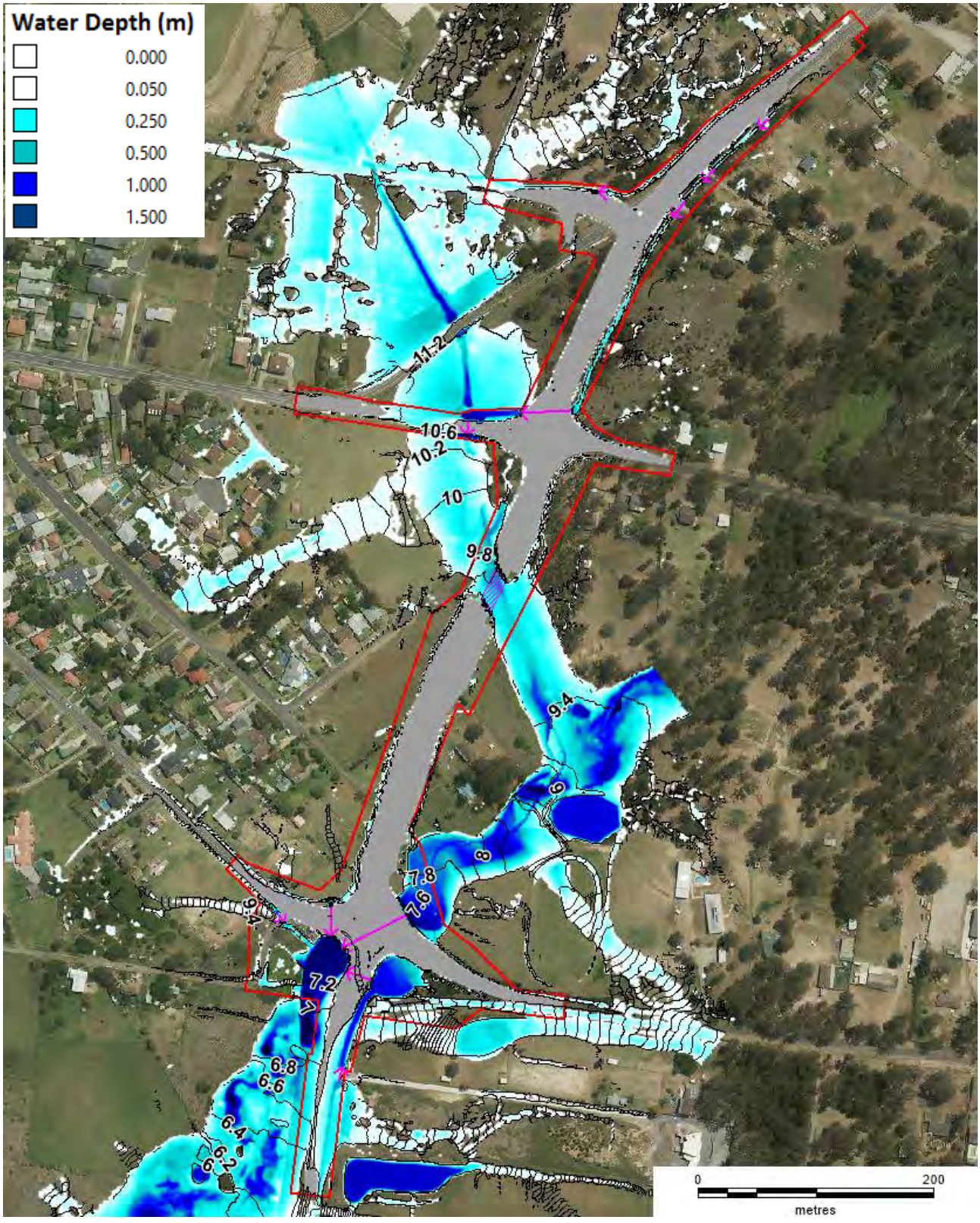


Figure 4-3 Water depth and flood level contour – 100 Year ARI

4.5 Afflux

For the current project, afflux criteria adopted assumes a maximum impact of up to 50mm at properties and up to 200mm at the waterways .

Afflux maps for the proposed Pitt Town Bypass for the 5, 10, 20 and 100 Year ARI are shown in Figure 4-4 to Figure 4-7 respectively. The project boundary is shown as red outline in these figures. For clarity, flood impacts within the project boundary are not shown in the figures.

No impacts to existing buildings are anticipated for the 5, 10, 20 and 100 Year ARI events.

From the results, water level increase is generally less than 50mm at properties for the 5, 10, 20 and 100 Year ARI events. However, localised afflux of up to 200mm is predicted immediately downstream of proposed OPT5 culvert due to the changes introduced at this location which resulted in concentrated flows downstream of OPT5 culvert.

For the 100 Year ARI event, afflux is predicted in the following additional locations:

- Afflux of up to 110mm is predicted within the waterway at the property upstream of OPT5 culvert but the afflux does not extend upstream of Cattai Road.
- Afflux of up to 100mm downstream of the causeway at Old Pitt Town Road.
- Afflux is up to 90mm within Hortons Creek upstream of the PTB5 bridge.

Flood impacts upstream of the PTB5 could be further reduced with minor creek realignment works. This would minimise the clash of the creek and proposed bridge abutment and loss of creek in-bank conveyance area. This is to be investigated and modelled in detailed design phase.

Flood impacts upstream of OPT5 culvert could be reduced further for the 100 Year ARI flood by increasing the number of culverts but this crossing is constrained by the project boundary. It is recommended that RMS to:

- consult with the property owners upstream of OPT5 culvert to allow for higher afflux upstream of this culvert, and/or
- acquire more land upstream of OPT5 culvert so that more culverts can be accommodated.



Figure 4-4 5 Year ARI afflux

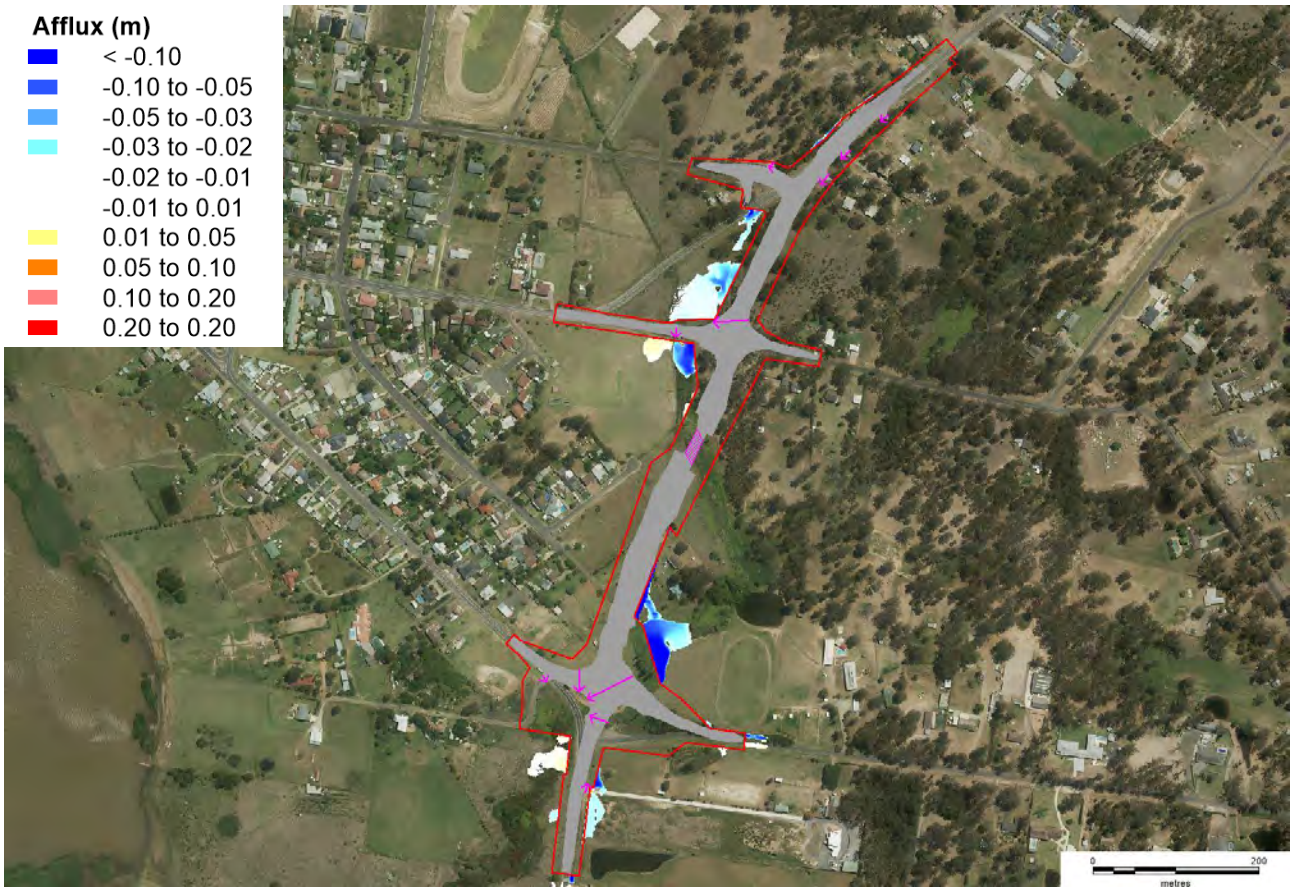


Figure 4-5 10 Year ARI afflux

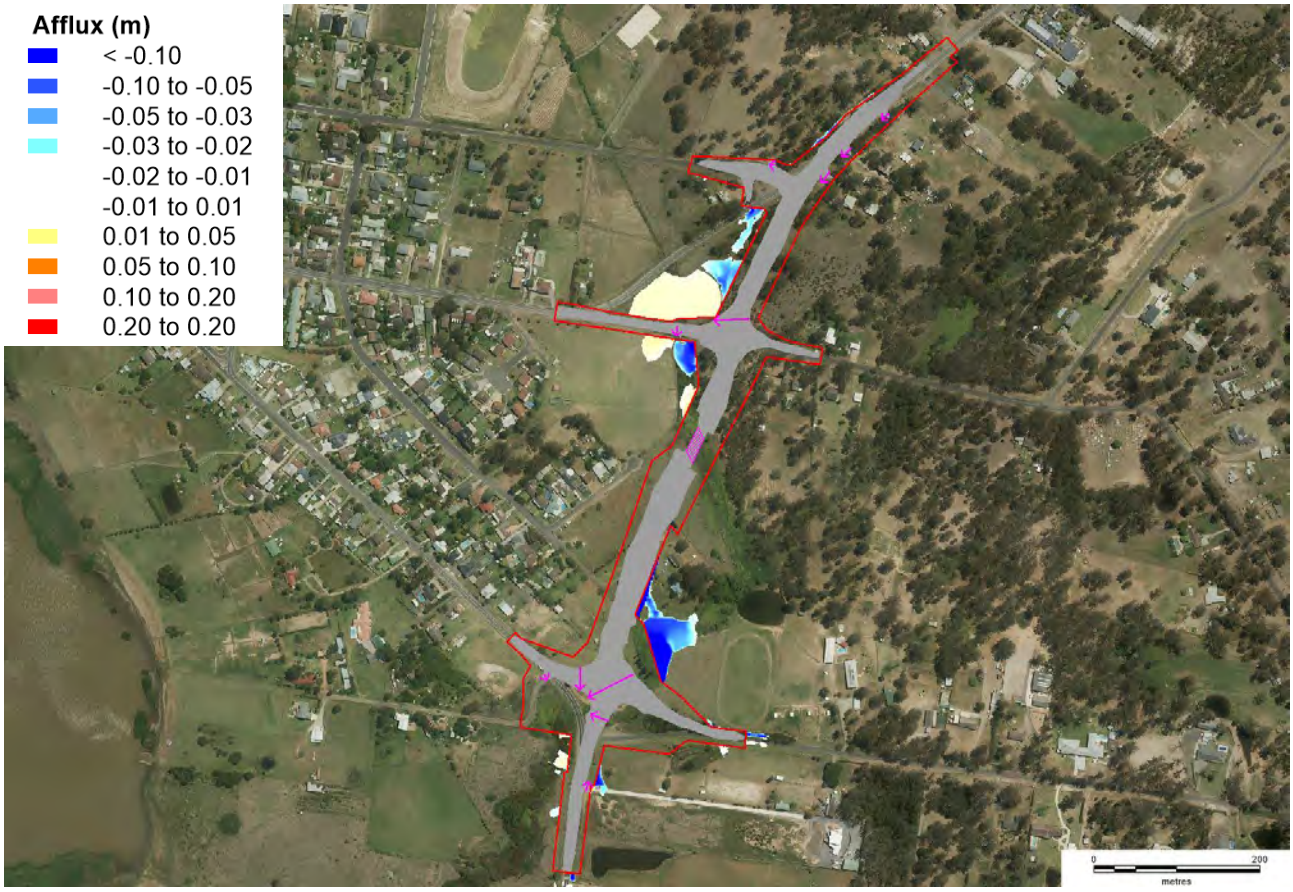


Figure 4-6 20 Year ARI afflux

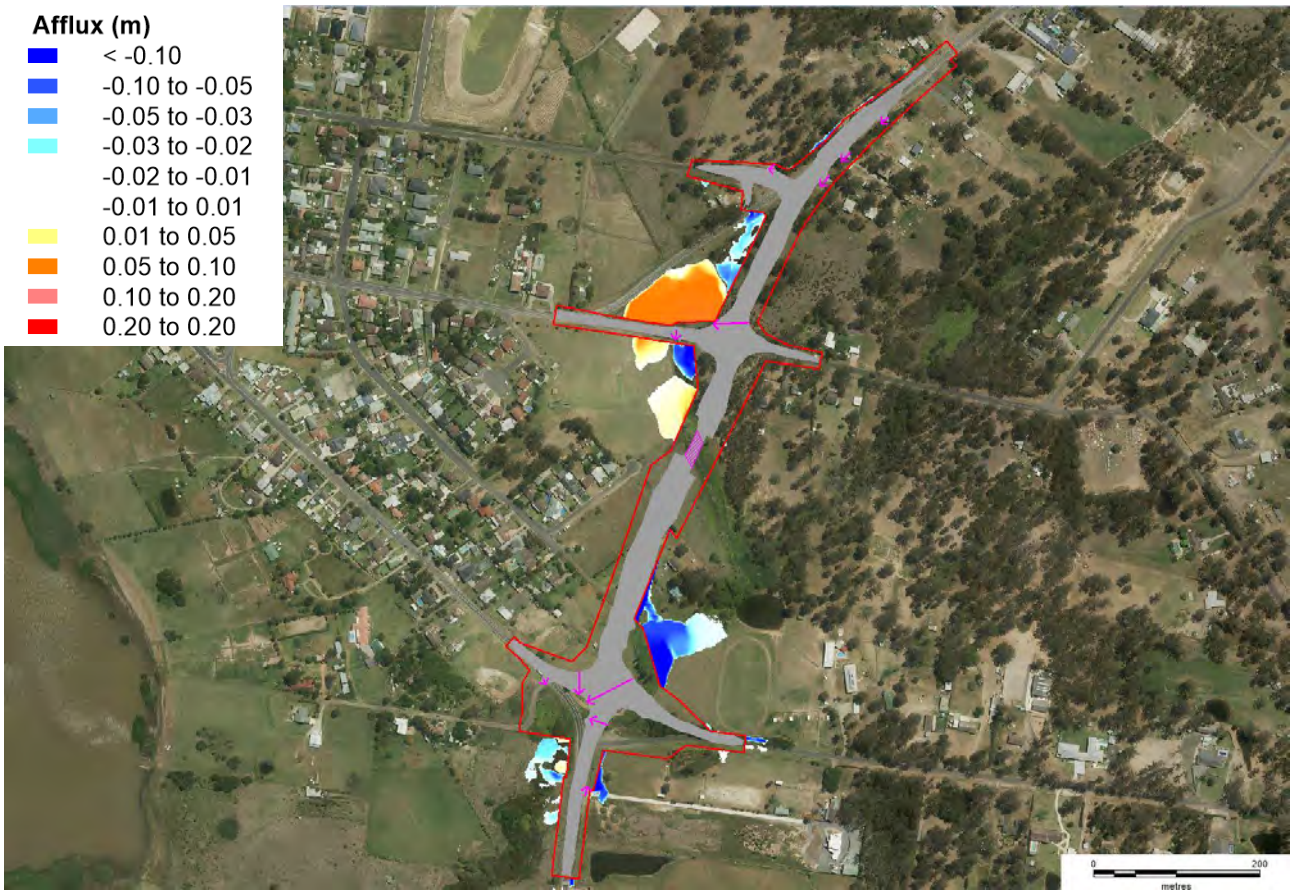


Figure 4-7 100 Year ARI afflux

5 PROPOSED BRIDGE SCOUR ASSESSMENT

5.1 Assessment background

The depth of contraction, local pier and local abutment scour at the proposed bridge were estimated using HEC-RAS (Version 5.0.1). HEC-RAS scour estimations are based on the Hydraulic Engineering Circular No 18 (HEC-18) – Evaluating Scour at Bridges (FHWA 2001). Flow information was extracted from the TUFLOW hydraulic model for the 5, 10, 20, 100 and 2000 Year ARI events. Scour depths were estimated for all these events.

Key assumptions for the scour assessment is summarised below:

- infinite constant design flow,
- cohesionless material, and
- homogeneous soil profile

There is currently uncertainty relating to the estimation of scour at bridges and they are summarised below:

- There are still significant gaps in knowledge and general understanding.
- The equations for estimating scour are based on laboratory experiments with limited field verification. The lack of reliable field data has made it difficult to verify predictions of potential scour depths obtained from small-scale laboratory tests. It is likely that many laboratory tests have over-simplified the complex nature of scour.
- Most predictive formulae for the estimation of bridge scour have been derived from laboratory experiments that tends to provide worst-case conditions. They are typically conducted in loose, cohesionless soils and in many instances, do not represent actual field conditions. The outcome of this is believed to be a conservative estimation of scour at bridge sites.

Consequently, analysis, interpretation and judgement should be applied to the HEC-RAS outputs to ensure a realistic outcome that considers the hydraulics, geotechnics (including bedrock depths and presence of cohesive soils) and evidence of existing scour at the proposed bridge site.

5.1.1 Geotechnical Input Data

Two key parameters required for the scour estimation are the D50 and D95 particle sizing. It is a characteristic size of the material that will be transported by the stream. HEC-18 recommended a minimum D50 of 0.2mm.

D50 and D95 were both adopted as the minimum of 0.2mm. to give a conservative estimate of potential scour depth at Concept Design phase.

5.2 Scour Depths Estimation

HEC-RAS calculates contraction scour, abutment scour, and pier scour at the bridges. The scour assessment has assumed a homogenous soil profile. It has also been assumed that no below-ground structures are in place other than piles with the same dimensions and locations as the bridge piers.

The total scour at the piers and abutments is a combination of the local scour and the contraction scour. A summary of the HEC-RAS scour estimation results for the 5, 10, 20, 100 and 2000 Year ARI local catchment design flood are shown in Table 5-1 below.

Table 5-1 Summary of Scour Depth Estimates

ARI (Year)	Total Abutment Scour (Abutment + Contraction) (m)
5	1.28
10	1.36
20	1.51
100	1.95
2000	2.30

It is important to note that the scour assessment results were based on the 80% Concept Design. The bridge design has been revised slightly in the 100% Concept Design which leads to only small increase in velocities and flood levels. This is likely to have minimal impact on the scour depth estimates, given the relatively minor scour depths magnitude in particular. The bridge design is a single span bridge at 100% Concept Design and the piers scour estimates are no longer relevant as there will be no piers.

It is recommended to revise the scour assessment in detailed design phase to incorporate the bridge design changes and the realignment of creek under the bridge. Scour estimation and design is a specialist field requiring geotechnical engineering expertise and comprehensive input data. Results of a HEC-RAS scour assessment should be interpreted by a geotechnical engineer experienced in scour estimation, and the results revised with a practical focus.

5.3 Design of Scour Protection to HEC-23

Whilst the bridges should be designed to accommodate the effects of contraction scour without rock protection, rock is recommended to be provided as a countermeasure to minimise the requirements for maintenance. Therefore, it is proposed that the scour protection design is provided up to the 100 Year ARI event.

The adopted document for the design of scour protection is the Hydraulic Engineering Circular No. 23 (HEC-23), September 2009 (Publication No. FHWA-NHI-09-111). HEC 23 provides equations to calculate the size of rock to be used, the grading of the rock protection, the horizontal extent and the vertical depth of the scour protection.

The bridge design was revised to a single span bridge and there is no piers. Scour protection design was undertaken for abutment only.

5.3.1 Abutment Scour Protection

The sizing of abutment rock riprap scour protection is separated into two scenarios, based on the abutment flow Froude Number. The Froude Number for all abutments were found to be less than 0.8.

For Froude Numbers $(V/(gy)^{1/2}) \leq 0.80$, the recommended design equation for sizing rock riprap for spill-through and vertical wall abutments is in the form of the Isbash relationship:

$$\frac{D_{50}}{y} = \frac{K}{(S_s - 1)}\left[\frac{V^2}{gy}\right]$$

Where:

D_{50} = median stone diameter, (m)

V = characteristic average velocity in the contracted section, (m/s)

S_s = specific gravity of rock riprap (taken as 2.5)

y = depth of flow in the contracted bridge opening, (m)

K = 0.89 for a spill-through abutment

Figure 5-1 and Figure 5-2 show the plan and cross section of rock riprap extent.

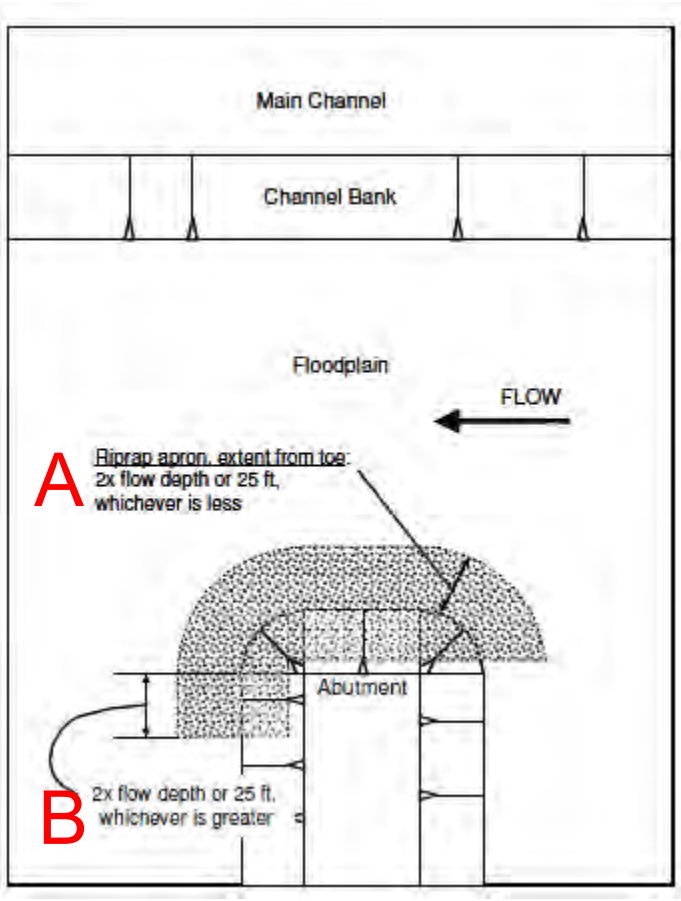


Figure 5-1 Plan view of the extent of rock riprap apron (Source: HEC23, 2009)

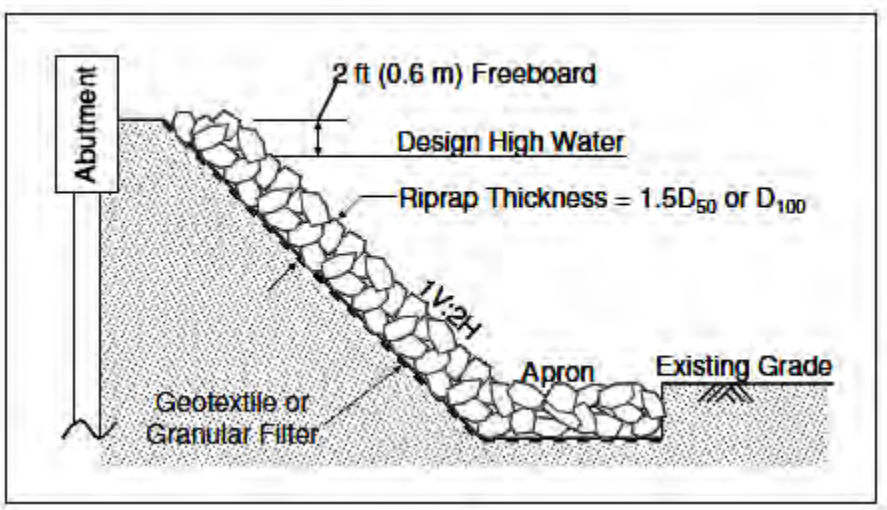


Figure 5-2 Typical cross section for abutment riprap (Source: HEC23, 2009)

5.3.2 Proposed Scour Protection Design

The properties of the scour protection that was proposed at the abutments are summarised in and Table 5-2 respectively.

Table 5-2 Scour protection - abutment

Bridge	PTB5
D_{50} (m)	0.25
Riprap thickness t, (m)	0.4
Min elevation level of top of riprap	10.52
Riprap Apron extent from toe of abutment “A” (m)	1.8
Riprap extent downstream around abutment “B” (m)	7.6

A minimum D_{50} rock dimension of 0.25m was adopted to provide reasonably robust rip rap protection that is resilient to unpredictable, localised increased flow velocities.

It is recommended that the scour protection is inspected regularly and following significant floods, e.g. extended rainfall that results in road or rail closures in the region or any flood that contacts the soffit of the bridge deck. If the scour protection is found to be damaged, it is recommended that the scour protection be repaired as soon as practical and/or further investigations conducted.

For all disturbed areas during construction, it is recommended that the areas are revegetated to prevent excessive soil loss.

6 CONCLUSIONS

The results indicate that the flood immunity at the proposed Pitt Town Bypass will be greatly improved over its current level to the 100 Year ARI local catchment flows, except at transitions to existing road and the causeway at Old Pitt Town Road. The flooding analysis outlined in this report showed that the proposed culvert configurations provide enough hydraulic capacity for the 100 Year ARI local catchment flows for all locations except at the road tie ins.

Water level increase from the proposed Pitt Town Bypass is generally kept under 50mm at properties and 200mm at the creek for all ARI up to and including the 100 Year. No impacts to buildings are anticipated.

For the 100 Year ARI event, afflux of up to 110mm is predicted at the properties upstream of OPT5 culvert but the afflux does not extend upstream of Cattai Road and result in flood levels lower than the predicted 5 Year ARI regional flood level. The flood impacts upstream of OPT5 culvert could be reduced further for the 100 Year ARI flood by increasing the number of culverts but this location is constrained by the project boundary. Therefore, it is recommended that RMS:

- consult with the property owners upstream of OPT5 culvert to allow for higher afflux upstream of this culvert, and/or
- acquire more land upstream of OPT5 culvert so that more culverts can be accommodated.

Scour depths at the proposed bridge PTB5 abutments was estimated for the 5, 10, 20, 100 and 2000 Year ARI local catchment design flood using HEC-RAS (HEC18). D50 and D95 were both adopted as the HEC18 recommended minimum of 0.2mm to give a conservative estimate at Concept Design phase. A summary of the scour results is shown in Table 5 1.

Abutment scour protection design at the proposed bridge PTB5 was based on HEC23 and the results are summarised in and Table 5-2. It is recommended that the scour protection is inspected regularly and following significant floods or any flood that contacts the soffit of the bridge deck. If the scour protection is found to be damaged, it is recommended that the scour protection be repaired as soon as practical and/or conduct further investigations.

The TUFLOW models developed for this project only analyse the local catchment flows assuming no backwater from the main Hawkesbury River. Regional flooding was not modelled in the current project because the Hawkesbury-Nepean Valley is a very complex floodplain and has been studied extensively in the past. The project site will be affected by very deep regional flood for ARI less than 5 Year. With substantial difference in the local Hortons Creek catchment area (424 Ha) and the Hawkesbury-Nepean Valley catchment area (2.2million Ha), the critical duration from the regional flooding would be substantially longer than the local catchment. Therefore, flood impacts from the project is deemed insignificant from regional flooding.

The TUFLOW models created for this analysis have been specifically set-up to predict the potential hydrologic and hydraulic impact of the road upgrade and to determine sizes of major cross drainage structures. They should not be used for another purpose without thorough knowledge of the model's set-up.

Appendix I

Non-Aboriginal Statement of Heritage Impact

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Pitt Town Bypass

Non-Aboriginal Statement of Heritage Impact (SoHI)

Report to Arcadis

September 2018



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Document history and status

1		Josh Symons	Josh Symons	5 March 2018	PD Review	First draft
2		Josh Symons	Josh Symons	23 March 2018	Client review	Second draft
3		Josh Symons	Josh Symons	2 May 2018	Client review	Final draft
4		Josh Symons	Josh Symons	14 September 2018	Final	Final

Printed:	
Last saved:	14 September 2018
File name:	170387 Pitt Town Bypass SoHI
Author:	Charlotte Simons and Jenny Winnett
Project manager:	Josh Symons
Name of organisation:	Artefact Heritage
Name of project:	Pitt Town Bypass SoHI
Name of document:	SoHI Pitt Town Bypass
Document version:	Final

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EXECUTIVE SUMMARY

Roads and Maritime Services (Roads and Maritime) propose to build a bypass of Pitt Town, NSW (the proposal). The bypass would be about one kilometre long between Pitt Town Road and Buckingham Street, east of Pitt Town .

The need for the Pitt Town Bypass is driven by the large number of heavy vehicles, sometimes up to 18 per cent of total vehicles, traveling daily through Pitt Town. The number of vehicles is expected to increase due to nearby development. The proposal would provide a connection between Pitt Town Road in the west and Cattai Road in the east, which would improve road connectivity and safety in the area.

Roads and Maritime and its predecessors have been considering the bypass for over 70 years, with a road reserve in place since the 1940s (currently zoned SP2 infrastructure in the Hawkesbury Local Environmental Plan 2012) and the Department of Main Roads developing an indicative bypass plan in 1951.

Artefact Heritage have been engaged by Arcadis, on behalf of Roads and Maritime, to provide a non-Aboriginal (historic) Statement of Heritage Impacts (SoHI) for the project. This SoHI will be included in the Review of Environmental Factors (REF) for the proposed Pitt Town Bypass.

The aim of this SoHI is to identify heritage items and archaeological areas which may be impacted by the proposed works, determine the level of heritage significance of each item, assess the potential impacts to those items, recommend mitigation measures to reduce the level of heritage impact and identify other management or statutory obligations.

Overview of findings

This SoHI has made the following conclusions:

- There is one listed heritage item within 25m of the proposal site boundary. This includes:
  - ‘Cottage’ (Hawkesbury Local Environmental Plan [HLEP] 2012 Item No. I277)
- The ‘Cottage’ (HLEP 2012 Item No. I277) has been assessed as being significant at a local level
- Portions of the study area have been assessed as demonstrating moderate potential to contain archaeological relics
- The proposal has been assessed as having a:
  - Minor physical impact on the ‘Cottage’ heritage item
  - Minor visual impact on the ‘Cottage’ heritage item
  - Potential impact to areas assessed as demonstrating moderate potential to contain archaeological relics.

Recommendations

The following recommendations will aid in mitigating the impact of the proposed Pitt Town Bypass on nearby heritage items and the wider Pitt Town cultural landscape:

- Consideration should be given to planting native screening vegetation along the bypass alignment after completion to mitigate impact on the views and setting within the study area

- As the proposal has not been assessed as resulting in any impacts above 'minor' on locally listed items within the study area, consultation with Hawkesbury City Council under the ISEPP would not be required
- As the proposed construction footprint is within 25m of the 'Cottage' heritage item, there is potential risk for impacts from vibration during construction, depending on the nature of equipment utilised. Construction vibration damage should be carefully managed and monitored. It is recommended that the construction methodology for works within a 25m range of the locally listed 'Cottage' heritage item be subject to approval by Roads and Maritime prior to commencement of works in this area
- Should works be required within the area assessed as having moderate potential to contain archaeological relics, an Archaeological Research Design (ARD) must be prepared
- Dependant on the assessed level of impact in the ARD, this may necessitate application for an excavation permit, or Exception Notification, under either Section 140 or Section 139(4) of the *Heritage Act 1977* respectively, to the Heritage Division of the Office of Environment and Heritage. Examples of possible outcomes have been provided in Table 9. The ARD would be required to support any application to Heritage Division.
- If unexpected archaeological finds are discovered during the proposed work, the Roads and Maritime *Standard Management Procedure: Unexpected Heritage Items* (2015) must be followed. The NSW Heritage Division would be notified of the discovery of a relic in accordance with Section 146 of the NSW *Heritage Act* 1977. In areas where a permit to impact 'relics' under the Heritage Act is in place, a heritage consultant and Roads and Maritime would need to determine consistency of the unexpected find with existing approvals and advise if a notification to Heritage Division would be required.
- A heritage induction must be presented to workers before commencement of construction of works in the vicinity of the 'Cottage' heritage item (LEP 2012 Item No. I277) and include values of the place, avoidance procedure, and contacts (site manager, RMS heritage officer) for reporting unexpected archaeological finds or inadvertent impacts to the heritage item.

Table 1: Potential outcomes for archaeological management.

Impact	Additional documentation required	Archaeological investigation	Approval
High	Archaeological Research Design and Methodology	Test excavation	S139 Exception Notification
		Open area salvage excavation	S140 permit application
Moderate	Archaeological Research Design and Methodology	Test excavation	S139 Exception Notification
Low	Archaeological Research Design and Methodology	Test excavation/ Archaeological monitoring	S139 Exception Notification

CONTENTS

1.0 Introduction and Background 1
1.1 Background 1
1.2 Study Area 1
1.3 Structure of this Report 4
2.0 Methodology 5
2.1 Identification of heritage listed items 5
2.2 Archaeological assessment 5
2.2.1 NSW Heritage assessment guidelines 5
2.2.2 Research potential 6
2.3 Assessment of heritage impact 7
2.4 Limitations and Constraints 8
2.5 Authorship 8
3.0 Heritage Management Framework 9
3.1 Introduction 9
3.2 Environmental Protection and Biodiversity Conservation Act 1999 9
3.2.1 Commonwealth Heritage List 9
3.2.2 National Heritage List 9
3.3 Heritage Act 1977 9
3.3.1 State Heritage Register 10
3.3.2 Section 170 registers 10
3.4 Environmental Planning and Assessment Act 1979 11
3.4.1 Hawkesbury LEP 2012 11
3.5 Non-Statutory Registers 13
3.5.1 The Register of the National Estate 13
3.5.2 Register of the National Trust 13
3.6 State Environmental Planning Policy (Infrastructure) 2007 13
4.0 Historical Context 14
4.1 Aboriginal histories of the locality 14
4.2 Development of the Hawkesbury 14
4.3 The Macquarie Towns 15
4.4 The Development of Pitt Town 16
4.4.1 John Benn 18
4.4.2 James Wilbow 20
4.4.3 Robert Hobbs 20
4.4.4 John Palmer 20
4.5 Subdivision and Agriculture 22

5.0 SIte Inspection 25
6.0 Built Heritage Assessment 32
6.1 Assessment of Significance 32
6.1.1 Cottage (Hawkesbury LEP 2012 Item No. I277) 32
6.2 Overview of land-use 34
6.3 Assessment of Archaeological Potential 37
6.3.1 Evidence of residential development 37
6.3.2 Evidence of agricultural practices 38
6.3.3 Road corridors 39
6.4 Assessment of Archaeological Significance 39
6.4.1 Assessment against the NSW heritage assessment guidelines 40
6.5 Overview of archaeological potential 41
7.0 Impact Assessment 43
7.1 Proposal Description 43
7.2 Assessment of Proposal against Management Policies 45
7.2.1 Hawkesbury DCP 2002 45
7.3 Assessment of Heritage Impact 46
7.3.1 Cottage (LEP 2012 Item No. I277) 46
7.3.2 Archaeological impact 48
7.4 Statement of Heritage Impact 49
8.0 Conclusions and Recommendations 51
8.1 Conclusions 51
8.2 Recommendations 51
9.0 References 53

FIGURES

Figure 1: Location and extent of study area (proposed maximum disturbance footprint). 3

Figure 2: Location of the “Cottage” in relation to the study area and construction footprint. 12

Figure 3: Detail from Surveyor C. Grimes 1796 *Plan of the Settlements in New South Wales* showing the Mulgrave Place Farms..... 15

Figure 4: c.1826 plan of Pitt Town with the study area shaded in red. Source: SLNSW. 17

Figure 5: Knapp’s 1828 plan of Pitt Town. The portion of the study area covered by the plan is shaded in red. Source: State Records MAP SZ405. 18

Figure 6: Galloway’s 1843 survey of the township of Pitt Town. The portion of the study area covered by the plan is shaded in red. Source: State Records NSW- MAP 4746. 19

Figure 7: Detail of Knapp’s 1828 plan of Pitt Town showing the Hobbs residence. The portion of the study area covered by the plan is shaded in red. Source: State Records MAP SZ405. 21

Figure 8: Land utilisation in Pitt Town Bottoms in 1942. Source: Maze, W. H. 1943. 22

Figure 9: Subdivision north of Pitt Town, the Hall Estate. 23

Figure 10: 1955 aerial photograph (with study area in red). 24

Figure 11: View north along Pitt Town Road towards study area. 25

Figure 12: View south along Pitt Town Road from intersection with Glebe Road. 25

Figure 13: View west along Glebe Road to Pitt Town Road/Bathurst Street intersection. 25

Figure 14: View east along Glebe Road. 25

Figure 15: View north from Glebe Road across adjoining paddock. 26

Figure 16: View north east from Glebe Road across adjoining paddock. 26

Figure 17: View east from Bathurst Street across adjoining paddock. 26

Figure 18: View south east along Bathurst Street towards intersection at Glebe Road. 26

Figure 19: View north west along Bathurst Road towards curtilage of ‘Cottage’ heritage item at 22 Bathurst Street. 26

Figure 20: View south west across Bathurst Road towards ‘Cottage’ heritage item at 22 Bathurst Street. 26

Figure 21: View south west to ‘Cottage’ heritage item located at 22 Bathurst Street. 27

Figure 22: View south east along the eastern boundary of ‘Cottage’ heritage item curtilage. 27

Figure 23: View north west from Bathurst Road to ‘Cottage’ heritage item at 22 Bathurst Road. 27

Figure 24: View north east to ‘Cottage’ heritage item at 22 Bathurst Road. 27

Figure 25: View east to historic cistern located within the curtilage of the ‘Cottage’ heritage item..... 27

Figure 26: View east from curtilage of ‘Cottage’ heritage item across Bathurst Road to adjoining paddocks. 27

Figure 27: View north west along the eastern boundary of the curtilage of the ‘Cottage’ heritage item on Bathurst Road. 28

Figure 28: View south east across Bathurst Street at corner of Lagoon Road, towards study area. .. 28

Figure 29: View north east across paddock adjoining Bathurst Road. 28

Figure 30: View east across paddocks adjoining Bathurst Road and Glebe Road. 28
Figure 31: View north east across paddock adjoining Wellesley Street and Buckridge Street. 28
Figure 32: View south east along Wellesley Street towards adjoining properties and paddocks. 28
Figure 33: View south west across paddock between Wellesley Street and Bathurst Street. 29
Figure 34: View north across sports oval from end of Buckridge Street. 29
Figure 35: View south from end of Buckridge Street towards adjoining paddocks. 29
Figure 36: View south west from end of Buckridge Street towards adjoining paddocks. 29
Figure 37: View north east from end of Buckridge Street. 29
Figure 38: View east along Old Pitt Town Road from near intersection with Eldon Street and Cattai Road. 29
Figure 39: View west along Old Pitt Town Road towards intersection with Eldon Street and Cattai Road. 30
Figure 40: View south from northern side of Old Pitt Town Road. 30
Figure 41: View north across property adjoining Old Pitt Town Road. 30
Figure 42: View north across Old Pitt Town Road. 30
Figure 43: View north east along Cattai Road at corner of Buckingham Street. 30
Figure 44: View south east across Cattai Road at corner of Buckingham Street. 30
Figure 45: View north to historic shed located on Cattai Road. 31
Figure 46: View south west along Cattai Road. 31
Figure 47: View west to Cottage heritage item. 32
Figure 48: Overview of former structures. 36
Figure 49: Overview of archaeological potential. 42
Figure 50: Plan of the proposed Pitt Town Bypass (Source: Arcadis). 44
Figure 51: View east from cottage across Bathurst Street. 47
Figure 52: View south east from cottage towards proposed location of Bathurst Street and Glebe Road roundabout and new bypass alignment. 47

TABLES

Table 1: Potential outcomes for archaeological management. iv
Table 2: Lots located within the study area 2
Table 3: NSW heritage assessment criteria 6
Table 4: Terminology for assessing the magnitude of heritage impact. 8
Table 5: LEP items located within the study area 11
Table 6: Significance assessment for the 'Cottage' 33
Table 7: Consideration against NSW heritage assessment criteria 40
Table 8: Statement of heritage impact 49
Table 9: Potential outcomes for archaeological management. 52

ABBREVIATIONS AND GLOSSARY

Acronym	Description
Archaeological remains	Relics or work of local or state significance
DCP	Development Control Plan
EIS	Environmental Impact Statement
EP&A Act	*Environmental Planning and Assessment Act* 1979
EPBC Act	*Environment Protection and Biodiversity Conservation Act* 1999
ICOMOS	International Council on Monuments and Sites
LEP	Local Environmental Plan
LGA	Local Government Area
NHL	National Heritage List
NSW	New South Wales
OEH	Office of Environment and Heritage
Relic	Any deposit, artefact, object or material evidence that relates to the settlement of the area that comprised New South Wales, not being Aboriginal settlement, and is of State or local significance
SHI	State Heritage Inventory
SHR	State Heritage Register
UNESCO	United Nations Educational, Scientific and Cultural Organisation
Works	Evidence of significant infrastructure that may be buried and archaeological in nature
WHL	World Heritage List

1.0 INTRODUCTION AND BACKGROUND

1.1 Background

Roads and Maritime Services (Roads and Maritime) proposes to build a bypass of Pitt Town, NSW (the proposal). The bypass would be approximately one kilometre long between Pitt Town Road and Buckingham Street, east of Pitt Town.

The need for the Pitt Town Bypass is driven by the large number of heavy vehicles, sometimes up to 18 per cent of total vehicles, traveling daily through Pitt Town. The number of vehicles is expected to increase due to nearby development. The proposal would provide a connection between Pitt Town Road in the west and Cattai Road in the east, which would improve road connectivity and safety in the area.

Roads and Maritime and its predecessors have been considering the bypass for over 70 years, with a road reserve in place since the 1940s (currently zoned SP2 infrastructure in the Hawkesbury Local Environmental Plan 2012) and the Department of Main Roads developing an indicative bypass plan in 1951.

Artefact Heritage have been engaged by Arcadis, on behalf of Roads and Maritime, to provide a non-Aboriginal (historic) Statement of Heritage Impacts (SoHI) for the project. This SoHI will be included in the Review of Environmental Factors (REF) for the proposed Pitt Town Bypass.

The aim of this SoHI is to identify heritage items and archaeological remains which may be impacted by the proposed works, determine the level of heritage significance of each item, assess the potential impacts to those items, recommend mitigation measures to reduce the level of heritage impact and identify other management or statutory obligations.

1.2 Study Area

Pitt Town is located within the Hawkesbury Local Government Area (LGA) in the Greater Sydney region about 45km north west of Sydney. The proposed bypass would extend between the intersection of Bathurst Street with Glebe Road in the south, through cleared land, across Old Pitt Town Road to Cattai Road in the north (Figure 1). The bypass would be approximately 1,060m long. The study area is located to the east of the main township of Pitt Town.

The study area is located approximately 2.5km east of the Hawkesbury River near the Pitt Town Lagoon and is intersected by Hortons Creek, which is an ephemeral tributary to the lagoon. The study area extends from 220m north of r the intersection of Cattai Road and Buckingham Street to about 230m south of the intersection of Pitt Town Road and Glebe Road.

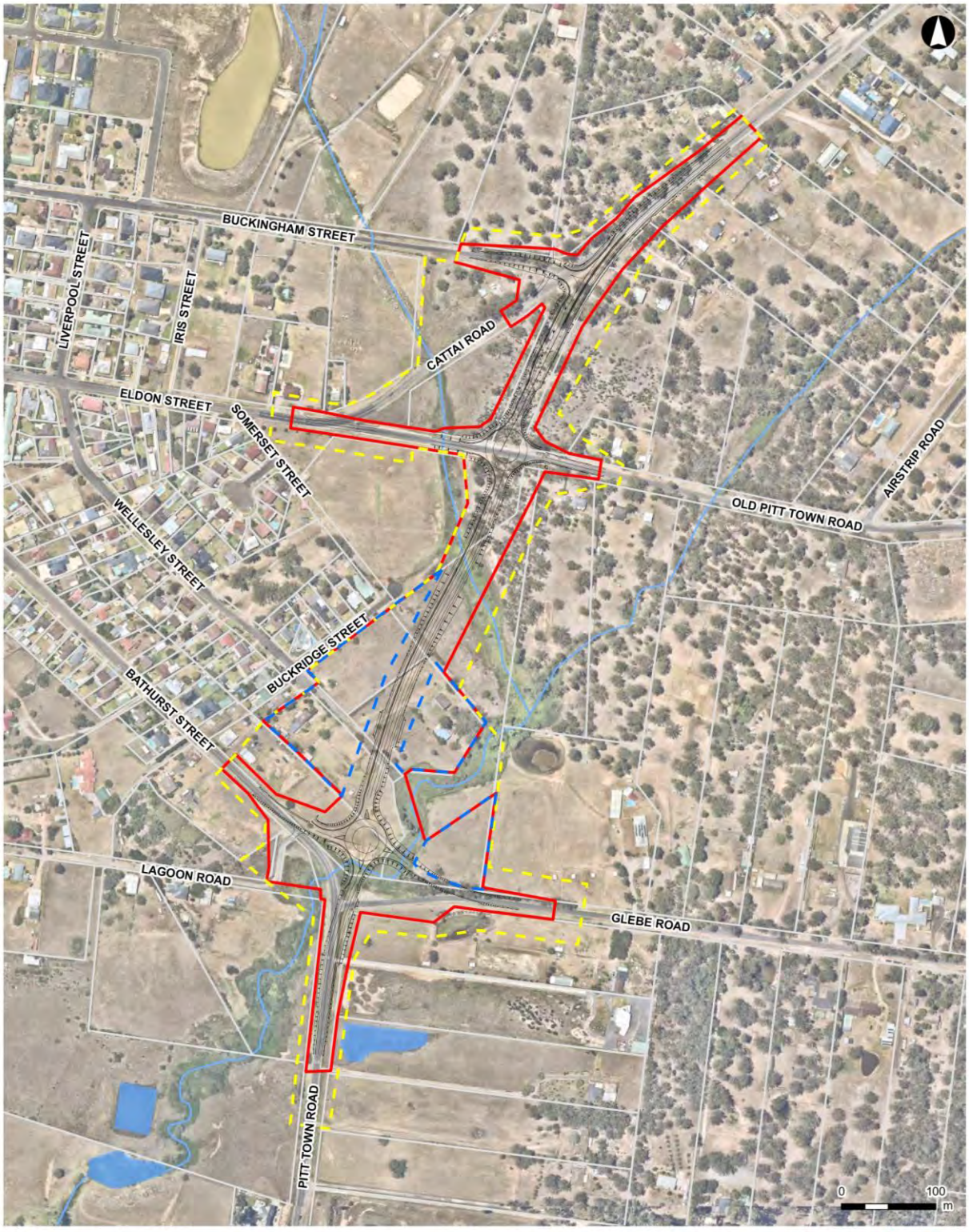
The study area comprises a buffer around the proposed bypass alignment and construction footprint, including proposed upgrade areas to existing roads (Pitt Town Road, Bathurst Street, Glebe Road, Eldon Street, Old Pitt Town Road and Cattai Road). The buffer identifies potential heritage items within the immediate catchment of the project, and potential visual impacts that may occur. The buffer zone also supports assessment of other potential indirect impacts, for example as a result of vibration from works undertaken within 25m from heritage items. Any reference to the study area includes reference to the buffer zone, unless otherwise stated.

The study area comprises sections of the lots identified below.

Table 2: Lots located within the study area

Lot	Deposited Plan	Lot	Deposited Plan
2	215001	3	522823
3	712795	254	752050
2	712795	52	1187464
3	215001	8	6916
4	215001	10	6916
2	709145	4	225516
1	986055	3	225516
1	196036	2	225516
5	215001	1	851776
3	565918	4	778197
1	107709	9	6916
1	560897	1	1042091
2	774487	1	561695
1	522823		

Figure 1: Location and extent of study area (proposed maximum disturbance footprint).



1.3 Structure of this Report

The structure and content of this report is as follows:

- **Chapter 1** (this chapter) – Project background and description
- **Chapter 2** – An overview of report methodology
- **Chapter 3** – The heritage management framework including the legislative and policy context, and relevant criteria applicable to the proposal
- **Chapter 4** – An overview of the historical context of the study area
- **Chapter 5** – A description of the site and findings from the site inspection
- **Chapter 6** – An assessment of significance of heritage items within the study area
- **Chapter 7** – An assessment of archaeological potential and significance within the study area
- **Chapter 8** – An overview of impacts to heritage items and archaeology arising from the proposal
- **Chapter 9** – Conclusions and recommended measures to mitigate and manage potential impacts
- **Chapter 10** – References of sources used in the preparation of this report.

2.0 METHODOLOGY

2.1 Identification of heritage listed items

Heritage listed items within the study area and buffer of each site were identified through a search of relevant state and federal statutory and non-statutory heritage registers:

- World Heritage List
- Commonwealth Heritage List
- National Heritage List
- State Heritage Register
- Hawkesbury LEP 2012
- Section 170 Heritage and Conservation Registers for Sydney Water, Roads and Maritime, Railcorp, Ausgrid and Department of Housing
- NSW State Heritage Inventory database.

Items listed on these registers have been previously assessed against the NSW Heritage Assessment guidelines (as outlined in Section 2.2.1). Statements of heritage significance, based on the NSW Heritage Assessment guidelines, as they appear in relevant heritage inventory sheets and documents, are provided in this assessment.

Where relevant Conservation Management Plans (CMP's) and other heritage management documents and guidelines have been utilised to provide additional information regarding heritage significance. Where used, these have been cited.

2.2 Archaeological assessment

An overview approach to the identification of potential archaeological resources has been adopted in this Heritage Impact Assessment. Historical archaeological potential is defined as the potential of a site to contain historical archaeological relics, as classified under the NSW *Heritage Act 1977*. The assessment of historical archaeological potential is based on the identification of former land uses and evaluating whether subsequent actions (either natural or human) may have impacted on archaeological evidence for these former land uses. Knowledge of previous archaeological investigations, understanding of the types of archaeological remains likely to be associated with various land uses, and the results of site inspection are also taken into consideration when evaluating the potential of an area to contain archaeological remains.

Assessments of significance are preliminary in nature and, where possible, significance has been assessed against the NSW Heritage Assessment Criteria. The assessment is informed by the NSW Heritage Division's 2009 guidelines *Assessing Significance for Historical Archaeological Sites and Relics.*

2.2.1 NSW Heritage assessment guidelines

Determining the significance of heritage items or a potential archaeological resource is undertaken by utilising a system of assessment centred on the *Burra Charter* of Australia ICOMOS. The principles of the charter are relevant to the assessment, conservation and management of sites and relics. The

assessment of heritage significance is outlined through legislation in the Heritage Act and implemented through the *NSW Heritage Manual* and the *Archaeological Assessment Guidelines*.[1]

If an item meets one of the seven heritage criteria, and retains the integrity of its key attributes, it can be considered to have heritage significance. The significance of an item or potential archaeological site can then be assessed as being of local or state significance. If a potential archaeological resource does not reach the local or state significance threshold, then it is not classified as a relic under the Heritage Act.

'State heritage significance', in relation to a place, building, work, relic, moveable object or precinct, means significance to the State in relation to the historical, scientific, cultural, social, archaeological, architectural, natural or aesthetic value of the item.

'Local heritage significance', in relation to a place, building, work, relic, moveable object or precinct, means significance to an area in relation to the historical, scientific, cultural, social, archaeological, architectural, natural or aesthetic value of the item.[2]

The overall aim of assessing archaeological significance is to identify whether an archaeological resource, deposit, site or feature is of cultural value. The assessment will result in a succinct statement of heritage significance that summarises the values of the place, site, resource, deposit or feature. The heritage significance assessment criteria are as follows:

Table 3: NSW heritage assessment criteria

Criteria	Description
A – Historical Significance	An item is important in the course or pattern of the local area's cultural or natural history.
B – Associative Significance	An item has strong or special associations with the life or works of a person, or group of persons, of importance in the local area's cultural or natural history.
C – Aesthetic or Technical Significance	An item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in the local area.
D – Social Significance	An item has strong or special association with a particular community or cultural group in the local area for social, cultural or spiritual reasons.
E – Research Potential	An item has potential to yield information that will contribute to an understanding of the local area's cultural or natural history.
F – Rarity	An item possesses uncommon, rare or endangered aspects of the local area's cultural or natural history.
G - Representativeness	An item is important in demonstrating the principal characteristics of a class of NSW's cultural or natural places of cultural or natural environments (or the cultural or natural history of the local area).

2.2.2 Research potential

In 1984, Bickford and Sullivan examined the concept and assessment of archaeological research potential; that is, the extent to which archaeological resources can address research questions. They

[1] NSW Heritage Office 1996; 25-27
[2] This section is an extract based on the Heritage Office Assessing Significance for Historical Archaeological Sites and Relics 2009:6.

developed three questions which can be used to assess the research potential of an archaeological site:

- Can the site contribute knowledge that no other resource can?
- Can the site contribute knowledge that no other site can?
- Is this knowledge relevant to:
  - General questions about human history?
  - Other substantive questions relating to Australian history?
  - Other major research questions?

In the 2009 guidelines *Assessing Significance for Historical Archaeological Sites and 'Relics'*, the NSW Heritage Division has since provided a broader approach to assessing the archaeological significance of sites, which includes consideration of a site's intactness, rarity, representativeness, and whether many similar sites have already been recorded, as well as other factors. This document acknowledges the difficulty of assessing the significance of potential subsurface remains, because the assessment must rely on predicted rather than known attributes.[3]

A site can have high potential for archaeological remains, and yet still be of low research potential if those remains are unlikely to provide significant or useful information.

2.3 Assessment of heritage impact

This Heritage Impact Assessment has been prepared using the document *Statement of Heritage Impact* 2002, prepared by the NSW Heritage Office, contained within the *NSW Heritage Manual,* as a guideline.

Impacts on heritage are identified as either:

- Direct impacts, resulting in the demolition or alteration of fabric of heritage significance
- Indirect impacts, resulting in changes to the setting or curtilage of heritage items or places, historic streetscapes or views
- Potential direct impact, resulting in impacts from vibration and demolition of adjoining structures.

Specific terminology and corresponding definitions are used in this assessment to consistently identify the magnitude of the project's direct, indirect or potentially direct impacts on heritage items or archaeological remains. The terminology and definitions are based on those contained in guidelines produced by the International Council on Monuments and Sites (ICOMOS) [4] and are shown in Table 4. It is assumed that all direct and potential direct impacts are a result of construction. Indirect impacts are assumed to be operational unless specified as temporary in which case they are related to construction.

[3] NSW Heritage Branch 2009
[4] Including the document *Guidance on Heritage Impact Assessments for Cultural World Heritage Properties*, ICOMOS, January 2011.

Table 4: Terminology for assessing the magnitude of heritage impact.

Magnitude	Definition
Major	Actions that would have a long-term and substantial impact on the significance of a heritage item. Actions that would remove key historic building elements, key historic landscape features, or significant archaeological materials, thereby resulting in a change of historic character, or altering of a historical resource. These actions cannot be fully mitigated.
Moderate	This would include actions involving the modification of a heritage, including altering the setting of a heritage item or landscape, partially removing archaeological resources, or the alteration of significant elements of fabric from historic structures. The impacts arising from such actions may be able to be partially mitigated.
Minor	Actions that would results in the slight alteration of heritage buildings, archaeological resources, or the setting of an historical item. The impacts arising from such actions can usually be mitigated.
Negligible	Actions that would results in very minor changes to heritage items.
Neutral	Actions that would have no heritage impact.

2.4 Limitations and Constraints

This report provides an assessment of non-Aboriginal (historical) heritage values only.

2.5 Authorship

This report was prepared by Jenny Winnett (Senior Heritage Consultant, Artefact Heritage) and Charlotte Simons (Heritage Consultant, Artefact Heritage) with input and review from Josh Symons (Principal, Artefact Heritage). Dr Sandra Wallace (Director, Artefact Heritage) also reviewed the report.

3.0 HERITAGE MANAGEMENT FRAMEWORK

3.1 Introduction

There are several items of State legislation that are relevant to the current study. A summary of these Acts and the potential legislative implications follow.

3.2 Environmental Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) (EPBC Act) provides a legislative framework for the protection and management of matters of national environmental significance, that is, flora, fauna, ecological communities and heritage places of national and international importance. Heritage items are protected through their inscription on the World Heritage List, Commonwealth Heritage List or the National Heritage List.

The EPBC Act stipulates that a person who has proposed an action that will, or is likely to, have a significant impact on a World, National or Commonwealth Heritage site must refer the action to the Minister for Sustainability, Environment, Water, Population and Communities (hereafter Minister). The Minister will then determine if the action requires approval under the EPBC Act. If approval is required, an environmental assessment would need to be prepared. The Minister would approve or decline the action based on this assessment.

A significant impact is defined as “an impact which is important, notable, or of consequence, having regarded to its context or intensity.” The significance of the action is based on the sensitivity, value and quality of the environment that is to be impacted, and the duration, magnitude and geographic extent of the impact. If the action is to be undertaken in accordance with an accredited management plan, approval is not needed and the matter not need be referred to the Minister.

3.2.1 Commonwealth Heritage List

The Commonwealth Heritage List has been established to list heritage places that are either entirely within a Commonwealth area, or outside the Australian jurisdiction and owned or leased by the Commonwealth or a Commonwealth Authority. The Commonwealth Heritage List includes natural, Indigenous and historic heritage places which the Minister for Sustainability, Environment, Water, Population and Communities is satisfied have one or more Commonwealth Heritage values.

No sites within or near the study area are included on the Commonwealth Heritage List.

3.2.2 National Heritage List

The National Heritage List has been established to list places of outstanding heritage significance to Australia. It includes natural, historic and Indigenous places that are of outstanding national heritage value to the Australian nation.

No sites within or near the study area are included on the National Heritage List.

3.3 Heritage Act 1977

The *Heritage Act 1977* (NSW) (Heritage Act) is the primary item of State legislation affording protection to items of environmental heritage in NSW. The Heritage Act is designed to protect both listed heritage items, such as standing structures, and potential archaeological remains or relics.

Under the Heritage Act, 'items of environmental heritage' include places, buildings, works, relics, moveable objects and precincts identified as significant based on historical, scientific, cultural, social, archaeological, architectural, natural or aesthetic values. State significant items are listed on the NSW State Heritage Register (SHR) and are given automatic protection under the Heritage Act against any activities that may damage or affect its heritage significance.

To carry out activities within the curtilage of an item listed on the SHR, approval must be gained from the Heritage Council by securing a Section 60 permit. In some circumstances, under Section 57(2) of the Heritage Act, a Section 60 permit may not be required if works are undertaken in accordance with the NSW Heritage branch document *Standard Exemptions for Works Requiring Heritage Council Approval* [5]or in accordance with agency specific exemptions. This includes works that are only minor in nature and will have minimal impact on the heritage significance of the place.

3.3.1 State Heritage Register

The SHR was established under Section 22 of the Heritage Act and is a list of places and objects of particular importance to the people of NSW, including archaeological sites. The SHR is administered by the Heritage Division of the Office of Environment and Heritage (OEH). This includes a diverse range of over 1,500 items, in both private and public ownership. To be listed, an item must be deemed to be of heritage significance for the whole of NSW.

There are no SHR listed items within the study area.

3.3.2 Section 170 registers

Under the Heritage Act all government agencies are required to identify, conserve and manage heritage items in their ownership or control. Section 170 requires all government agencies to maintain a Heritage and Conservation Register that lists all heritage assets and an assessment of the significance of each asset. They must ensure that all items inscribed on its list are maintained with due diligence in accordance with State Owned Heritage Management Principles approved by the Government on advice of the NSW Heritage Council. These principles serve to protect and conserve the heritage significance of items and are based on NSW heritage legislation and guidelines.

There are no s170 register listed items within the study area.

Archaeological relics

Part 6 Division 9 of the Heritage Act protects archaeological 'relics' from being exposed, moved, damaged or destroyed. This protection extends to situations where a person has reasonable cause to suspect that archaeological remains may be affected by the disturbance or excavation of the land. It applies to all land in NSW that is not included in the SHR. Section 4(1) of the Heritage Act (as amended 2009) defines 'relic' as follows:

> *"relic means any deposit, artefact, object or material evidence that:*
>
> *(a) relates to the settlement of the area that comprises New South Wales, not being Aboriginal settlement, and*
>
> *(b) is of State or local heritage significance."*

[5] Heritage Council of New South Wales 2009

Sections 139-145 of the Heritage Act prevent the excavation or disturbance of land known or likely to contain relics, unless in accordance with an excavation permit. Excavation permits are issued under Section 140 of the Heritage Act, or Section 60 for sites listed on the SHR. Excavation Permit Applications must be supported by an Archaeological Research Design. Section 146 of the Heritage Act requires that any discovery or location of a 'relic' is reported to the Heritage Council.

If the proposed works are minor and would have minimal impact on the heritage significance of the place or site, they may be granted an exception or exemption under Section 139 (4) or Section 57 (2) of the Heritage Act.

Works

The Heritage Act identified 'works' as being in a separate category to archaeological 'relics.' 'Works' refer to past evidence of infrastructure. 'Works' may be buried, and therefore archaeological in nature, however, exposure of a 'work' does not trigger reporting obligations under the Heritage Act. 'Works', as items of environmental heritage, have the potential to provide information that contributes to our knowledge of past practices, and good environmental practice recognises this. Roads and Maritime, for example, uses its *Standard Management Procedure: Unexpected Heritage Items* to manage the discovery of such works (Roads and Maritime 2015).

3.4 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act) establishes the framework for cultural heritage values to be formally assessed in the land use planning and development consent process. The EP&A Act requires that environmental impacts are considered prior to land development; this includes impacts on cultural heritage items and places as well as archaeological sites and deposits. The EP&A Act requires that Local Governments prepare planning instruments (such as Local Environmental Plans [LEPs] and Development Control Plans [DCPs]) in accordance with the Act, to provide guidance on the level of environmental assessment required.

The current study area falls within the boundaries of the Hawkesbury Local Government Area (LGA) and is subject to the Hawkesbury LEP 2012. This includes a schedule of local heritage items and planning controls related to development in the vicinity of heritage items.

3.4.1 Hawkesbury LEP 2012

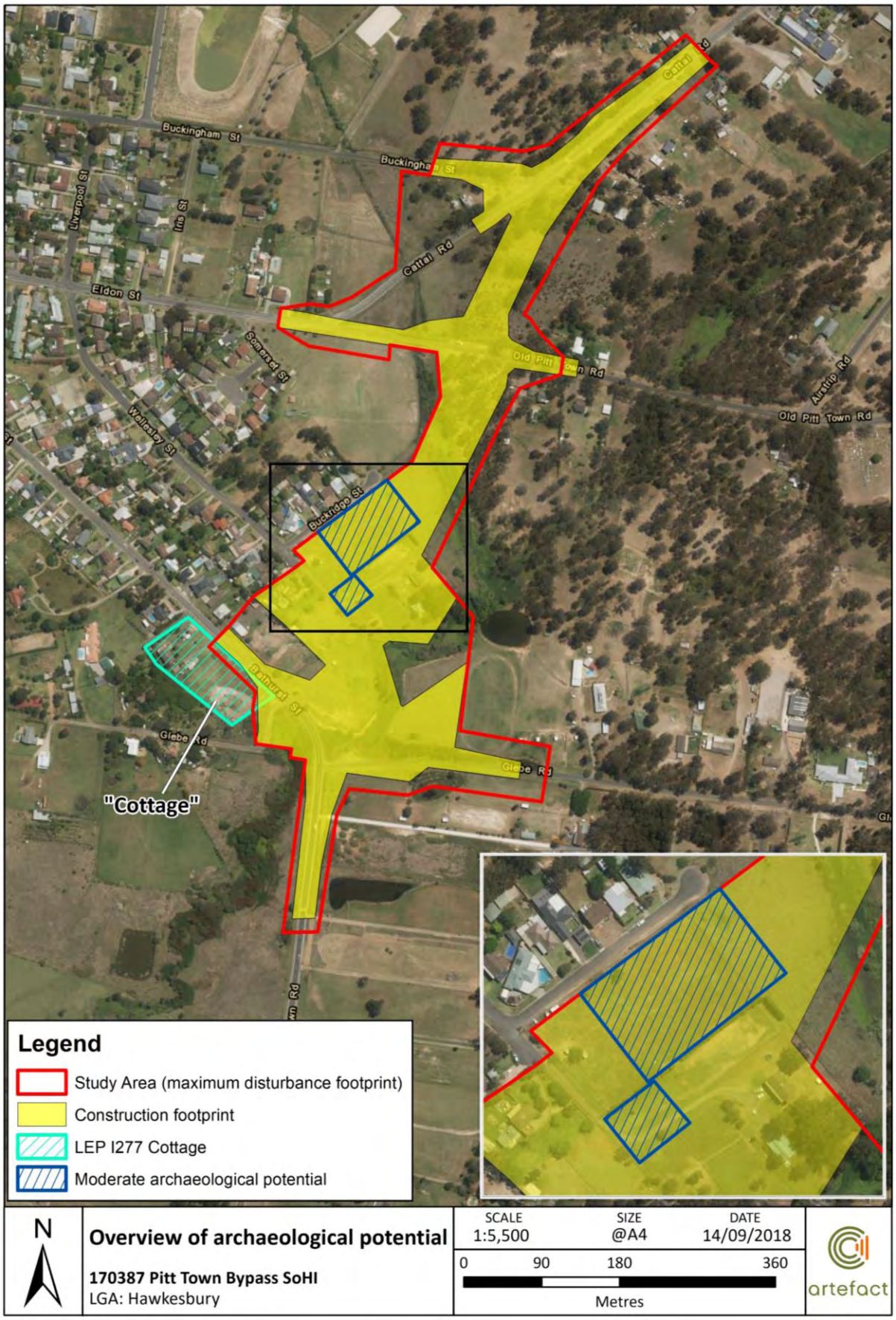
The study area falls within the Hawkesbury LEP 2012. The Hawkesbury LEP 2012 aims to conserve the heritage significance of heritage items and heritage conservation areas, including associated fabric, settings and views; and to protect archaeological sites. The LEP stipulates development controls in relation to development proposed on or near heritage listed properties, archaeological sites, or Aboriginal places of heritage significance. The associated Hawkesbury DCP 2002 provides planning guidance and outlines specific controls for development relating to heritage items and within heritage conservation areas.

There is one heritage item listed on the Hawkesbury LEP 2012 that is partially located within the study area. This item is listed in Table 5 and shown in Figure 2.

Table 5: LEP items located within the study area

LEP Number	Name	Location	Significance
I277	Cottage	22 Bathurst Road, Pitt Town	Local

Figure 2: Location of the "Cottage" in relation to the study area and construction footprint.



3.5 Non-Statutory Registers

3.5.1 The Register of the National Estate

The Register of the National Estate is a list of natural, Aboriginal and historic heritage places throughout Australia. It was originally established under the *Australian Heritage Commission Act* 1975. Under that Act, the Australian Heritage Commission entered more than 13,000 places in the register. Following amendments to the *Australian Heritage Council Act* 2003, the Register of the National Estate (RNE) was frozen on 19 February 2007 and ceased to be a statutory register in February 2012. The RNE is now maintained on a non-statutory basis as a publicly available archive and educational resource.

There are no items listed on the Register of the National Estate within the study area.

3.5.2 Register of the National Trust

The National Trust of Australia is a community-based, non-government organisation committed to promoting and conserving Australia's Indigenous, natural and historic heritage. The Register of the National Trust (RNT) was established in 1949. It is a non-statutory register.

There are no items listed on the Register of the National Trust within the study area.

3.6 State Environmental Planning Policy (Infrastructure) 2007

The State Environmental Planning Policy (Infrastructure) 2007 (ISEPP) was introduced in order to streamline the development of infrastructure projects undertaken by state agencies. Generally, where there is conflict between the provisions of the ISEPP and other environmental planning instruments, the ISEPP prevails.

Under the ISEPP, development may be carried out by a public authority without consent on any land (Section 111). The ISEPP overrides the heritage controls included in the Hawkesbury LEP. Roads and Maritime is only required to consult with the councils when development may “have an impact that is not minor or inconsequential” on a local heritage item. When this is the case, a Statement of Heritage Impact must be provided to the relevant council, and the response of the council must be taken into consideration (Clause 14).

4.0 HISTORICAL CONTEXT

4.1 Aboriginal histories of the locality

Before the appropriation of their land by Europeans, Aboriginal people lived in small family or clan groups that were associated with particular territories or places. It seems that territorial boundaries were fairly fluid, although details are not known. The study area is located within the Darug language group area. The Darug language group is thought to have covered the area south from Port Jackson, north from Botany Bay, and west from Parramatta (Attenbrow 2010, p. 34).

The arrival of British settlers in NSW and subsequent expansion along the Hawkesbury and Georges Rivers had damaging repercussions for the Darug peoples (Attenbrow 2010, p. 14). The Hawkesbury River and surrounding areas were important hunting and fishing grounds for the local groups residing there. The acquisition of these lands by settlers resulted in conflict lasting from 1789 to 1805 (Attenbrow 2010, p. 15).

The Darug people continue to live in the region and as such they have contemporary cultural, social and spiritual meanings for this area.

4.2 Development of the Hawkesbury

In the first years of settlement the most pressing need for the colony was a stable food source to alleviate the potential famine and reduce the reliance on ships bringing supplies from England. The soil in Sydney Cove was of poor quality, and although the Rose Hill / Parramatta based Government Farms were obtaining better results, the estimates of production were still too small to support the growing colony.[6] The need for fertile agricultural land was pressing. The area of present-day Windsor was surveyed by Governor Phillip, although it was decided that the distance from Sydney made the proposal risky, and the township was abandoned.

By 1774 the first farms in the region were located on the eastern bank of the Hawksbury River known then as ‘Pitt Reach’ and the offshoot of South Creek. When instruction came through from England regarding the alienation of land to settlers in the form of grants, it was found that two of the recipients, James Ruse and Charles Williams, along with 20 other families, were already established in the area.

The land was formally granted by Lieutenant-Governor Francis Grose, who reported to England that he had permitted settlement on the banks of the Hawkesbury River, and described the soil as being “particularly rich.”[7] Grose names the locality ‘Mulgrave Place’, in honour of his friend and patron, Lord Mulgrave (Figure 3).[8] It has been suggested that the distance from Sydney and its bureaucracy influenced the character of the Hawkesbury River settlements. Many of the original colonists were ex-convicts, encouraged to settle in the region by reductions in their sentences. It is also possible this encouragement was an attempt to confine those lower on the socio-economic scale geographically. The locality was put to use producing maize, wheat and barley. Cattle, sheep, goats, pigs and horses were also raised in the area.[9]

Unfortunately, within the first years of settlement, a number of destructive floods devastated the region, destroying crops and livestock, drowning settlers and their families and destroying buildings. Between 1799 and 1819 there were ten major floods. As a consequence, the government rations

[6] Karskens 2009 p. 117.
[7] Barkley et al 1994 p. 9.
[8] EMM August 2015 p.12.
[9] EMM August 2015 p.12.

were reduced, the price of produce and livestock increased, and the colony relied on imports from Bengal and Rio de Janeiro to support the population.[10]

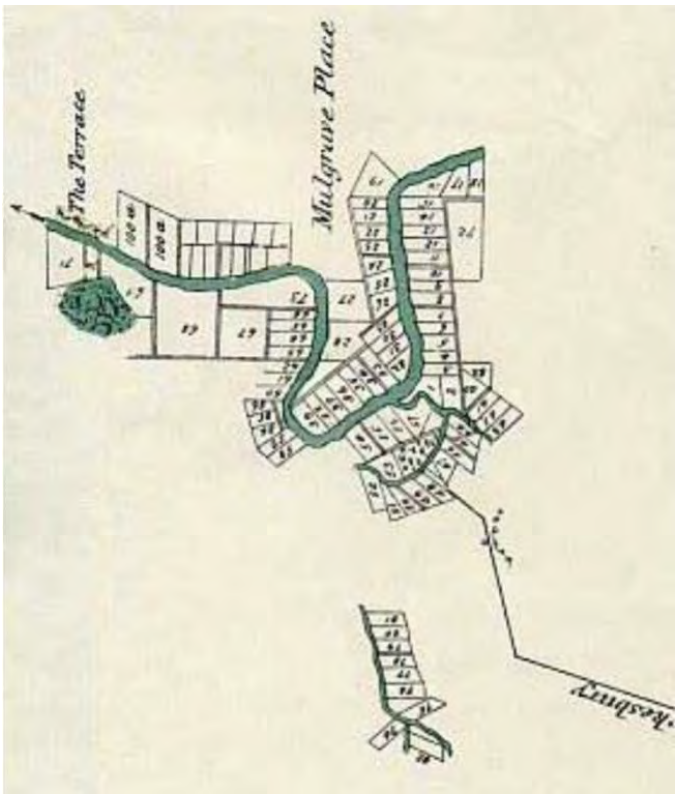
4.3 The Macquarie Towns

Governor Lachlan Macquarie arrived in the colony in 1809. The Hawkesbury farms were not flourishing at this time, although the population of the region had increased. Macquarie selected a number of new sites for the establishment of market towns which would serve the local population. Macquarie travelled throughout the region selecting sites on the ridge-line on which the new towns of Windsor, Richmond, Castlereagh, Wilberforce and Pitt Town were developed.

The establishment of the Macquarie Towns was an early act of social organisation carried out by Macquarie, although he was acting on instruction originally issued to Governor Phillip from London. These instructions were the town was to be located near a navigable river and to contain town and pasture lots. The aim of the townships was to provide the settlers with ways to assist each other, provide security and easy access to trade routes for farm produce.

The town land contained granted land (ie private land) and land set aside for defence, civic and cultural purposes. Macquarie's town allotments were intended to form an "inseparable part" of the farms, and were not to be sold separately. On selection of the town sites, the Acting Surveyor marked out several allotments, so that the settlers could commence "with the least possible delay the business of erecting houses and removing thither".[11] The new buildings were to be constructed of brick or weatherboard, to have brick chimneys and singled roofs, and no dwelling house was to be less than 3m high.

Figure 3: Detail from Surveyor C. Grimes 1796 *Plan of the Settlements in New South Wales* showing the Mulgrave Place Farms.



[10] EMM August 2015 p.13.
[11] Proudfoot, H. and Hawkesbury City Council, *The Hawkesbury A Thematic History* 2017 p.20.

With the development of links with Bathurst, and the opening of agricultural land further west, the importance of the Hawkesbury agricultural region diminished. The character of the area also shifted as the new road to Parramatta was constructed, making the area more attractive to settlers other than those who had little choice but to take up government incentives.

Drought followed by wheat leaf rust in the 1870s necessitated a change in crop types and by the 1890s the area was a major producer of citrus. The regions dairy industry was also established at this time, although it declined through the early decades of the 20th century. In 1965 the Hawkesbury region was described as follows:

> *The grain crops and pigs of early days are now largely replaced by fruits and vegetables whilst dairying has become of prime importance. The inexhaustible fertility of the soil allows almost continuous cropping and the prosperity of the district is broadly based on dairying, orcharding, vegetable growing, sweet corn, mushroom and poultry raising.*
>
> *The secondary industries of the area have been mainly associated with primary production. Thus milling, brewing, tanning and butter-making in turn have risen and declined. Vegetable canning and fresh milk treatment have now been of prime importance for a generation.*[12]

The last dairy in the area was sold in 1972.[13]

4.4 The Development of Pitt Town

The first Pitt Town site was surveyed by Governor Macquarie in January 1811.[14] Macquarie noted in his journal:

> *I proceeded… to explore the ground marked out for the township of Pitt-Town in the Nelson District. This ground is not so good or so conveniently situated for the settlers in general as might be wished, it being not less than 3 ½ miles from some few of the front farms; but no better is to be had and therefore there is no alternative left but to place the town on these heights, and which I have accordingly determine on.*

Macquarie named the town for the British Prime Minister William Pitt.[15] The original location of the town has not been recorded, and no plan has survived. It is assumed that no buildings were ever constructed there. In October of 1815 the town reserve was relocated. The town site was surveyed in an unusual triangular configuration due to the topography and the route of the roads northwards and to the river. Land was set aside for a school, a village reserve and a burial ground. A cattle and passenger punt was provided at Pitt Town in 1828. The same year, the first irrigation pump in the colony was placed on the river near the town by Lawrence May.

A number of inns were established in the 1820s, including the Johnston family's Macquarie Arms Inn, and Daniel Birdwood's Bird in Hand Inn. In 1828 a combined brick Church of England school house and chapel was erected in Bathurst Street. St James' Church was completed on the site in 1857.

[12]Gill, J. C. H. The Macquarie Towns, 25 March 1965.
[13] EMM August 2015 p.14.
[14] Austral Archaeology *Built Heritage & Archaeological Landscape Investigation Windsor Bridge Options* Report for Roads & Traffic Authority NSW, August 2011.
[15] Nichols, M. Pictorial History of the Hawkesbury p. 79.

Before the completion of Scots' Church in 1862, the Presbyterians worshipped in Ebenezer. There was no provision for Roman Catholics.[16]

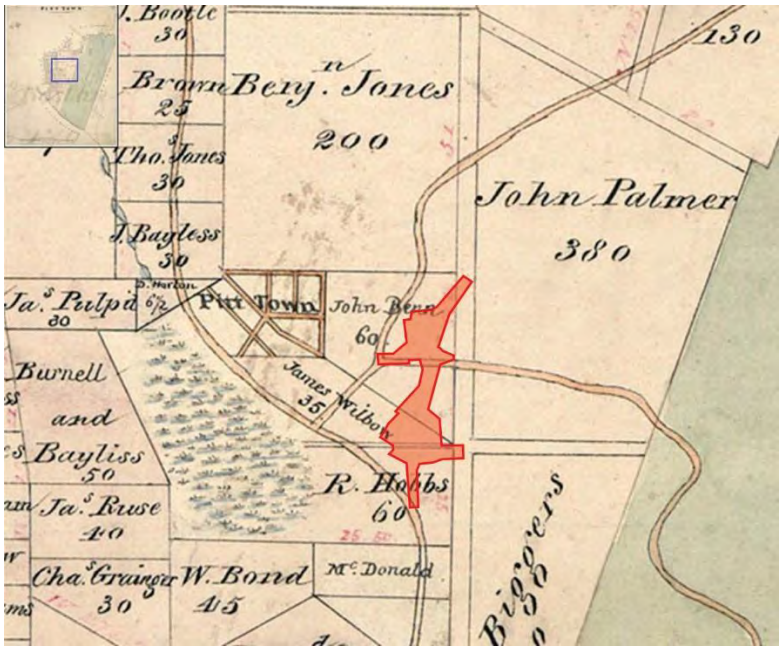
New development was generally sited to the south of the village and progressed along the alignment of Bathurst and Wellesley Streets, as shown in Knapp's survey of 1828 (Figure 5).[17] Survey of the town in 1843 indicates that development continued along the same alignment (Figure 6).[18]

Pitt Town industry was related to primary production and was dominated by the processing of grain, hides and wool. May had established his horse-power driven flour mill in Pitt Town in 1815. John Hall was operating a mill in Pitt Town by the late 1820s and in 1831 George Hall had also erected a mill on his farm outside of Pitt Town. In addition, John McDonald and John Dwight operated Threshing Machines.

Shipbuilding was another important local enterprise. The Hawkesbury River provided an important link with Sydney in the early years of the settlement. Shipbuilding was therefore a lucrative trade. By 1802 ships were being constructed in the colony, both in Sydney and the colony. Ships sailed between the Windsor region and Sydney, to Newcastle for coal and the Bass Straight and New Zealand for seal skins. The most prominent shipbuilder in the region was John Grono who constructed 12 vessels between 1804 and 1833. Grono purchased John Benn's property on the river at Canning Reach where he constructed his boats. Two of the early land grantees in the current study area were briefly a part of this trade: John Benn with his cutter 'Unity' and John Palmer.[19] Timber for the local boat building trade was obtained from the Pitt Town Common, located to the east of the study area.

The study area is located on what was originally the eastern fringe of Macquarie's township, and spanned portions of four early land grants; John Benn's 60 acres, James Wilbow's 35 acres, Robert Hobbs' 60 acres and 380 acres granted to John Palmer (Figure 4). A portion of John Benn's grant was relinquished in 1815 for use of the township. [20]

Figure 4: c.1826 plan of Pitt Town with the study area shaded in red. Source: SLNSW.



[16] Austral Archaeology August 2011.
[17] Surveyor Knapp's survey of the township of Pitt Town (State Records MAP SZ405).
[18] Surveyor James Galloway's survey of the township of Pitt Town (State Records MAP 4746).
[19]Proudfoot, H. and Hawkesbury City Council 2017 p.15.
[20] Proudfoot, H. and Hawkesbury City Council 2017 p. 28.

Figure 5: Knapp's 1828 plan of Pitt Town. The portion of the study area covered by the plan is shaded in red. Source: State Records MAP SZ405.



4.4.1 John Benn

Benn arrived on the 'Gorgon' in 1791 after being sentenced to seven years' transportation. Commonly known as 'Big Ben', Benn was granted 30 acres at Portland Head. In 1803, presumably due to the positive results obtained at his Portland Head property, Benn was granted a further 60 acres at Pitt Town. By 1806, Benn owned 150 acres and employed six convict servants.[21]

In 1808 Benn, along with fellow Pitt Town resident James Webb, launched their jointly-owned cutter 'Unity'. The fisheries trade was profitable, and Benn was able to insulate his overall wealth from the disastrous floods that affected other land owners during this period.

John Benn is known primarily for his association with the development of horse racing in the Hawkesbury region. Races between Benn's horse 'Scratch' and 'Tickle Toby', owned by fellow emancipist and Hawkesbury settler Lawrence May, are among the earliest recorded account in the colony.

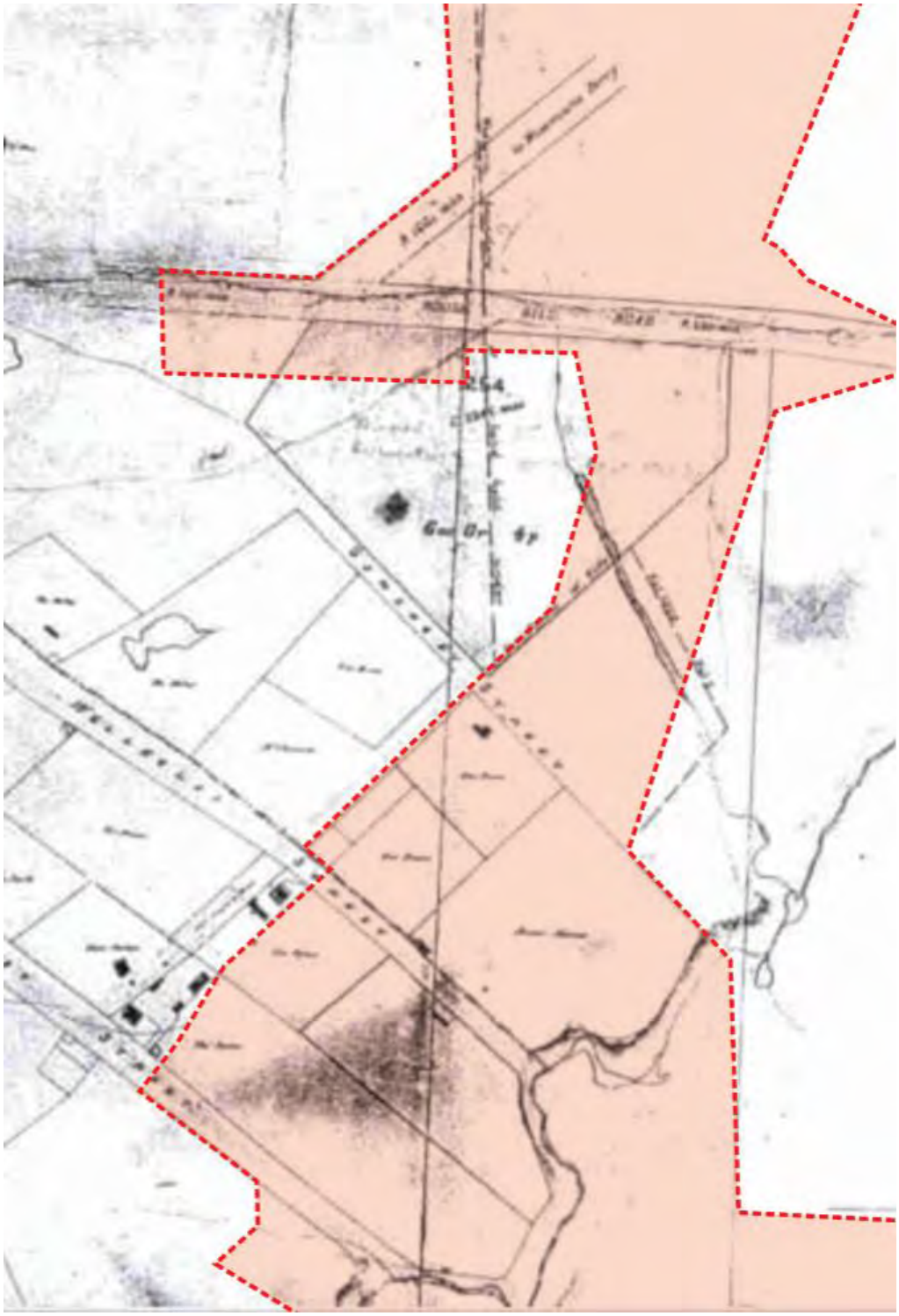
Benn married colonial-born Eliza Griffin (also known as Lydia Griffin) in 1814. In 1815, when riding home from Sydney, Benn was thrown from his horse and killed.[22] His biography stated the following:

> *…The deceased left Parramatta for his farm, which is two miles from Windsor, between four and five in the evening of Sunday, and passed through the gate at Rouse Hill about an hour after, saying he had rode very quick. It did not appear*

[21] Binney K. R. Horsemen of the First Frontier (1788-1900) p. 143.
[22] Binney K. R. Horsemen of the First Frontier (1788-1900) p. 143.

that he was afterwards seen alive by any person – The same evening his horse was found in a corn field near his house, and a search was in consequence made for the rider, who was unhappily found dead upon the road leading to the farm, about a mile and a half distant. The deceased always bore the character of a very respectable settler, and had accumulated by his industry property, a part of which he latterly employed in maritime speculations, in which he was also fortunate.

Figure 6: Galloway's 1843 survey of the township of Pitt Town. The portion of the study area covered by the plan is shaded in red. Source: State Records NSW- MAP 4746.



4.4.2 James Wilbow

James Wilbow was born in 1768. Wilbow was sentenced with seven years transportation after being indicted for a burglary where four waistcoats were stolen from a John Edwards. After spending four years on board the convict hulks at Portsmouth, Wilbow was transported to the colony to serve the final three years of his sentence and arrived with the 3rd fleet on the 'Salamander' on the 21 August 1791.

Wilbow married Mary Margaret Martin in Sydney in 1807. Mary was one of 1063 convicts transported on the 'Neptune' in December 1789. Martin had previously been married to Thomas Smith of Parramatta, and had two children from that relationship, Catherine and James.

Wilbow was granted 35 acres of land in the vicinity of Pitt Town in the period between 1800 and 1804.

The 1825 census shows Mary was living in Pitt Town, although by this time Wilbow had entered into a common law marriage with Elizabeth Ship c.1817. Elizabeth Ship had been transported to the colony on the 'Northampton' in December of 1814. Ship and Wilbow had two sons, William, who died as an infant in 1817 and James born 1823, and two daughters, Margaret, born in 1819 and Jane, who also died in infancy c.1823.The 1825 census indicates that Elizabeth, James and Margaret were living in Sydney, where Elizabeth was working as a laundress and Wilbow as a constable. James is not mentioned in the census.

The 1828 census indicates that Wilbow was now residing at Pitt Town. It is unclear whether he had reconciled with Mary, but Elizabeth remained in Sydney and the census does not mention her children. Elizabeth died in Sydney on the 5 June 1831, at the age of 49, following an accident where she fell into the fire and was severely injured.

James Wilbow died at Wilberforce on the 18 March 1840. Mary Martin died at Pitt Town on the 17 September 1847, at the age of 72.

4.4.3 Robert Hobbs

Hobbs, originally a silk weaver from Spitalfields, England, was indicted for stealing 38 pieces of calico in September of 1790. Hobbs was transported to the colony on the 'Active' in 1791. Hobbs married fellow convict Bridget Heslin, who was transported on the 'Sugarcane' in 1793 with her four children. In the period between 1800 and 1804 Hobbs was granted 60 acres of land near Pitt Town. The 1818 muster lists Robert and Bridget, as well as two sons, Joseph and Edward.

The Hobbs' resided in Pitt Town with their nine children. The 1828 survey has Hobbs house fronting Bathurst Street (Figure 7; outside the study area), 'Hobbs Farm' is illustrated as being further south-east (Figure 5; inside the study area). Robert Hobbs died in 1839 at the age of 76.

4.4.4 John Palmer

Palmer was born in England in 1760. In 1786 he joined the 'Sirius' as purser and voyaged to NSW with the First Fleet. Palmer was appointed Commissary-General of the colony by Governor Phillip in 1790 and subsequently returned to England to collect his family, returning to the colony in 1800.[23]

Palmer was granted 100 acres on the shores of what is now Woolloomooloo Bay by Governor Francis Grose in 1801 and constructed a luxurious house. He also engaged in milling, on a site close to Government House, and coastal trading, contributing his smallest vessel to the burgeoning river trade

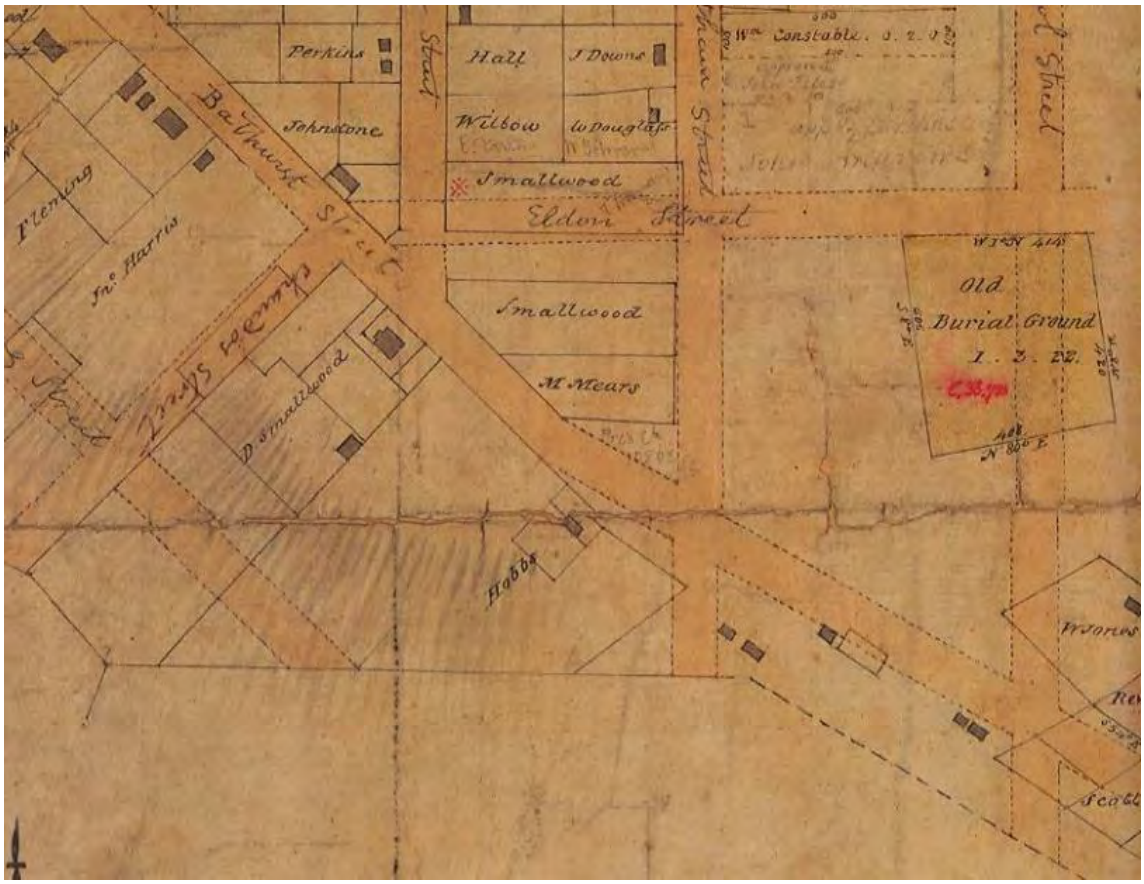
[23] Foster, J. 'John Palmer' *Journal of the Royal Australian Historical Society* Vol11, 1925.

on the Hawkesbury.[24] Palmer acquired substantial amount of land and bred cattle and sheep and also grew wheat. Palmer was granted 380 acres near Pitt Town in the period between 1800 and 1804. In 1818 the grant was resumed by Macquarie for the formation of the township. To compensate Palmer, he was granted 1500 acres at Rouse Hill.[25]

Palmer was demoted after siding with Governor Bligh following the mutiny in 1810, and was retired by Governor Macquarie on half-pay. He then settled on his farm at Parramatta, where he died in 1833, the last surviving officer of the first fleet.[26] His death notice states the following:

> *Palmer's death certificate gives his quality of profession as a Gentleman, with no indication of the many offices he held and the part he played in the very early days of the colony. He now rests in a family crypt next to his wife, who had predeceased him by one year and to whom he had married for half a century.* [27]

Figure 7: Detail of Knapp's 1828 plan of Pitt Town showing the Hobbs residence. The portion of the study area covered by the plan is shaded in red. Source: State Records MAP SZ405.



[24] Proudfoot, H. and Hawkesbury City Council 2017 p. 15.
[25] Foster, J. 'John Palmer' *Journal of the Royal Australian Historical Society* Vol11, 1925.
[26] Death Notice *The Sydney Herald*, 30 September 1833, p. 4.
[27] Death Notice *The Sydney Herald*, 30 September 1833, p. 4.

4.5 Subdivision and Agriculture

Pitt Town, like many of the small towns on the Hawkesbury, grew very slowly during the nineteenth century after the first burst of activity in the 1820s when the Macquarie towns were established, land cleared, and crops planted.

By 1892 Pitt Town was described as a small village, consisting principally of a very long street, with Episcopal and Presbyterian stone-built churches, a public school with an attendance of 86, one inn and a number of dwelling houses.[28] The population was 350. At this time even Windsor, the chief Macquarie Town and primary centre of the district, was considered a frontier town.

Throughout the 1880s and 1890s, subdivision of farming land in the areas surrounding Pitt Town was occurring, and small farmlets of 4 to 11 acres were on offer. Few of these 'farms' appear to have had agricultural potential, and instead were offered as speculation for investment under the guise of "poultry farms" or "orchard blocks" (Figure 9).[29]

Figure 8 is based on a survey of land use in the Hawkesbury undertaken in the early 1940s. The survey shows that much of the land surrounding Pitt Town, even into the mid-20th century, was utilised as pasture. Intensive agriculture focused on the flats surrounding the river with vegetables and lucerne being the primary crop types. At this time arable farming was chiefly focused on the alluvial flats, with some citrus orchards on higher ground. Pasture was noted as being of poor quality, with many areas having reverted to secondary scrub due to the sandy soil.[30] The dairy industry in the region was also on the decline. It was noted at the time that farm size had remained relatively small, reflecting the original subdivision patterns of the early days of settlement.[31]

Figure 8: Land utilisation in Pitt Town Bottoms in 1942. Source: Maze, W. H. 1943.



[28] The Australian Handbook, 1892, quoted in Proudfoot, H. and Hawkesbury City Council 2017 p33.
[29] Proudfoot, H. and Hawkesbury City Council 2017 p. 33.
[30] Proudfoot, H. and Hawkesbury City Council 2017 p. 45.
[31] Proudfoot, H. and Hawkesbury City Council 2017 p. 45.

The importance of the Hawkesbury for food production has progressively declined. The area continues to be primarily small-scale agricultural, with residential development increasing with the improvement of roads and the expansion of Sydney.

Local services were slowly introduced. Pitt Town was connected to electricity in 1935. Sewerage infrastructure was introduced to the much larger towns of Windsor and Richmond in 1939 and 1962 respectively.

The 1955 aerial photograph indicates that the study area was relatively undeveloped (Figure 10). A number of agricultural structures are located throughout the study area, many of which were demolished before 1965. Two residences were originally located on Buckridge Street (Figure 10) and were demolished by 1965. Two structures pre-dating this period remain standing today.

The expansion of Pitt Town continued into the 1970s and 1980s, with a number of new residences constructed next to the study area on former agricultural land throughout the later 20th century.

Figure 9: Subdivision north of Pitt Town, the Hall Estate.

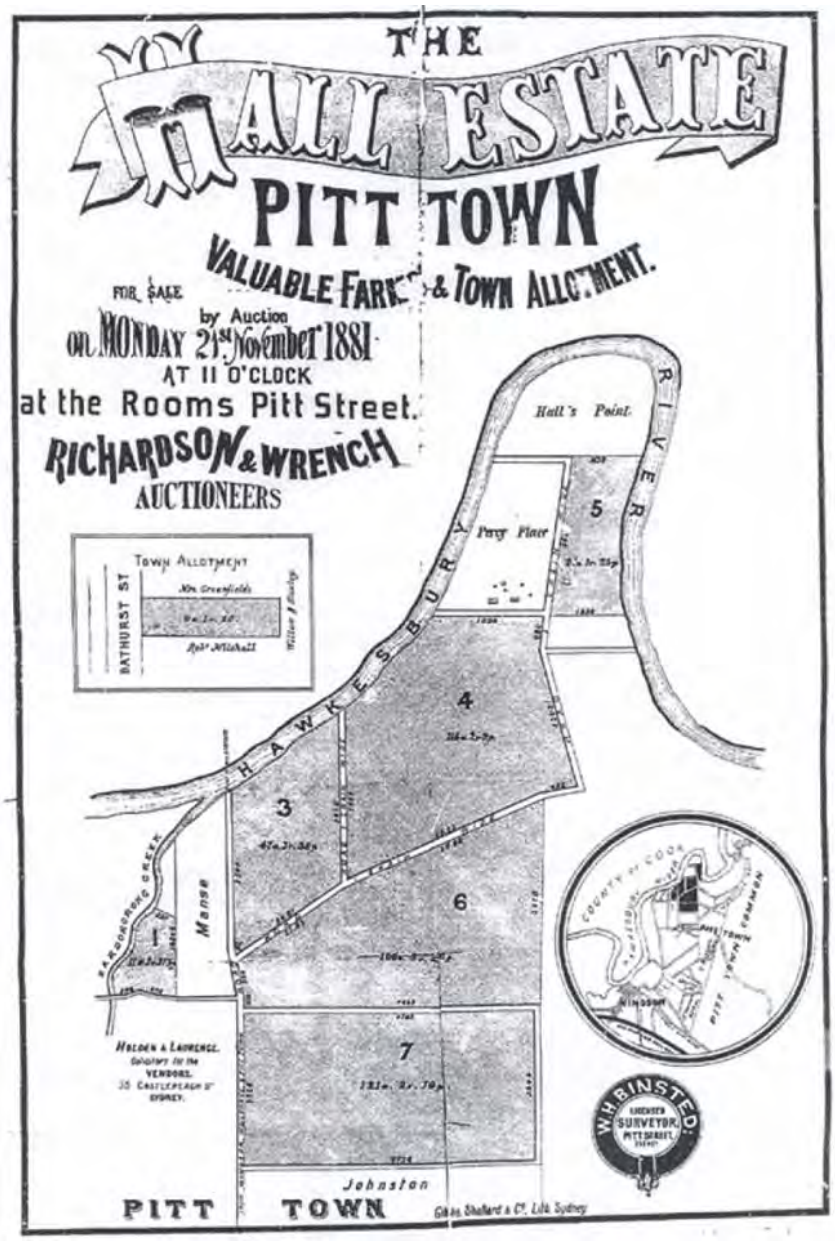
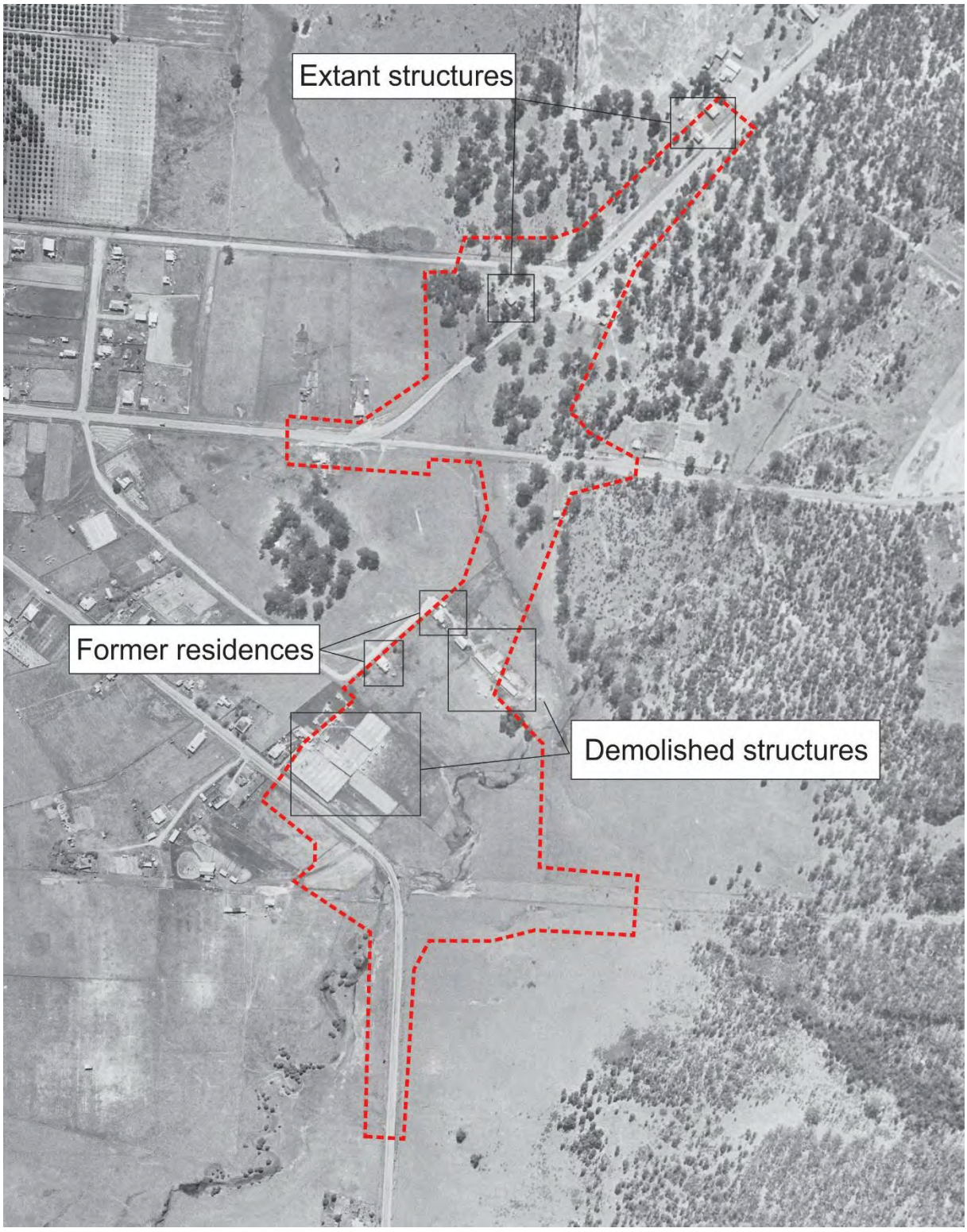


Figure 10: 1955 aerial photograph (with study area in red).



5.0 SITE INSPECTION

A site inspection of the study area was undertaken on 15 February 2018 by Jenny Winnett and Charlotte Simons of Artefact Heritage. The aim of the inspection was to identify and assess potential impacts of the proposed works to surrounding heritage items, including impacts to potential archaeological deposits with the study area, and historic views and vistas. The inspection was undertaken on foot and a photographic record was made.

The study area is characterised by its semi-rural setting, with partially cleared woodland on a gently sloping landscape dissected by roads, small rural lots and nearby low density residential development. The study area encompasses Pitt Town Road, Bathurst Street, Glebe Road, Eldon Street, Old Pitt Town Road, Buckridge Street, Buckingham Street and Cattai Road, and a small portion of Brinsley Park sports oval.

The northern portion of the study area features grassed paddocks and regrowth woodland interspersed with sparsely occurring remnant native trees. To the south, the study area features cleared paddocks and residential dwellings along with fences, sheds and ancillary farm items. The southern portion of the study area features a locally listed 'Cottage' heritage item, which is located along Bathurst Road.

Several paddocks on private property were not able to be accessed during the survey due to site conditions and accessibility constraints. Although it is noted these areas were able to be surveyed from nearby vantage points and adjoining properties.

Figure 11: View north along Pitt Town Road towards study area.



Figure 12: View south along Pitt Town Road from intersection with Glebe Road.



Figure 13: View west along Glebe Road to Pitt Town Road/Bathurst Street intersection.



Figure 14: View east along Glebe Road.



Figure 15: View north from Glebe Road across adjoining paddock.



Figure 16: View north east from Glebe Road across adjoining paddock.



Figure 17: View east from Bathurst Street across adjoining paddock.



Figure 18: View south east along Bathurst Street towards intersection at Glebe Road.



Figure 19: View north west along Bathurst Road towards curtilage of 'Cottage' heritage item at 22 Bathurst Street.



Figure 20: View south west across Bathurst Road towards 'Cottage' heritage item at 22 Bathurst Street.



Figure 21: View south west to 'Cottage' heritage item located at 22 Bathurst Street.



Figure 22: View south east along the eastern boundary of 'Cottage' heritage item curtilage.



Figure 23: View north west from Bathurst Road to 'Cottage' heritage item at 22 Bathurst Road.



Figure 24: View north east to 'Cottage' heritage item at 22 Bathurst Road.



Figure 25: View east to historic cistern located within the curtilage of the 'Cottage' heritage item.



Figure 26: View east from curtilage of 'Cottage' heritage item across Bathurst Road to adjoining paddocks.



Figure 27: View north west along the eastern boundary of the curtilage of the 'Cottage' heritage item on Bathurst Road.



Figure 28: View south east across Bathurst Street at corner of Lagoon Road, towards study area.



Figure 29: View north east across paddock adjoining Bathurst Road.



Figure 30: View east across paddocks adjoining Bathurst Road and Glebe Road.



Figure 31: View north east across paddock adjoining Wellesley Street and Buckridge Street.



Figure 32: View south east along Wellesley Street towards adjoining properties and paddocks.



Figure 33: View south west across paddock between Wellesley Street and Bathurst Street.



Figure 34: View north across sports oval from end of Buckridge Street.



Figure 35: View south from end of Buckridge Street towards adjoining paddocks.



Figure 36: View south west from end of Buckridge Street towards adjoining paddocks.



Figure 37: View north east from end of Buckridge Street.



Figure 38: View east along Old Pitt Town Road from near intersection with Eldon Street and Cattai Road.



Figure 39: View west along Old Pitt Town Road towards intersection with Eldon Street and Cattai Road.

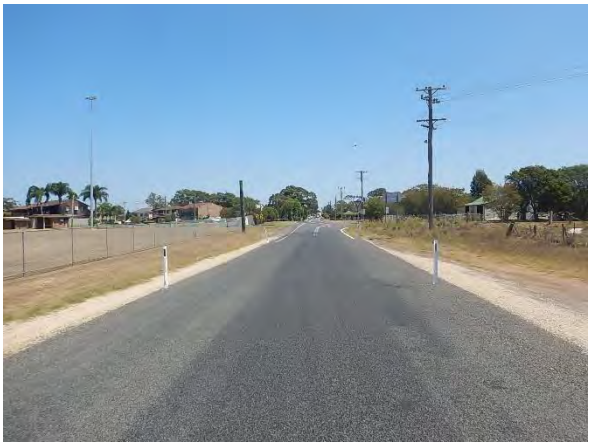


Figure 40: View south from northern side of Old Pitt Town Road.



Figure 41: View north across property adjoining Old Pitt Town Road.



Figure 42: View north across Old Pitt Town Road.



Figure 43: View north east along Cattai Road at corner of Buckingham Street.



Figure 44: View south east across Cattai Road at corner of Buckingham Street.



Figure 45: View north to historic shed located on Cattai Road.



Figure 46: View south west along Cattai Road.



6.0 BUILT HERITAGE ASSESSMENT

6.1 Assessment of Significance

The following section provides an overview description and assessment of significance of heritage items that are located within the study area. Information for each item has been extracted from their respective SHI database listings on the NSW Office of Environment & Heritage website.[32]

6.1.1 Cottage (Hawkesbury LEP 2012 Item No. I277)

Figure 47: View west to Cottage heritage item.



6.1.1.1 History

Little is known on the early history of the 'Cottage' heritage item, and a historical overview is not provided in the item's SHI listing. The building's mid-Victorian style suggests it was likely constructed sometime around the 1860s to 1870s. The SHI assessment of significance for the item suggests the item was potentially built as the town residence for a farmer on the lowlands.

Located near the southern entry to the township, the cottage remains as evidence of the early settlement at Pitt Town. The earliest available aerial photography of area in 1955 shows that at this time, the cottage was extant in its current location, with the kitchen wing to the rear of the house. A fence appears to have surrounded the cottage and its adjoining garden. To the rear (south west) of the site were several pens and sheds. The rest of the site appears to have been undeveloped.

[32] NSW Office of Environment & Heritage, 'Cottage' 2001. Accessed online at: http://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDetails.aspx?id=1740002

6.1.1.2 Description

The 'Cottage' heritage item comprises a single storey weatherboard dwelling located adjacent to Bathurst Road, which was designed in the Victorian style. The cottage features a hipped roof with corrugated steel sheeting and a hipped convex curved verandah to the building's front (northeast) elevation that is supported on stop chamfered timber posts. Several six over six pane double hung timber framed windows remain.

A brick chimney is on the northwest side of the house, along with a chimney located in the rear yard that provides evidence of the earlier (and since removed) kitchen wing. The cottage is currently propped for structural support. A modern brick residence is located in the rear north-west corner of the site. A domed brick cistern is located directly to the south of the cottage building.

6.1.1.3 Assessment of significance

The following assessment of significance of the 'Cottage' heritage item has been adapted from its SHI listing, and is presented in Table 6 below.

Table 6: Significance assessment for the 'Cottage'

Criterion	Explanation
A – Historical Significance	While little is known of the history of this cottage, it is clearly important as one of the early surviving cottages in the town, possibly built as the town cottage for one of the farmers on the lowlands. The item has **local** significance under this criterion.
B – Associative Significance	The site does not have any direct associations, or connections with prominent members of the local community. The item does not meet the local significance threshold under this criterion.
C – Aesthetic or Technical Significance	The cottage at 22 Bathurst Road, Pitt Town is an important mid-Victorian cottage. Close to the southern entry to the town, the cottage helps to establish the nineteenth century character of the village. The item has **local** significance under this criterion.
D – Social Significance	Whilst the cottage has some associations with the establishment and development of Pitt Town, it does not appear to retain any substantial social significance. The item does not meet the local significance threshold under this criterion.
E – Research Potential	The cottage has some research potential, revealing early vernacular systems of construction. The item has **local** significance under this criterion.
F – Rarity	The cottage is a rare surviving early residence in the area dating from early years of settlement of the Pitt Town region. The item has **local** significance under this criterion.
G – Representativeness	The cottage is a representative and intact example of an early Victorian workers cottage in the area. The item has **local** significance under this criterion.

6.1.1.4 Statement of significance

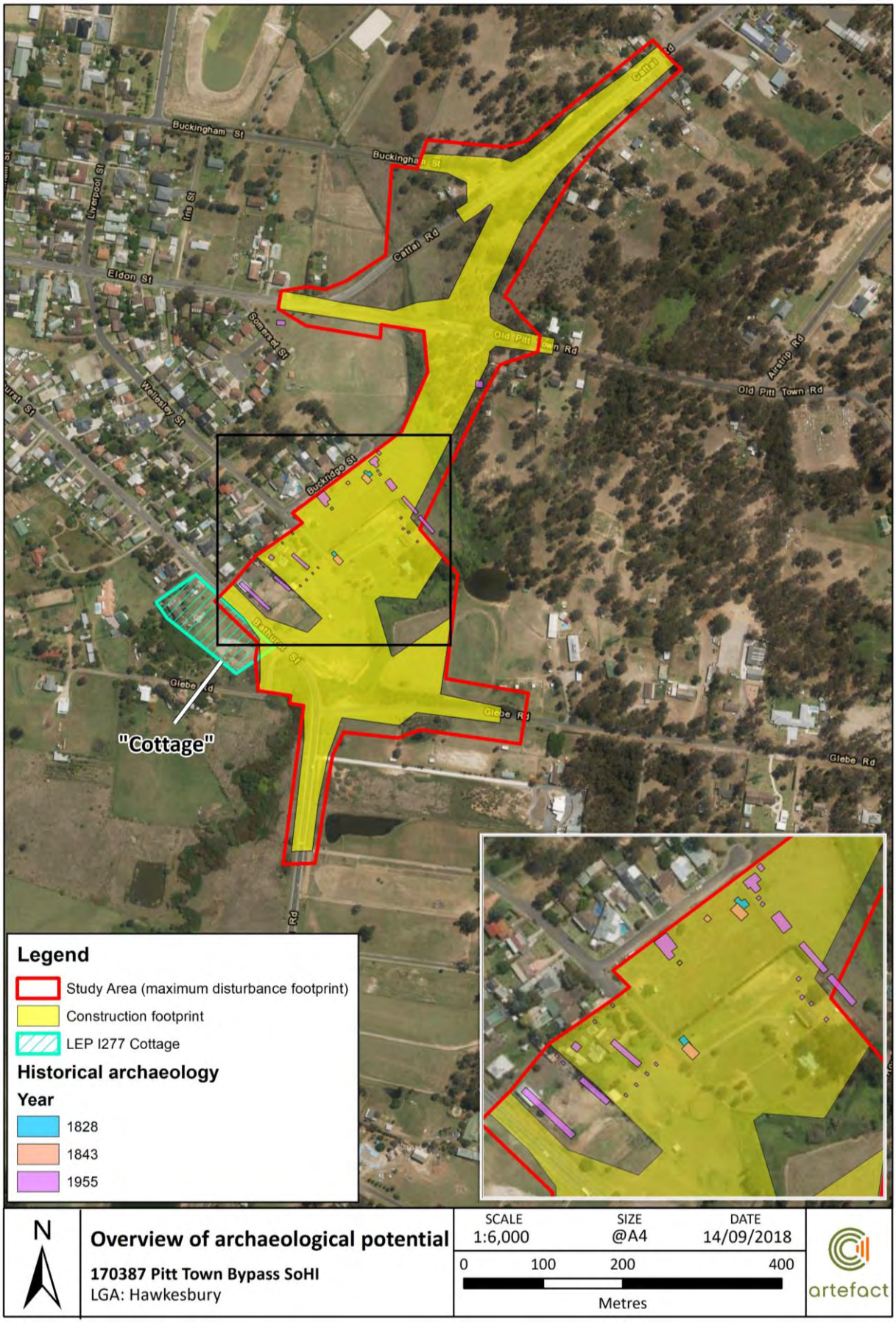
The cottage at 22 Bathurst Road, Pitt Town is an important mid-Victorian cottage. Close to the southern entry to the town it helps to establish the nineteenth century character of the village. The cottage has some research potential, revealing early vernacular systems of construction.

6.2 Overview of land-use

Analysis of historic plans and aerial photographs indicate that the study area has always been on the periphery of the Pitt Town settlement. As a result, structural development within the study area has been limited, although it is noted that outbuildings, temporary and light-weight structures, such as shelters for livestock, do not tend to be mapped, and therefore may have been located in unknown locations throughout the study area.

The 1828 plan indicates that at least two structures were located within the study area. These structures are still present on the 1843 plan, with the addition of a small shed, outbuilding or cistern. The earliest aerial photograph of the study area, taken in 1955, indicates that these buildings have been demolished in the interim, and a number of agricultural buildings and two residences, have been constructed.

Figure 48: Overview of former structures.



6.3 Assessment of Archaeological Potential

The study area has been subject to relatively low levels of development, which have preserved a landscape that is characteristic of an early rural settlement. Development has more recently increased in the area with residential development. Some of the historical features identified in this report span multiple land phases, and archaeological evidence may be difficult to attribute to one particular phase or ownership. Therefore, potential archaeological evidence is discussed below within element categories.

The potential for the survival of an archaeological resource in a particular place is affected by activities which may have caused ground disturbance. These processes include the physical development of the site (for example, phases of building construction) and the activities that occurred there.

The likelihood of the survival of an archaeological resource is distinct from its significance. The assessment of significance is included in Section 5.5.1.

6.3.1 Evidence of residential development

Early residences associated with ex-convicts and farmers are unlikely to have been substantial, particularly in the early years of settlement. Two structures are showing on the 1828 (Figure 5) and 1843 (Figure 6) surveys of Pitt Town. It is likely that these residents lived in primitive slab huts consisting of one or two rooms, with packed earth floors and timber shingles on the roof. Kitchens were external, as were cesspits or privies. As families expanded and became settled, it is possible residences were expanded or re-built. Dependent on the date the structure was built, there is some potential for deposits associated with the residents occupying the structure to be preserved within the footings. Underfloor deposits, however, are unlikely to be associated with a building post-dating 1880 due to construction techniques that were commonplace at this time. The introduction of tongue-and-groove flooring, for example, has been found to significantly reduce the amount of accumulated refuse under floorboards and therefore limit the potential for occupation deposits.

A former residence fronting Buckridge Street is shown on the 1955 aerial photograph of Pitt Town (Figure 10). The earliest formal evidence of Buckridge Street is a dashed line on a parish plan dating to 1942, although it is likely that an informal road corridor was in this location at an earlier date. The area has remained vacant since its demolition. The dating of the structure is unclear, although the presence of a hipped roof and potential external kitchen may date the structure as early as the late 19th century. There is high potential that remains associated with this structure are located within the study area. Archaeological remains associated with the former property are likely to consist of brick or stone footings, and post holes associated with verandahs or additions to the buildings.

Although a council was active in the Hawkesbury region from a relatively early date, the introduction of municipal services was slow, possibly due to the rural nature of the area and low population in comparison with neighbouring towns of Windsor and Richmond. This suggests that residents were burning or burying refuse on their properties into the 20th century. This increases the likelihood that archaeological remains including rubbish pits may survive in the rear yard of the property. It is also possible the yard may contain evidence of a privy, wells or a cistern, due to the later introduction of municipal water and sewerage. These types of structures may contain artefact rich deposits with potential to provide data on the former inhabitants of the property.

As illustrated in Figure 48, early structures were clustered on Buckridge and Bathurst Streets. As this area is currently vacant, the area may not have been subject to significant levels of ground disturbance, and as such, archaeological remains are likely to be relatively intact. There is therefore **moderate potential** that an archaeological resource associated with the construction and occupation

of 19th century residences be located within the study area. Archaeological remains may include the following:

- Structural remains (postholes, footings, hearths, beaten earth, brick or cobbled surfaces, or evidence of timber flooring joists)
- Wells, cesspits or privies, cisterns
- Yard scatters, occupation deposits
- Outbuildings / external kitchen (postholes, hearths)
- Rubbish pits.

6.3.2 Evidence of agricultural practices

The removal of vegetation, and preparation of the land for agricultural use, would have been the earliest land-use within the study area. Evidence for these activities is typically ephemeral, consisting of plough marks in underlaying intact subsoils, tree boles and plantings pits. Archaeological remains are likely to have been disturbed by ongoing modification of the landscape through ploughing and plantings. There is **nil to low potential** that archaeological evidence of land clearance, and modification for agricultural or pasturing purposes, would be located within the study area.

Structures for the shelter of livestock, sheds, outbuildings or informal huts for stockmen may have been located throughout the study area. These structures are rarely documented in contemporary plans or accounts. Rural structures were typically light-weight and constructed of locally sourced materials, timber or stone. Archaeological remains of these types of structures seldom survive intact in the archaeological record, as they were not intended to be permanent. Building materials were often re-used and removed to other locations. Agricultural buildings were not intensely inhabited and are therefore rarely associated with an artefactual resource. Therefore, there is **low potential** that archaeological remains associated with undocumented outbuildings and shelters would be located within the study area. Overall, the study area has **low potential** to contain an archaeological resource associated with early agricultural activities, the remains may include the following:

- Evidence of tree clearance (tree boles, etc)
- Evidence of cultivation (postholes, plough marks in subsoils, etc)
- Environmental data/ecological samples
- Rubbish dumps
- Evidence of the formalisation of agricultural precinct boundaries, such as postholes associated with early fence lines
- Postholes for lightweight structures for agricultural purposes, such as timber shelters
- Evidence of outbuildings/shelters/huts (postholes, packed earth flooring, etc).

Networks of water management and storage systems may exist throughout the study area, taking the form of former dams, drains or culverts. The study area contains a number of minor watercourses and natural drainage lines and is in close proximity to dams and the Pitt Town Lagoon. It is possible that early drainage lines pass through the study area, discharging into watercourses. In-ground drainage systems tend to be modified through time, and it is unlikely they would retain evidence of early construction or use. Similarly, former open drainage channels tend to be in-filled, or formalised through the introduction of ceramic and metal pipes. There is therefore **low potential** that water management systems within the study area would represent early occupation. Remains may include the following:

- Evidence of former dam construction
- Evidence of watercourse modification (such as earthen ditches with battered sides excavated into underlying soils; tanks; swales)

- Ceramic or brick drains.

The 1955 aerial indicates that a number of structures were located within the study area at this time (Figure 49). These structures are likely to have been associated with agricultural use, such as animal shelters, sheds, garages and other outbuildings. As structures of this type were typically of timber and iron construction, they are often archaeologically ephemeral. There is **low-moderate potential** that archaeological remains associated with these 20th century agricultural structures still exist in the study area. Archaeological remains may include the following:

- Postholes
- Evidence of flooring treatments (packed earth or flagging)
- Rubbish dumps.

6.3.3 Road corridors

The alignment of Old Pitt Town Road was designated by Governor Macquarie in 1810. Other roads in the study area appear to be late-19th and 20th century additions or modifications to earlier road corridors. These mostly respect the boundaries of the earliest land grants, which is typical of the surrounding area. Glebe Road was identified in early plans as a road reserve but had not been built by 1955. Somerset Road originally extended to the south-east, and passed through the study area.

It is unlikely that any of the roads through Pitt Town were sealed until the mid-twentieth century. Road corridors remain in use and have therefore been subject to ongoing modification through widening for modern traffic, the introduction of electrical and drainage services and asphalt and bitumen surfacing. There is **low potential** that archaeological remains associated with earlier phases of: Old Pitt Town Road, early tracks or farm road would be located within the study area. Archaeological remains may include:

- Earlier road surface treatments (packed gravel, Telford road base, cobblestones, stone flagging)
- Evidence of early watercourse crossings (postholes, stone alignments, earthen bunds with remnant earthenware pipe as culverts, timber remnants), particularly in the vicinity of the Glebe Road and Bathurst Street intersection, where the road crosses a watercourse.

6.4 Assessment of Archaeological Significance

This section assesses the heritage significance of the known or potential archaeological remains outlined in Section 6.3. Similar to other types of heritage items, archaeological remains should be managed in accordance with their significance. Assessing the heritage value of archaeological remains is complicated by the fact that their extent and nature is often unknown. Judgement must therefore be based on expected or potential attributes.

The *NSW Heritage Manual* provides the framework for the following significance assessment of the study area. These guidelines incorporate the aspects of cultural heritage value identified in the *Burra Charter* (Australia ICOMOS 2013). The Heritage Branch (now Heritage Division) has also issued the 2009 *Assessing Significance for Historical Archaeological Sites and 'Relics* .[33] and the 1996 *Archaeological Assessment Guidelines*.[34]The assessment of historical archaeological sites requires a specialised framework in order to consider the range of values of an archaeological site.

[33] NSW Heritage Branch 2009
[34] NSW Heritage Office 1996: 25 – 27

6.4.1 Assessment against the NSW heritage assessment guidelines

The significance of the potential archaeological resource, defined as being all potential archaeological remains within a site as identified in Section 5.4, has been assessed using the NSW heritage assessment criteria and is outlined in Table 7.

Table 7: Consideration against NSW heritage assessment criteria

Criteria	Discussion	Local	State
Associations with individuals, events or groups of historical importance NSW Heritage Criterion A, B and D	If an artefactual or structural archaeological resource associated with the earliest occupation of the study area is identified, it may have the ability to provide information relating to the establishment and occupation of the early years of Governor Macquarie's Pitt Town settlement. If remains are found to be intact and substantial, they may contribute to our knowledge of the development of early rural settlement in the Hawkesbury, and potentially early agricultural practises in this region (including the extent of land clearance, crop types, range and use of outbuildings, etc). If the study area contains the remains of former structures and features associated with a substantial artefactual resource, analysis may provide insight into the preferences and life-ways of the former inhabitants of the study area. The study area is likely to have associations with current and former residents of Pitt Town, which has an active history group. There is likely to be local interest in the history and archaeology of the study area. Pitt Town is associated with the administration policies of the early governors, especially Macquarie. However, physical archaeological remains within the study area are unlikely to have direct associations. There is low potential that archaeological remains in the study area would be able to be linked directly to the Benn, Wilbow, Hobbs or Palmer families. There is potential, should archaeological remains of the early residence survive, that remains may be associated with the Glynn family. It is unknown if the family has any surviving members. Archaeological evidence of residences, outbuildings and artefact bearing deposits associated with the early to mid-19th century development of Pitt Town would have contributory value to this criterion at a **local** level.		-
Aesthetic or technical significance NSW Heritage Criterion C	It is acknowledged that whilst exposed archaeological remains do have some aesthetic qualities, these are primarily due to a connection to the history of a place, or artefactual remains, and are not considered aesthetically significant in and of themselves. Remains are likely to be typical of early structures and deposits, and unlikely to demonstrate technical significance. The potential archaeological resource, as outlined in Section 5.4, would not reach the significance threshold under this criterion.	-	-
Ability to demonstrate the past through archaeological remains NSW Heritage Criterion A, C, F and G	The study area has the potential to yield archaeological remains which may provide information regarding the evolving agricultural and pastoral activities of an early settlement on the Hawkesbury which is significant for its contribution to the survival of the early colony. Archaeological remains associated with the earliest phase of occupation of the study area may yield information		-

Criteria	Discussion	Local	State
	relating to early 19th century construction techniques, and contain an artefactual resource associated with former residents. In particular, intact artefact-bearing structures or deposits, such as wells, rubbish pits and occupation deposits, may provide an archive of information that may not be able to be ascertained through other historical sources. Few examples of early 19th century residences from Pitt Town and the surrounding Hawkesbury towns have been archaeologically investigated. It is possible that an intact and substantial archaeological resource associated with this early phase would have local significance under this criterion. Archaeological evidence of residences, outbuildings and artefact bearing deposits associated with the early to mid-19th century development of Pitt Town would have contributory value to this criterion at a **local** level.		
Archaeological research potential NSW Heritage Criterion E	Should artefact bearing deposits be identified (i.e. discarded within cesspits / wells, rubbish pits or occupation deposits) these remains have the potential to provide information unavailable elsewhere, particularly as little is known about the nature of the occupation of the study area in the early nineteenth century. Artefact-rich deposits can provide data related to the preferences (ie food and drink), occupations, domestic activities and cultural practises (ie smoking, drinking, cottage industry, games) and socio-economic standing of the former inhabitants of the study area. The archaeological recording, analysis and interpretation of the potential archaeological resource could be expected to contribute to research questions in Australian history, such as the development of agriculture, the development of local economies, the building of settlements and the development of domestic and cultural life.[35] Should intact occupation and artefact bearing deposits be encountered, they would have **local** significance under this criterion.		

6.5 Overview of archaeological potential

The archaeological potential of the study area has been assessed as follows:

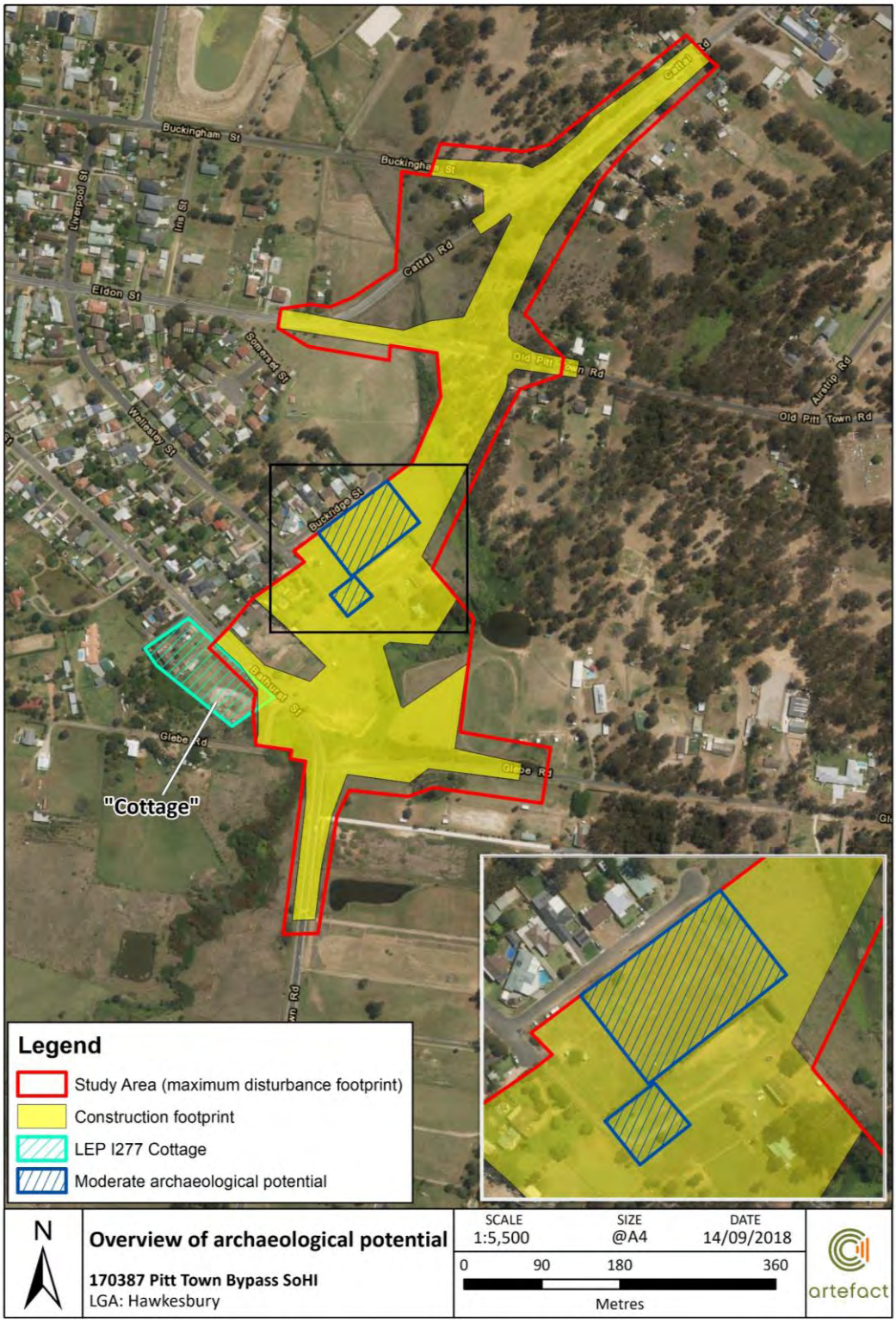
- Moderate potential to contain former structures and features containing artefact bearing deposits, such as wells, cesspits, rubbish dumps and occupation deposits
- Low to moderate potential to contain archaeological remains associated with former infrastructure i.e. culverts, bridges and former road alignments
- Nil to low potential to contain archaeological remains associated with the earliest agricultural development of the study area.

[35] Heritage Council of NSW 2001

Of the potential archaeological remains within the study area, only intact artefact bearing deposits have been assessed as having archaeological research potential, and would reach the local significance threshold against the NSW heritage assessment criteria (Table 7).

Overall, portions of the study area, as illustrated in Figure 49, have moderate potential to contain an archaeological resource that would reach the local significance threshold, and be considered 'relics' under the *Heritage Act* 1977 (amended 2009).

Figure 49: Overview of archaeological potential.



7.0 IMPACT ASSESSMENT

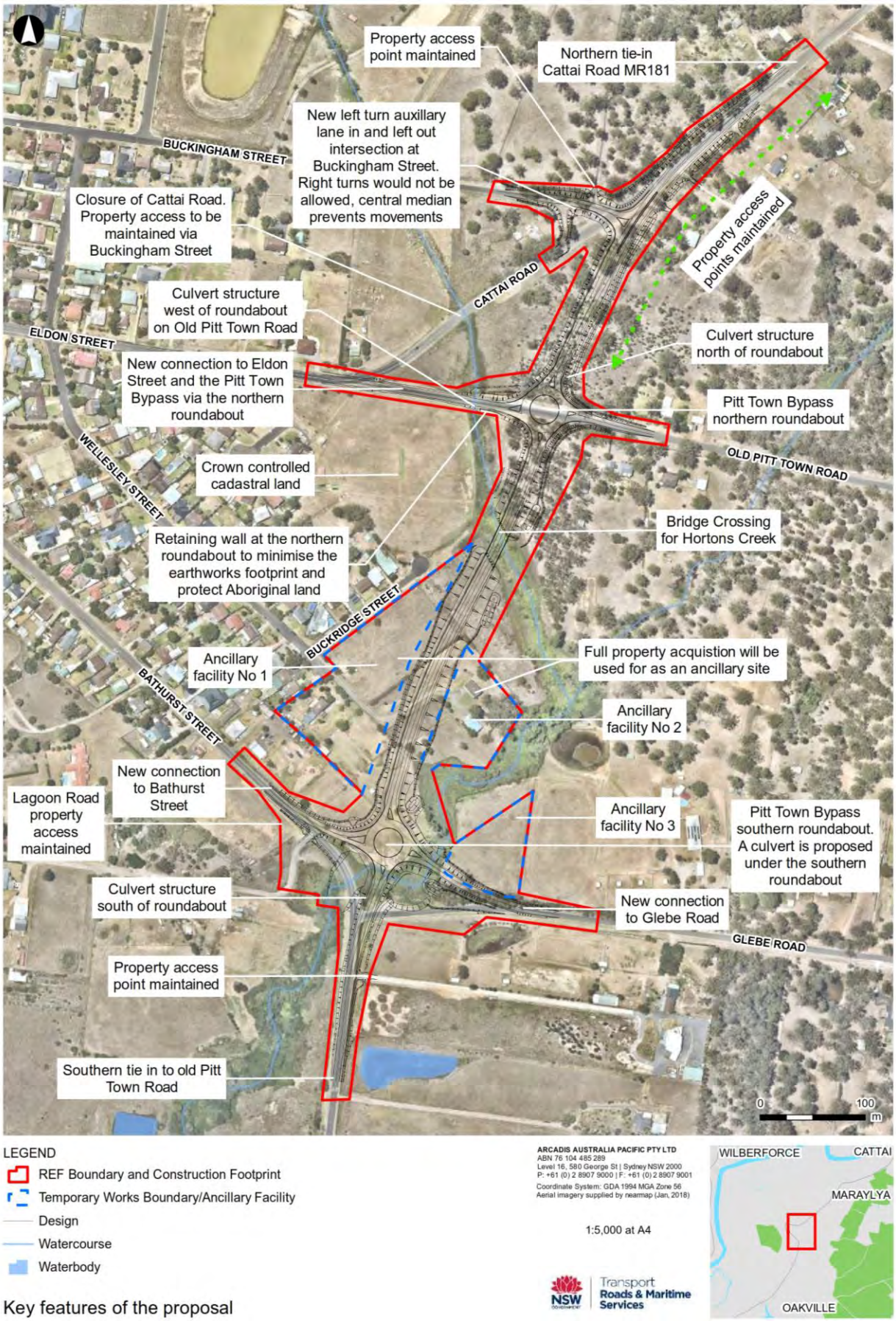
The objective of a SoHI is to evaluate and explain how the proposed development, rehabilitation or land use change will affect the heritage value of the site and/or place. A SoHI should also address how the heritage value of the site/place can be conserved or maintained, or preferably enhanced by the proposed works.

7.1 Proposal Description

Roads and Maritime propose to construct a bypass of Pitt Town. The bypass would be approximately 1km in length, and link Buckingham Street and Cattai Road in the north, with Pitt Town Road to the south.

- The key features of this proposal include:
- Extending Pitt Town Road past Bathurst Street onto Cattai Road, east of Eldon Street
- Installing a new roundabout at Eldon Street and Old Pitt Town Road
- Closing a portion of Cattai Road to maintain access from Buckingham Street
- Providing new crossings of Hortons Creek at the southern and central sections of the proposal
- Installing a new roundabout at Pitt Town Road/Bathurst Street and Glebe. Road.

Figure 50: Plan of the proposed Pitt Town Bypass (Source: Arcadis).



7.2 Assessment of Proposal against Management Policies

The following sections will assess the proposal against strategies and policies outlined in the following relevant heritage management plan:

- Hawkesbury DCP 2002.

7.2.1 Hawkesbury DCP 2002

Hawkesbury DCP 2002 provides the following statements relating to character and heritage conservation that are relevant to this assessment:

> ***4.2 Desired Character***
>
> *Pitt Town provides a relaxed and comfortable lifestyle with a semi rural village character. New development is to maintain a semi rural village character with generous and landscaped building setbacks and open streetscapes within a modified grid urban structure. New development will have building designs and materials compatible with the semi rural setting and traditional housing forms. The public domain is to reinforce the semi rural character of Pitt Town.*

> ***4.11 Heritage Conservation***
>
> *4.11.1 Aims*
>
> - *Places of recognised heritage significance are retained and conserved;*
> - *The cultural landscape heritage values of Pitt Town are protected.*

While it is not within a listed cultural or visual landscape under the LEP 2012, the study area and more broadly the Pitt Town district, retains a semi-rural character that is essential to the area's cultural landscape heritage values as identified in the DCP 2002. The remnant semi-rural landscape within the study area reflects the settlement and development patterns of the region, the agricultural pursuits of which have been influenced over time by the rich alluvial soils of the Hawkesbury and associated flooding patterns. The cultural landscape of Pitt Town remains largely intact, and provides a distinctive landscape character surrounding existing heritage items and conservation areas.

The proposal would result in a new road alignment passing through several undeveloped sites comprising agricultural and forest lands, and crossing Hortons Creek at the southern and central sections of the proposal. The proposal would change views within the rural character and setting of the study area, including distant views to and from surrounding heritage items like the 'Cottage' (LEP 2012 Item No. I277). Potential visual impacts of the proposal associated with the study area's cultural landscape heritage values would be increased by removal of vegetation and trees within the bypass alignment.

It is noted that several larger portions of land within the study area have been developed for residential purposes. The impact of the proposal needs to be considered within the broader cultural landscape of the region.

In order to maintain the existing character and cultural landscape of the Pitt Town area, the Hawkesbury DCP 2002 requires that places of recognised heritage significance are retained and conserved. Section 7.3 assesses potential physical and visual impacts on items located within the study area, including the locally listed 'Cottage' heritage item (LEP 2012 Item No. I277), and areas of archaeological potential.

7.3 Assessment of Heritage Impact

7.3.1 Cottage (LEP 2012 Item No. I277)

7.3.1.1 Physical impact

The proposal would involve works that would encroach upon the curtilage of the 'Cottage' heritage item. Upgrades to tie in Bathurst Street with a new roundabout at the intersection at Pitt Town Road/Bathurst Street and Glebe Road would involve road improving and realignment works. While it is understood the road alignment works would not physically impact the cottage itself, the proposed construction footprint would encroach upon the south-eastern corner of the item's heritage curtilage by up to 22m.

The proposed encroachment of the construction footprint into the curtilage of the 'Cottage' heritage item would result in excavation and earth movements in the vicinity of the heritage item, although these would be undertaken approximately 24m from the cottage structure itself. The proposed construction footprint would occupy an area of approximately 123m^2 within the item's heritage curtilage. It is noted that with a total heritage curtilage of around 8172m^2, the proposal would only result in permanent impacts within approximately two per cent of the item's heritage curtilage. Associated impacts from the proposal, as such, would be relatively localised. As the proposed construction footprint associated with the upgraded road connection to Bathurst Street itself would be undertaken within 25m from the cottage building itself, there is potential for indirect impact to this heritage item by way of vibration impacts.

It is noted that establishment of the Pitt Town bypass would reduce through traffic along Bathurst Street, particularly usage of the road by freight, which would potentially have a positive long-term indirect impact for the heritage item by way of reducing traffic noise and vibration.

The proposal would result in a minor physical impact to the 'Cottage' heritage item.

7.3.1.2 Visual impact

The proposal would involve road improvements and associated works to Bathurst Street adjacent to the 'Cottage' heritage item. As the heritage item has historically been located alongside an existing roadway, it is not anticipated that this aspect of the proposal would result in any significant visual impact to the cottage. Construction of the Pitt Town bypass, however, to the east of Bathurst Street would alter and potentially diminish the distant rural landscape setting of the 'Cottage' heritage item.

Immediate views east from the front of the cottage capture adjacent housing and cottages (refer to Figure 51). The cottage retains expansive views south east across Bathurst Street towards surrounding residential properties and agricultural paddocks towards Hortons Creek (refer to Figure 52). The proposed bypass alignment would be discernible from views out from the cottage, in particular the proposed roundabout to the north of Hortons Creek. Although it is noted that the location of the proposed roundabout site on lower ground means that it would not be visually conspicuous from the cottage itself. The adjoining undeveloped site south of the cottage building assists in maintaining a semi-rural visual character for the item.

The proposal would result in a minor visual impact to the 'Cottage' heritage item.

Figure 51: View east from cottage across Bathurst Street.



Figure 52: View south east from cottage towards proposed location of Bathurst Street and Glebe Road roundabout and new bypass alignment.



7.3.2 Archaeological impact

The prevailing land use of the study area is agricultural, and it incorporates land originally granted to settlers in the 1790s. These land grants are still discernible in the property boundaries and roads throughout the study area, although some subdivision has been undertaken. The existing road alignments and their form generally demonstrate 19th century characteristics, albeit upgraded to suit modern vehicular traffic.

The portion of the study area identified as having moderate potential to contain archaeological relics (Figure 49) is located partially within the construction footprint (Figure 50). Works within the construction footprint have the potential to impact on archaeological relics, specifically, former structures and deposits formerly located in the rear yards of structures illustrated on the 1828 and 1843 historic plans (Figure 49).

As the detailed design of the proposal has not yet been resolved, the level of anticipated impact to potential archaeological remains which may occur due to excavation taking place within the construction footprint is not yet known.

Whilst the study area has low potential to contain archaeological remains associated with early infrastructure, including services and culverts, the proposed works are unlikely to impact on archaeological remains of this type.

Overall, dependent on the location and nature of in-ground impacts, the proposed works within the construction footprint have potential to impact on archaeological relics of local significance.

7.4 Statement of Heritage Impact

A Statement of Heritage Impact for the proposed works is provided in Table 8 below.

Table 8: Statement of heritage impact

Impact	Discussion
What aspects of the proposal respect or enhance the heritage significance of the study area?	The proposal has been designed, where possible, to minimise direct impacts on adjacent heritage items. While it is understood roadworks would not impact upon the curtilage of the 'Cottage' heritage item, encroachment upon the curtilage of the property as a result of the proposed construction footprint would not respect or enhance the heritage significance of the study area, as discussed below.
What aspects of the proposal could have a detrimental impact on the heritage significance of the study area?	The proposed construction footprint around the proposed tie in to Bathurst Street from the proposed roundabout at the intersection of Pitt Town Road/Bathurst Street with Glebe Road, would encroach upon the southeastern curtilage of the locally listed 'Cottage' heritage item (LEP 2012 Item No I277). This would potentially result in movement of machinery, excavations and earth movements in the vicinity of the heritage item, although this would not affect the cottage structure itself. It is understood the proposed new road alignment on Bathurst Street in the vicinity of the 'Cottage' would potentially result in permanent changes within approximately two per cent of the item's heritage curtilage. In the overall context of the heritage item, the physical impact of the proposal would therefore be relatively localised and away from significant elements, ie the cottage building itself. The proposal would result in changes to the significant semi-rural character and agricultural setting of the study area, and the relationship between this setting and existing heritage items including the 'Cottage'. While it is not within a listed cultural or visual landscape under the LEP 2012, the study area, and more broadly the Pitt Town district, retains a semi-rural character that is essential to the area's cultural landscape heritage values as identified in the DCP 2002. The new road and associated roundabouts would be visible from surrounding streetscapes and properties overlooking the alignment of the bypass, and would be discernible from the 'Cottage' heritage item. While the proposal would alter the cultural landscape heritage values of the study area, the overall impact within the broader landscape of Pitt Town is considered minor. A Visual Impact Assessment would be prepared for the proposal and would include a detailed assessment of the visual impacts of the bypass and appropriate mitigation measures. Excavation works within the portion of the construction footprint identified as having moderate potential to contain relics may impact on a locally significant archaeological resource associated with early 19th century structures. Works within the construction footprint that overlaps with identified areas of archaeological potential have the potential to impact on an archaeological resource which meets the local significance threshold under criteria A, B, D, F, and G. On finalisation of the design, an Archaeological Research Design (ARD) would be prepared to provide detailed assessment of archaeological impacts and appropriate management and mitigation measures. As the detailed design of the proposal has not yet been resolved, the level of anticipated impact to archaeological remains is not yet known. Recommendations contained in Section 8.2 provides guidance on obtaining relevant archaeological permits and procedures to be employed in the event that unexpected finds are encountered during the proposed work.

Have more sympathetic options been considered and discounted?	Development of the proposal considered various options for the Pitt Town Bypass by Roads and Maritime. Options included: • Option 1 – 'Do nothing' • Option 2 – Construct a bypass of Pitt Town Only one horizontal alignment was investigated for the proposal, which follows the established bypass corridor, The main differences in options, as such, were between the intersection treatments and access provision at intersecting roads. The bypass was considered to require upgrades to three intersections including intersections at Bathurst Street/Glebe Road, Eldon Street/Old Pitt Town Road, and Cattai Road/Buckingham Street. Two strategic sub-options were developed for the proposed new intersection at Pitt Town Road/Bathurst Street and Glebe Road including: • Sub-option 1 – A new two-lane roundabout • Sub-option 2 – A new four-way intersection with traffic lights Selection of the preferred option was based on community consultation and analysis which identified that Option 2 (the proposal) with roundabouts would best meet the proposal objectives by alleviating traffic congestion through Pitt Town and improving connectivity and safety, and would meet community preferences.

8.0 CONCLUSIONS AND RECOMMENDATIONS

8.1 Conclusions

This SoHI has made the following conclusions:

- There is one listed heritage item within 25m of the proposal site boundary. This includes:
  - 'Cottage' (Hawkesbury LEP 2012 Item No. I277).
- The 'Cottage' (LEP 2012 Item No. I277) has been assessed as being significant at a local level
- Portions of the study area have been assessed as demonstrating moderate potential to contain archaeological relics
- The proposal has been assessed as having a:
  - Minor physical impact on the 'Cottage' heritage item
  - Minor visual impact on the 'Cottage' heritage item
  - Potential impact to areas assessed as demonstrating moderate potential to contain archaeological relics.

8.2 Recommendations

The following recommendations will aid in mitigating the impact of the Pitt Town Bypass on nearby heritage items and the wider Pitt Town cultural landscape:

- Consideration should be given to planting native screening vegetation along the bypass alignment after completion to mitigate impact on the views and setting within the study area
- As the proposal has not been assessed as resulting in any impacts above 'minor' on locally listed items within the study area, consultation with Hawkesbury City Council under the ISEPP would not be required
- As the proposed construction footprint is within 25m of the 'Cottage' heritage item, there is potential risk for impacts from vibration during construction, depending on the nature of equipment utilised. Construction vibration damage should be carefully managed and monitored. It is recommended that the construction methodology for works within a 25m range of the locally listed 'Cottage' heritage item be subject to approval by Roads and Maritime prior to commencement of works in this area
- Should works be required within the area assessed as having moderate potential to contain archaeological relics, an Archaeological Research Design (ARD) must be prepared
- Dependant on the assessed level of impact in the ARD, this may necessitate application for an excavation permit, or Exception Notification, under either Section 140 or Section 139(4) of the *Heritage Act 1977* respectively, to the Heritage Division of the Office of Environment and Heritage. Examples of possible outcomes have been provided in Table 9. The ARD would be required to support any application to Heritage Division.
- If unexpected archaeological finds are discovered during the proposed work, the Roads and Maritime *Standard Management Procedure: Unexpected Heritage Items* (2015) must be followed.

The NSW Heritage Division would be notified of the discovery of a relic in accordance with Section 146 of the NSW *Heritage Act* 1977. In areas where a permit to impact 'relics' under the Heritage Act is in place, a heritage consultant and Roads and Maritime would need to determine consistency of the unexpected find with existing approvals and advise if a notification to Heritage Division would be required.

- A heritage induction must be presented to workers before commencement of construction of works in the vicinity of the 'Cottage' heritage item (LEP 2012 Item No. I277) and include values of the place, avoidance procedure, and contacts (site manager, RMS heritage officer) for reporting unexpected archaeological finds or inadvertent impacts to the heritage item.

Table 9: Potential outcomes for archaeological management.

Impact	Additional documentation required	Archaeological investigation	Approval
High	Archaeological Research Design and Methodology	Test excavation	S139 Exception Notification
		Open area salvage excavation	S140 permit application
Moderate	Archaeological Research Design and Methodology	Test excavation	S139 Exception Notification
Low	Archaeological Research Design and Methodology	Test excavation/ Archaeological monitoring	S139 Exception Notification

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Appendix J

Traffic and Transport Assessment

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ARCADIS Design & Consultancy for natural and built assets

PITT TOWN BYPASS

Traffic and Transport Assessment



Incorporating Hyder

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ROADS AND MARITIME SERVICES (ROADS AND MARITIME)

PITT TOWN BYPASS

Traffic and Transport Assessment

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This report has been prepared for Roads and Maritime in accordance with the terms and conditions of appointment for Pitt Town bypass dated June 2018. Arcadis Australia Pacific Pty Limited (Arcadis) (ABN 76 104 485 289) cannot accept any responsibility for any use of or reliance on the contents of this report by any third party.

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REVISIONS

Revision	Date	Description	Prepared by	Approved by
A	4 June	Draft Report for Internal Review	WH, KN, MR	
B	15 June	Second Draft Report	WH	
C	19 July	Second Draft Report incorporating Construction assessment for Internal Review	KN	
D	20 July	Final Draft for RMS review	KN	
E	24 Sep	Final Report	KN	FA
F	2 November	Updated final report	KN	FA

CONTENTS

1 INTRODUCTION 10
1.1 Report Purpose 10
1.2 Road Network 10
1.3 Study Scope and Objectives 12
1.4 The Proposal 12
1.5 Study Approach 14
1.6 Report Structure 14

2 EXISTING TRAFFIC AND TRANSPORT CONDITIONS 15
2.1 Road Hierarchy 15
2.2 Route and Speed Environment 17
2.3 Commuter Mode Share 18
2.4 Work Trips Distribution 19
2.5 Public Transport 21
2.6 Walking and Cycling 23
2.7 Heavy Vehicles 24
2.7.1 B-Double Routes 24
2.8 Crash Data 24
2.8.1 Road Safety Performance 29

3 EXISTING ROAD NETWORK PERFORMANCE 31
3.1 Existing Network 31
3.2 Traffic Surveys and Data 31
3.3 Traffic Results 34
3.3.1 Daily Traffic Volumes 34
3.3.2 Heavy Vehicle Volumes 36
3.3.3 Hourly Traffic Variation 38
3.3.4 Peak Hour Traffic Volumes 41
3.3.5 Peak Hour Traffic Flows Across the Network 42
3.3.6 Origin Destination Analysis 43

4 EXISTING SIDRA NETWORK MODEL DEVELOPMENT 47
4.1 Key Modelling Assumptions 47
4.1.1 Modelling Platform 47
4.1.2 Time Periods 48
4.1.3 Gap Acceptance 48
4.1.4 Vehicle Types 48
4.2 SIDRA Model Validation 49
4.2.1 Travel Time Validation 49
4.2.2 Queue Length Validation 50

4.3 Existing Intersection LoS 50

5 FUTURE TRAFFIC GROWTH 53
5.1 Future Traffic Growth in SIDRA Modelling 55
5.2 Forecast Daily Traffic Volumes 55

6 FUTURE TRAFFIC VOLUMES ON BYPASS AND IMPACTS TO ROAD NETWORK 57
6.1 Traffic Volumes on Bypass 57
6.2 Impacts on Road Network 58

7 FUTURE NETWORK PERFORMANCE 62
7.1 Travel Time Saving 62
7.2 Travel Speed Improvement 63
7.3 LoS of Concept Design 64
7.3.1 Cattai Road / Buckingham Street Intersection 64
7.3.2 A New Roundabout at Eldon Street / Old Pitt Town Road (Northern Roundabout) 65
7.3.3 A New Roundabout at Bathurst Street / Pitt Town Road / Glebe Road (Southern Roundabout) 66
7.3.4 LoS Results 67
7.4 Impact on Other Travel Modes 69
7.4.1 Bus Services 69
7.4.2 Pedestrian and Cycle Network 69
7.5 Management & Mitigation Measures 69
7.6 Preliminary Construction Traffic Impact 70
7.6.1 Construction Staging 70
7.6.2 Construction Traffic Movement 72
7.6.3 Construction Traffic Distribution 73
7.6.4 Traffic Impact Assessment 74
7.6.5 Management of Traffic and Transport Impacts 75

8 CONCLUSIONS 76
8.1 Overview 76
8.2 Existing Traffic Conditions 76
8.3 Crash Data Analysis 77
8.4 Future Traffic Growth 77
8.5 Traffic Volumes on the Bypass 77
8.6 Future LoS 77
8.7 Traffic Benefits 78

Appendix

Appendix A SIDRA Model Queue Length Validation Results

Appendix B **Existing 2018 and Forecast 2021, 2031, 2041 Turning Volumes (AM and PM)**

Appendix C **Existing 2018 and Forecast 2021, 2031, 2041 SIDRA Level of Service Results (AM and PM)**

1 INTRODUCTION

1.1 Report Purpose

The following document is a Traffic and Transport Assessment (hereafter referred to as 'the Study') report prepared for the proposed Pitt Town bypass (the 'proposal').

Roads and Maritime Services (Road and Maritime) is planning a bypass of Pitt Town between Pitt Town Road and Buckingham Street, east of Pitt Town, within the City of Hawkesbury local government area.

The proposed bypass is approximately one kilometre in total length and consists of a single two-lane carriageway with a posted speed limit of 70 kilometres per hour (km/h). The proposed bypass would reduce travel time for through and local traffic, improve the reliability of journeys and provide more consistent driving conditions. It would also divert a substantial proportion of through traffic onto the bypass, reducing traffic volumes on the local road network through the town centre, particularly heavy vehicles. This would improve local amenities and access, and reduce other traffic related impacts such as noise to nearby residents.

A consultation process involving the Roads and Maritime project team constituted an important element of the Study. In the course of preparing this traffic and transport report, relevant documents associated with the proposal have been reviewed, and potential traffic impacts on the road network have been assessed. Two technical reports were submitted to the Roads and Maritime project team with respect to traffic model development and impact of the bypass. Feedback from the Roads and Maritime project team was incorporated in the Study's development and outcomes at various stages of investigation.

This Traffic and Transport Assessment Report has been prepared to support the Review of Environment Factors (REF) submission.

1.2 Road Network

Pitt Town is a historic town and suburb of Sydney. Pitt Town is about 59 kilometres (km) north-west of the Sydney central business district in the local government area of the City of Hawkesbury. It is bounded in the north by the Hawkesbury River.

Through the study area, the road network connects Cattai Road and Pitt Town Road via Eldon Street, Chatham Street and Bathurst Street, running through the town centre and adjacent residential areas. The road network is currently one lane in each direction with a posted speed limit of 60 km/h, and experiences large volumes of through traffic, including a high proportion of heavy vehicle volumes. The intersection between Bathurst Street and Chatham Road currently experiences high turning volumes during the morning and afternoon peak hours.

Figure 1-1 below shows key roads and intersections, as well as the location of the proposed Pitt Town bypass in the context of traffic and transport study area.



Figure 1-1 Traffic and Transport Study Area

1.3 Study Scope and Objectives

The scope of the Study is to assess the performance of the proposal from a traffic and transport point of view. A road based traffic model was developed for the study area using SIDRA Network software (version 7).

Key objectives of the traffic and transport assessment were to:

- Identify key traffic issues that affect the traffic performance of study area's road network including Cattai Road, Eldon Street, Chatham Street, Bathurst Street and Pitt Town Road
- Determine level of service (LoS) of the road network with the proposal, taking into account expected traffic growth in the opening year (2021), 10 years after opening (2031) and 20 years after opening (2041). For modelling purposes, the Study assumes 2021 as the opening year of the proposed bypass
- Prepare a Traffic and Transport Assessment Report to support the Review of Environment Factors (REF) of the proposal.

1.4 The Proposal

The proposal involves building a bypass of Pitt Town, which extends from Pitt Town Road to Buckingham Street east of Pitt Town, within the City of Hawkesbury local government area (LGA). The proposed bypass is approximately one kilometre in total length and consists of a two-lane carriageway (1 lane each direction) with a posted speed limit of 70 km/h. Figure 1-2 shows the extent the proposal, the proposed bypass and road network upgrades.

The key features of the proposal include:

- Extending Pitt Town Road past Bathurst Street onto Cattai Road, east of Eldon Street
- Installing a new roundabout at the intersection of Pitt Town Road/Bathurst Street and Glebe Road (the southern roundabout)
- Installing a new roundabout at Eldon Street and Old Pitt Town Road (the northern roundabout)
- Closing a portion of Cattai Road to maintain access to Buckingham Street
- Providing new crossings of Hortons Creek at the southern and central sections of the proposal.

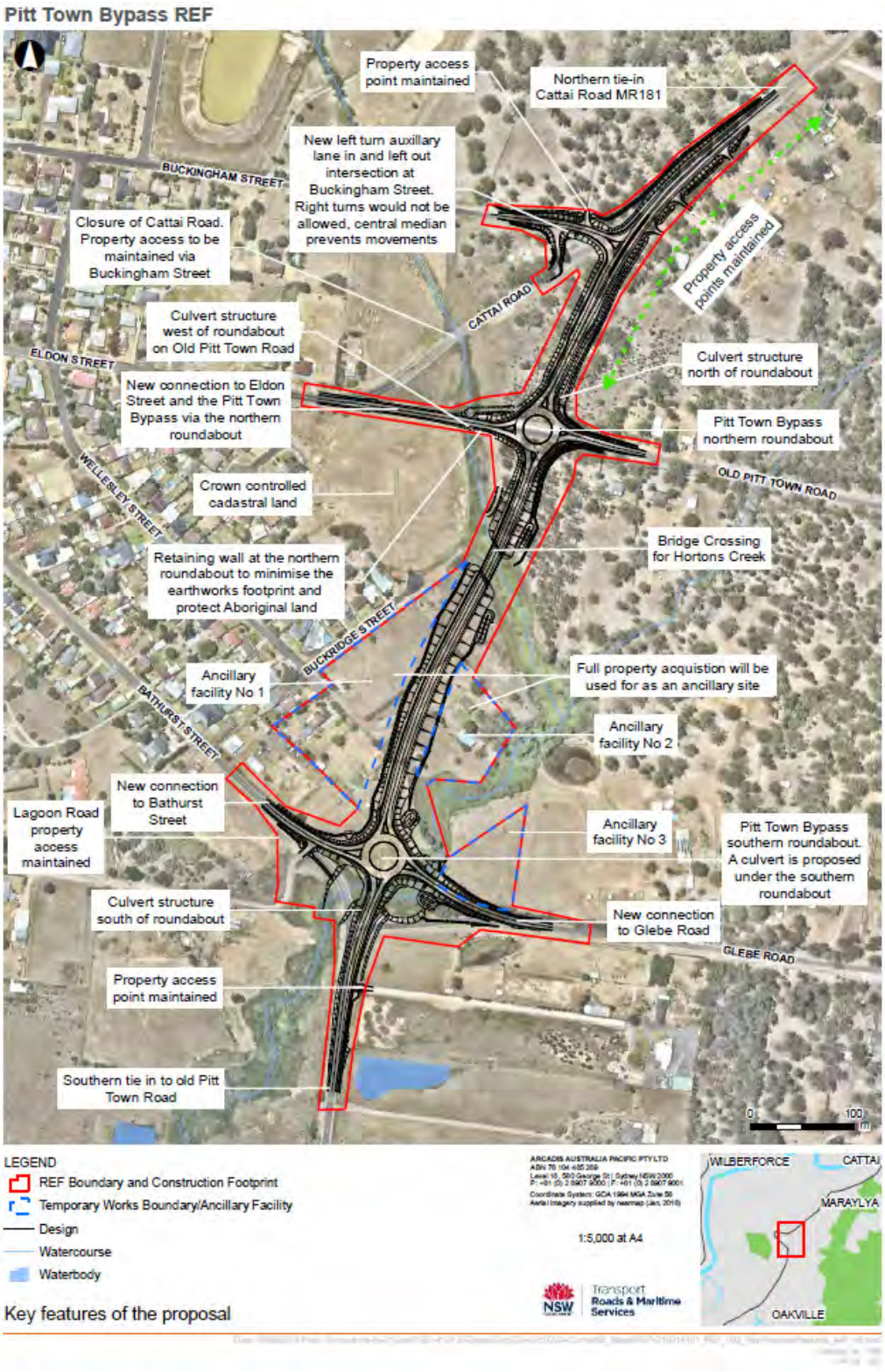


Figure 1-2 The Proposal

1.5 Study Approach

A comprehensive study approach has been developed specifically to achieve key study objectives which involved a 2018 traffic survey, traffic data analysis, development of a SIDRA Network model and assessment of the impact of the bypass to the road network. During the course of the study, two technical reports were prepared and reviewed by Roads and Maritime project team as follows:

- Technical Note 1 – Existing Traffic Conditions, issued in April 2018
- Technical Note 2 – Future Traffic Conditions, issued May 2018.

Key steps in the traffic assessment approach included the following:

1. **Traffic data, surveys and analysis**. Traffic surveys were conducted in February 2017 Three types of data were collected: midblock traffic counts, origin-destination (OD) surveys, and origin-destination travel time surveys. Additional traffic surveys were conducted in February 2018, including intersection turning volume counts, midblock counts and supplementary travel time surveys.
2. **Base case model development**. The existing base case SIDRA Network models were developed for 2018 traffic conditions using the February 2018 traffic survey data.
3. **Existing network performance assessment.** Existing 2018 LoS at key intersections within the study area was assessed for both morning (AM) and afternoon (PM) peak traffic conditions.
4. **Future base case model development**. For the purpose of traffic modelling, the peak hour traffic growth between 2018 and 2041 was assumed to be 2.5 % per annum. Forecast traffic volumes on key roads were prepared for three forecast years (2021, 2031 and 2041).
5. **Assess future traffic performance with the bypass**. Forecast traffic volumes on the proposed bypass and impact on the road network were assessed. Travel time savings attributable to the proposed bypass were estimated. Future traffic performance of upgraded intersections with the bypass were assessed using SIDRA Network for 2021 (opening year), 2031 (10 years after opening) and 2041 (20 years after opening) for morning (AM) and afternoon (PM) peak periods.

1.6 Report Structure

The remainder of this report is structured as follows:

- Chapter 2 – Existing Traffic And Transport Conditions – provides the context of existing traffic conditions within the Pitt Town study area
- Chapter 3 – Existing Road Network Performance – establishes the existing network performance within the study area. Results from traffic surveys are summarised in this section
- Chapter 4 – Existing SIDRA Network Model Development – provides an overview of the base year model development
- Chapter 5 – Future Traffic Growth – outlines the assumptions and data used to estimate future traffic forecasts
- Chapter 6 – Future Traffic Volumes on Bypass and Impacts to Road Network – outlines the forecast traffic volumes in the network due to the bypass
- Chapter 7 – Future Network Performance – establishes future traffic performance of the proposed bypass between Cattai Road and Pitt Town Road and compares with ‘do nothing’ condition
- Chapter 8 – Conclusions – provides a summary of key findings.

2 Existing Traffic and Transport Conditions

Existing traffic and transport conditions in the study area are described within this chapter. It provides the regional and local transport context within which the assessment has been undertaken.

2.1 Road Hierarchy

The sections of Cattai Road, Eldon Street, Chatham Street, Bathurst Street and Pitt Town Road form a north-south through connection across Pitt Town, and are classified State Roads. The roads run through a primarily residential area, connected to a network of local roads. Table 2-1 summarises characteristic of key roads. Figure 2-1 shows the existing road hierarchy.

Table 2-1 Road Characteristic

Roads	Characteristic
Cattai Road	Cattai Road is classified State Road providing north-south connection between Pitt Town to the north (i.e. Cattai). The road has a two lane undivided carriage way with sign-posted speed limit of 60 km/h. The road is designated B-Double routes for trucks up to 26 metres (m) long.
Eldon Road	Eldon Road is classified Stage Road connecting local roads within the town centre with Cattai Road. The road has a two lane undivided carriage way with sign-posted speed limit of 60 km/h. The road is designated B-Double routes for trucks up to 26 m long.
Chatham Street	Chatham Street between Bathurst Street and Eldon Street is classified as State Road. The road has a two lane undivided carriage way with sign-posted speed limit of 60 km/h. The road is designated B-Double routes for trucks up to 26 m long.
Bathurst Street	Bathurst Street is classified State Road connecting local roads within the town centre with Pitt Town Road. The road has a two lane undivided carriage way with sign-posted speed limit of 60 km/h. The road is designated B-Double routes for trucks up to 26 m long.
Pitt Town Road	Pitt Town Road is classified State Road providing north-south connection between Pitt Town to the south (i.e. Mcgraths Hill, Windsor). The road has a two lane undivided carriage way with sign-posted speed limit of 80 km/h. The road is designated B-Double routes for trucks up to 26 m long.



Figure 2-1 Road Hierarchy in the Study Area

2.2 Route and Speed Environment

Cattai Road and Pitt Town Road are currently connected by Eldon Street, Chatham Street and Bathurst Street, all of which are two lane roads (one lane in each direction).

The posted speed limit along all roads forming the connection between Cattai Road and Pitt Town Road is 60 km/h. The speed limits on adjoining roads through the Pitt Town residential area are generally 50 km/h, with the exception of Old Pitt Town Road and Glebe Road, with posted speeds of 70km/h. Figure 2-2 shows the posted speed limits within the study area.

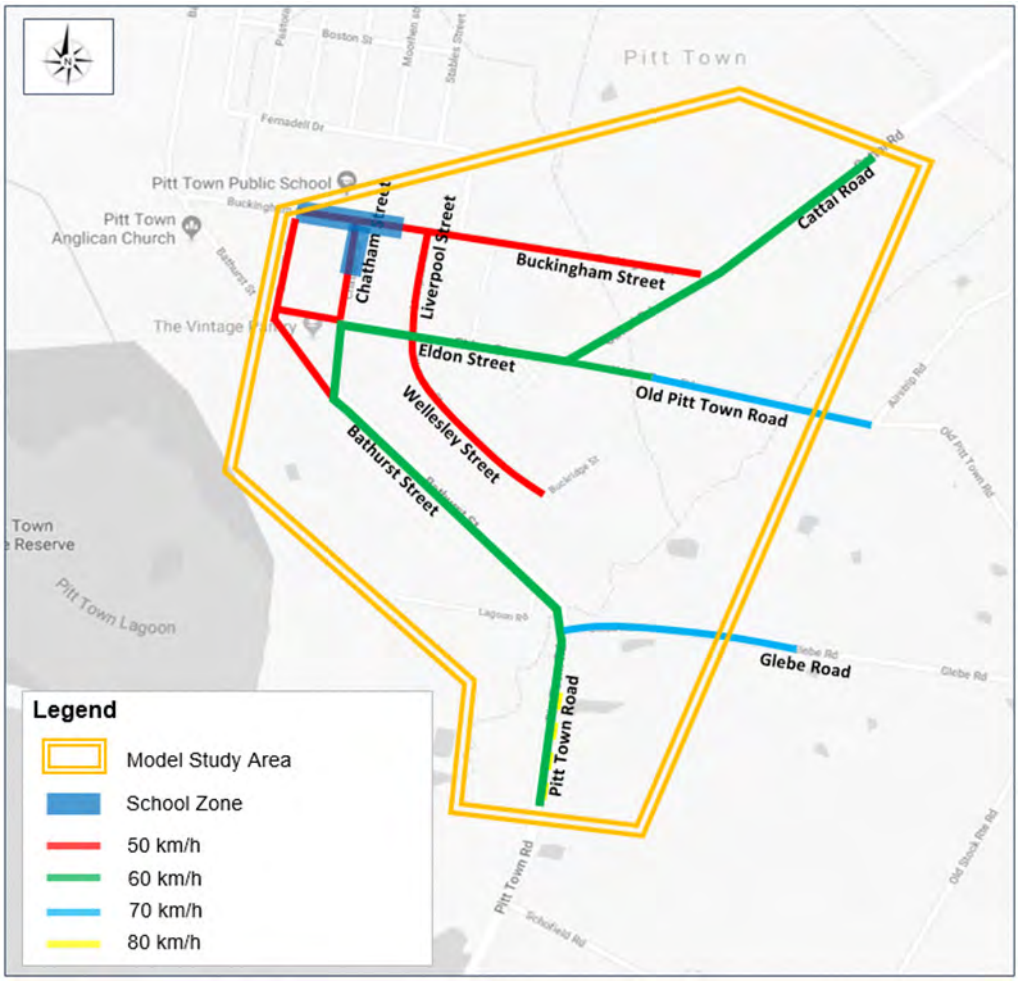


Figure 2-2 Posted Speed Limits in the Study Area

2.3 Commuter Mode Share

The Bureau of Transport Statistics (BTS) provides journey to work data (JTW) for the Sydney Greater Metropolitan Area (GMA), which comprises of a comprehensive sample of commuter travel, collected during the 2011 Census. Work trip origin and destinations are coded to the 2011 travel zones and shown in Figure 2-3. Table 2-2 summarises the work trips by mode of travel reported for the study area.

In 2011, about 845 residents travelled from the study area to work. About 16% of people did not travel to work or worked from home on the census day. The census data showed that around 77% of work trips from the study area were made by motorists in a private vehicle, with 3% of total trips being made by car passengers. About 3% of workers travelled by public transport, and 2% walked. Of the 3% public transport users, 1% of all trips were made by bus, with the remaining 2%t of trips being made by train.

Similarly, in 2011 about 287 employees travelled to the study area to work. The inbound trip statistics indicate that private vehicles are still the dominant mode of transport to work, accounting for about 63%, of which 3% are passengers. Only about 1% of employees travelled by public transport and 5% walked. The percentage of people who did not go to work or worked from home on the census date was high, at about 30%.

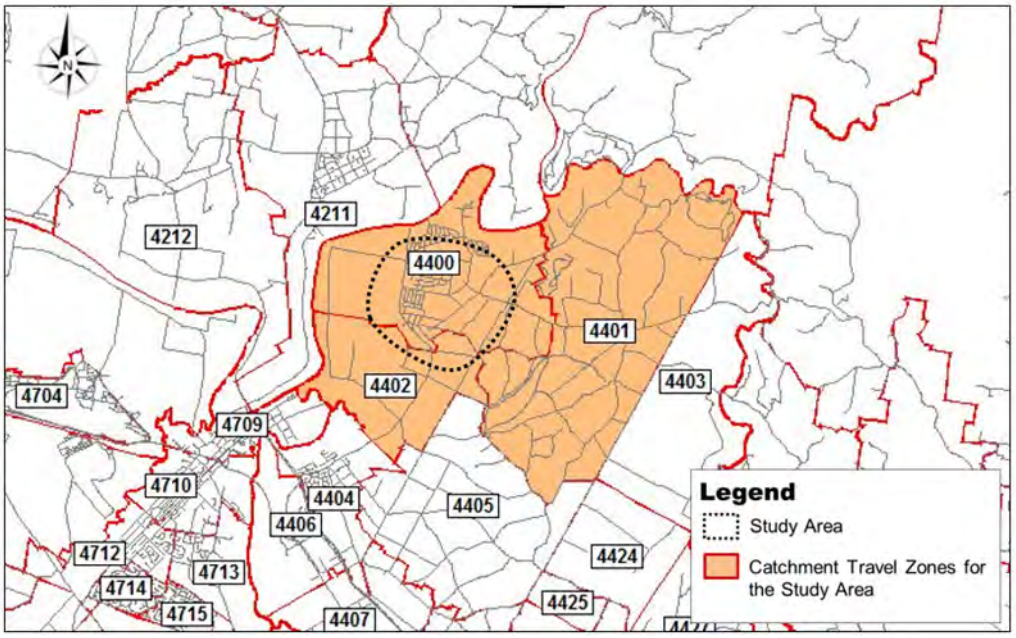


Figure 2-3 Travel Zones in the Study Area

Table 2-2 Commuter Mode Share in Study Area (JTW, 2011)

Travel Mode	Study Area as Home (Outbound trips)	% Trips as Home	Study Area as Workplace (Inbound trips)	% Trips as Workplace
Car Driver	624	74%	171	60%
Car Passenger	24	3%	8	3%
Walked Only	19	2%	13	5%
Train	19	2%	3	1%
Bus	5	1%	0	0%
Other	3	0%	3	1%
Worked at home/ Did not travel/ Not stated	151	18%	89	30%
Total	**845**	**100%**	**287**	**100%**
Selected travel zones (TZ): 4400				

Data Source: 2011 Journey to Work Data.

2.4 Work Trips Distribution

The JTW data was further analysed to understand the distribution of work trips to and from the study area. Outbound work trip distribution made by private cars (both as driver and as passenger) from the study area are summarised in Table 2-3. Inbound work trip distributions made by private car (both as driver and as passenger) to the study area are summarised in Table 2-4.

Pitt Town is situated within the Hawkesbury City Council.

The results indicate the following work trip patterns:

- Outbound work trip distribution shows that substantial trips are made to the Hawkesbury LGA (39 %). In addition to this, 15 % of outbound trips travelled to The Hills Shire LGA
- Inbound work trip distribution shows that substantial trips are made from the Hawkesbury LGA (69 %). In addition to this, 11 % of inbound trips travelled from The Hills Shire LGA.

Table 2-3 Daily Car Trips from the Study Area (Outbound)

Geographic Area	Number of car trips from study area (Outbound)	% Outbound trips from study area
Hawkesbury	250	39%
The Hills Shire	95	15%
Blacktown	74	11%
No fixed work address	55	8%
Parramatta	31	5%
Penrith	27	4%
Hornsby	20	3%
Ryde	18	3%
Auburn	14	2%

Geographic Area	Number of car trips from study area (Outbound)	% Outbound trips from study area
Holroyd	12	2%
Fairfield	8	1%
Ku-ring-gai	5	1%
Lane Cove	5	1%
North Sydney	5	1%
Willoughby	5	1%
Strathfield	4	1%
Sydney	3	<1%
Bankstown	2	<1%
Blue Mountains	2	<1%
Campbelltown	2	<1%
Canada Bay	2	<1%
Leichhardt	2	<1%
Liverpool	2	<1%
Newcastle	2	<1%
Total in Study Area	**646**	**100%**

Data Source: 2011 Journey to Work Data.

Table 2-4 Daily Car Trips to the Study Area (Inbound)

Geographic Area	Number of car trips to study area (Inbound)	% Inbound trips to study area
Hawkesbury	123	69%
The Hills Shire	20	11%
Blacktown	11	6%
Penrith	11	6%
Camden	2	1%
Great Lakes	2	1%
Marrickville	2	1%
Sydney	2	1%
Willoughby	2	1%
Wyong	2	1%
Holroyd	1	<1%
Total in Study Area	**178**	**100%**

Data Source: 2011 Journey to Work Data.

2.5 Public Transport

The study area is serviced by a single route, operated by Busways. Route 663 travels along the Windsor to Pitt Town loop at approximately hourly intervals during the peak periods. Figure 2-4 shows the bus service operating in the study area.



Source: www.busways.com.au, Gosford Bus Network Map (Effective from 26/11/2017)

Figure 2-4 Bus Routes Servicing the Study Area

The study area has no direct rail service. The nearest railway stations are Windsor station and Mulgrave station.

Windsor station is approximately 7 km from the Pitt Town study area via Pitt Town Road, Windsor Road, Macquarie Street, Hawkesbury Valley Way and George Street.

Mulgrave station is approximately 6 km from the Pitt Town study area via Pitt Town Road, Windsor Road, Mulgrave Road and Hawkesbury Valley Way.

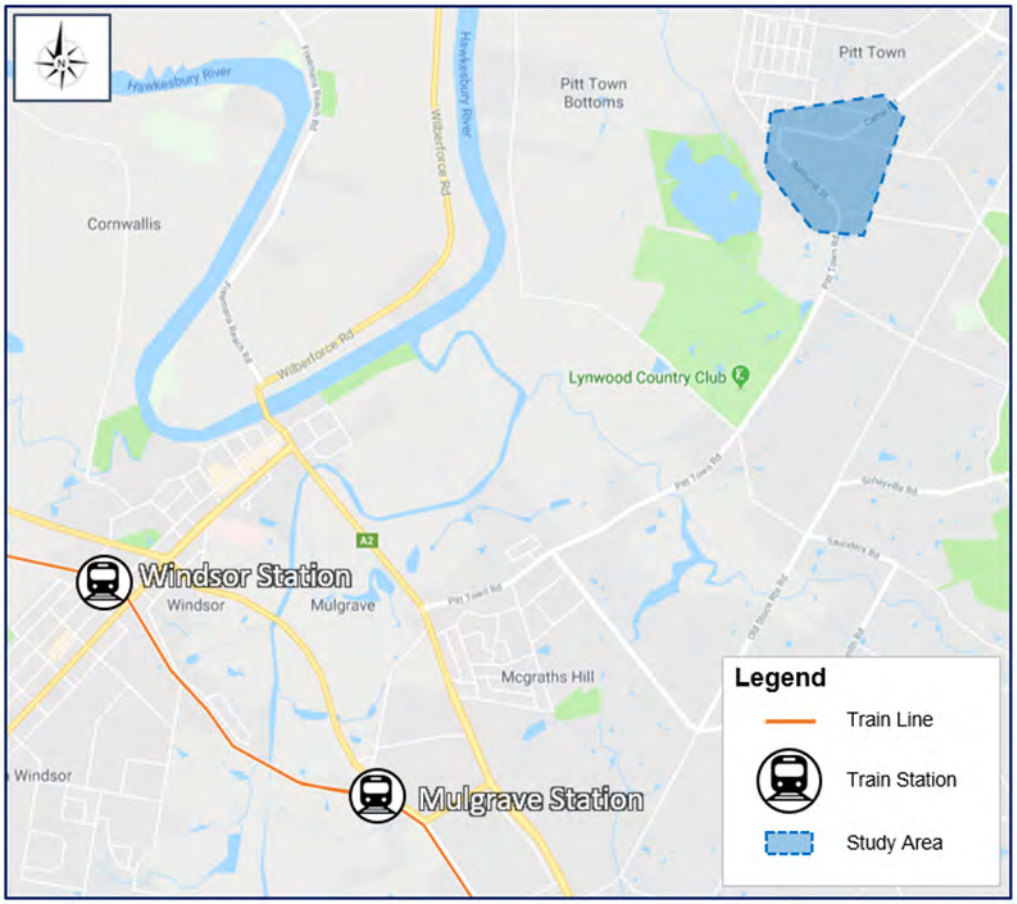


Figure 2-5 Train Stations Closest to the Study Area

2.6 Walking and Cycling

There are currently dedicated pedestrian footpaths along the section of Bathurst Street north of Chatham Street, and along Chatham Street. Other roads in the Pitt Town study area provide poor pedestrian amenities, presenting a road safety hazard. The high proportions of heavy vehicles through town centre network increase the risks of pedestrian safety.

Limited cycling amenities are available within the study area, with the exception on an on-road cycleway provided on Chatham Street and Eldon Street. Figure 2-6 shows the types of cycle routes in the study area.

Figure 2-6 shows the current cycle routes around the study area.



Source: Roads and Maritime Cycle Way Finder V3 (Last updated: 17/04/2018)

Figure 2-6 Existing Cycleway near the Study Area

2.7 Heavy Vehicles

2.7.1 B-Double Routes

Cattai Road, Eldon Street, Chatham Street, Bathurst Street and Pitt Town Road are designated B-Double routes for trucks up to 26 metres long. Figure 2-7 shows designated B-Double routes in the study area, sourced from Roads and Maritime.



Source: Roads and Maritime Restricted Access Vehicle Map NSW (map as of May 2018)

Figure 2-7 Designated B-Double Routes in the Study Area

2.8 Crash Data

This assessment is based on the crash data supplied by Roads and Maritime for a six-year period from 1 January 2011 to 31 December 2017. The crash data includes fatal, injury or vehicle damage accidents. The crash analysis has been undertaken for Pitt Town, along Cattai Road, Eldon Street, Chatham Street, Bathurst Street, Pitt Town Road and adjoining local roads.

Table 2-5 summarises crash statistics, classified by severity (fatal, injury and non-casualty). Of the 15 recorded crashes between January 2011 and December 2017, no fatal crashes were reported, 50% of crashes involved injury and 44% were non-casualty crashes. The 6 year crash data showed that about 8 people were injured.

Table 2-5 Severity of Crashes in the Pitt Town network

Crash Severity	Number of Crashes	Percentage	Number of people casualties
Fatal	0	0%	
Injury	8	53%	8 people injured
Non-casualty	7	47%	
Total	**15**	**100%**	**8**

Source: Roads and Maritime's crash data recorded from 1st January 2011 to 31st December 2017

Table 2-6 summarises crash statistics classified by road sections. There were 15 crashes recorded between January 2011 and December 2017 along the assessed network. Of all crashes reported, 5 crashes occurred at intersections and 10 crashes occurred on undivided road sections.

Table 2-6 Summary of Crashes by Location

Road	Total Number of Crashes Recorded	Intersection	Non intersection
Bathurst Street	6	2	4
Cattai Road	4	1	3
Chatham Street	2	0	2
Eldon Street	1	1	0
Pitt Town Road	1	1	0
Wellesley Street	1	0	1
Total	**15**	**5**	**10**

Source: Roads and Maritime's crash data recorded from 1st January 2011 to 31st December 2017

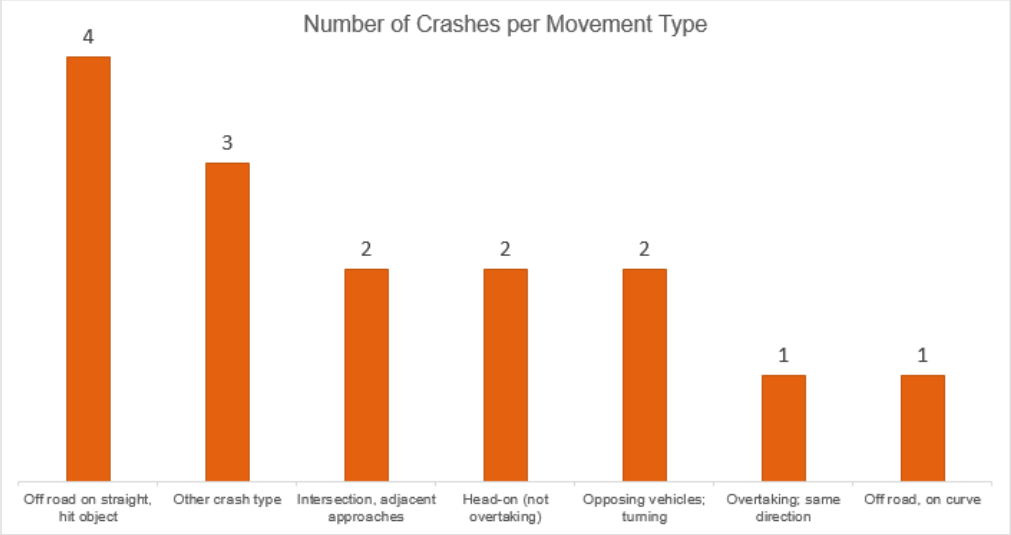
Table 2-7 shows the crash statistic for this period by type, and Figure 2-8 provides a visual indication of the distribution. The highest crash type recorded was off road, on straight, hitting object crashes, accounting for 4 crashes (27%). About 2 crashes (15%) were intersection, adjacent approaches or head-on (not overtaking) crashes.

It is likely that safety will deteriorate along the Pitt Town network and associated intersections in their current configuration for all road users as traffic levels and congestion increase, which is of on-going and substantial concern to Roads and Maritime and the local community.

Table 2-7 Summary of Crashes by Movement Type

Crash Movement	Count	Percentage
Off road on straight, hit object	4	27%
Other crash type	3	20%
Intersection, adjacent approaches	2	13%
Head-on (not overtaking)	2	13%
Opposing vehicles; turning	2	13%
Overtaking; same direction	1	7%
Off road, on curve	1	7%
Total	**15**	**100%**

Source: Roads and Maritime's crash data recorded from 1st January 2011 to 31st December 2017



Source: Roads and Maritime's crash data recorded from 1st January 2011 to 31st December 2017

Figure 2-8 Number of Crashes by Movement Types

Figure 2-9 below shows the location of all crashes in the study area.



Source: Roads and Maritime's crash data recorded from 1st January 2011 to 31st December 2017

Figure 2-9 Crashes by Location and Severity

2.8.1 **Road Safety Performance**

The road safety performance for various sections of Pitt Town from Buckingham Street to Pitt Town Road were assessed using crash rates per 100 million vehicle kilometres travelled (MVKT). The parameter vehicle-kilometre travelled (VKT) is an industry-accepted measure of crash exposure. In general, the more traffic that uses a road (traffic volume), and longer the trip length (kilometres travelled), the greater the exposure to crashes.

The three data inputs required for crash data analysis by MVKT are:

- Number of crashes
- Traffic volumes
- Segment lengths.

Crash rates mapping was prepared using colour codes and are shown in Figure 2-10 below.



Figure 2-10 Crash Rate Map for All Crashes in Pitt Town

The crash data analysis was only intended to be high level, to identify which sections of the Pitt Town network are performing well, and which are performing poorly. The graduated colour code allows for the determination of relative priorities between segments, with red coloured segments being those that have performed poorly, and green coloured segments being those that have performed comparatively better.

When considering all crashes (casualty and non-casualty crashes), the following segments were identified as poor performing segments with more than 40 crashes per 100MVKT:

- Cattai Road and Eldon Street between Chatham Street and Old Pitt Town Road (Section 1)
- Chatham Road between Eldon Street and Bathurst Street (Section 2)
- Bathurst Street between Chatham Street and Pitt Town Road (Section 3).

2.9 Evacuation routes

The *Hawkesbury Nepean Flood Plan* (SES, 2015) identifies Pitt Town Road as a designated regional evacuation route.

The entry point for the regional evacuation route is located at the intersection of the Bathurst Street and Buckingham Street, Pitt Town. Then the evacuation route continues along Bathurst Street, Bottles lane, Redfern Place, Mitchell Road and then Pitt Town Dural Road towards Dural.

3 EXISTING ROAD NETWORK PERFORMANCE

This chapter establishes existing transport network performance in the study area. Results of traffic surveys are summarised in this section and formed the basis of existing LoS assessment.

3.1 Existing Network

Daily traffic on the Pitt Town Road, Bathurst Street, Eldon Street and Cattai Road varies significantly. Cattai Road carries about 4,400 vehicles per day. On Eldon Street west of Liverpool Street, about 5,400 vehicles per day were recorded. Traffic volumes increase to 9,600 to 9,700 vehicles per day on Bathurst Street (east of Chatham Road), and Pitt Town Road (south of Glebe Road). The significant traffic variations between Bathurst Street (east of Chatham Road) and Eldon Street are contributed by local traffic generated to and from Pitt Town.

Pitt Town Road, Bathurst Street, Eldon Street and Cattai Road are designated B-double routes and are allowed for use by vehicles with a maximum vertical height clearance of 4.6 metres. About 640 to 950 heavy vehicles per day are recorded on Pitt Town Road, Bathurst Street, Eldon Street and Cattai Road, accounting for approximately 10 to 17% of total traffic.

Traffic on Pitt Town Road, Bathurst Street, Eldon Street and Cattai Road through Pitt Town is a mixture of through (passing) and local traffic. The proportion of through traffic on Pitt Town Road and Cattai Road was found to be about 31% in the northbound direction and about 61% in the southbound direction.

There were 13 crashes recorded between 2011 and 2016 in Pitt Town. About 54% of crashes involved injury and 46% were non-casualty crashes. The five-year crash data showed that about 7 people were injured. It is likely that safety would deteriorate along the Pitt Town network and associated intersections in their current configuration for all road users as traffic levels and congestion increases, which is of on-going and substantial concern to Roads and Maritime and the local community.

3.2 Traffic Surveys and Data

Traffic surveys were undertaken for Roads and Maritime in February 2017 and February 2018. The traffic data was made available by Roads and Maritime for this study purpose.

The February 2017 traffic surveys include:

- Midblock traffic counts
- Origin destination (OD) survey
- Origin destination travel time survey

The February 2018 traffic surveys include:

- Intersection classified turning movement counts (car and heavy vehicles)
- Midblock traffic counts.

To assess intersection performance, SIDRA Network (version 7.0.7.6759) modelling software was used. Table 3-1 below summarises the details of 2017 traffic surveys. Table 3-2 summarises the details of the additional traffic surveys undertaken in 2018.

Table 3-1 Specifications of Traffic Surveys Undertaken in 2017

Survey Type	Location	Survey Method	Survey Period
Midblock counts (refer to Figure 3-1)	• M-5: Bathurst Street, south of Glebe Road • M-6: Bathurst Street, north of Buckingham Street • M-7: Buckingham Street, east of Liverpool Street • M-8: Cattai Road, north of Buckingham Street •	Traffic counts using the automatic tube count (ATC) method Vehicle classification as per AustRoads 12 vehicle classes.	13th – 19th February 2017 7 days / 24 hours
Origin Destination (OD) Surveys (refer to Figure 3-1)	• Bathurst Street, north of Buckingham Street • Bathurst Street, south of Glebe Road • Cattai Road, north of Buckingham Street	OD survey including travel time data, using video record	14th, 15th and 18th February 2017 15 hours: 5AM to 8PM

Table 3-2 Specifications of Traffic Surveys Undertaken in 2018

Survey Type	Location	Survey Method	Survey Period
Midblock counts (refer to Figure 3-2)	• M-1: Cattai Road, between Buckingham Street and Old Pitt Town Road • M-2: Eldon Street, between Liverpool Street and Chatham Street • M-3: Bathurst Street, between Chatham Street and Lagoon Road • M-4: Old Pitt Town Road, between Cattai Road and Airstrip Road	Traffic counts using the automatic tube count (ATC) method Vehicle classification as per AustRoads 12 vehicle classes.	15th – 21st February 2018 7 days / 24 hours
Intersection movement counts (refer to Figure 3-1)	• I-1: Cattai Road / Buckingham Street (priority) • I-2: Cattai Road / Eldon Street / Old Pitt Town Road (priority) • I-3: Eldon Street / Liverpool Street / Wellesley Street (priority) • I-4: Eldon Street / Chatham Street (priority) • I-5: Chatham Street / Bathurst Street (priority) • I-6: Chatham Street / Pitt Town Road / Glebe Road (priority)	Movement counts using video camera surveys Classification counts for light and heavy vehicles Pedestrians counted.	13th – 19th February 2017 AM Peak 4 hours: 6AM to 10AM PM Peak 4 hours: 3PM to 7PM



Figure 3-1 Traffic Survey Locations Undertaken in 2017



Figure 3-2 Traffic Survey Locations Undertaken in 2018

3.3 Traffic Results

This section reports results from midblock traffic counts, intersection movement counts and origin-destination (OD) survey data.

3.3.1 Daily Traffic Volumes

Table 3-3 and Figure 3-3 shows the daily traffic volumes counted on the key roads within the study area. Table 3-3 reports daily traffic volumes for average weekday (5 days), average weekend (2 days) and critical day (Friday). Figure 3-3 show daily traffic volumes for the average weekday.

Table 3-3 Average Daily Traffic Volumes in 2018 within the Pitt Town study area

ID	Site Location	Daily Traffic			Comparison	
		Weekday Average (5 Days)	Weekend Average (2 Days)	Critical Day (Friday)	Critical Day vs Weekday (%)	Weekend vs Weekday (%)
State Roads						
M-8	Cattai Rd, north of Buckingham St	4,430	3,710	4,590	4%	-16%
M-1	Cattai Rd, between Buckingham Rd and Old Pitt Town Rd	4,280	3,940	4,620	8%	-8%
M-2	Eldon St, between Liverpool St and Chatham St	5,430	4,900	5,780	6%	-10%
M-3	Bathurst St, between Chatham St and Lagoon Rd	9,580	8,160	10,000	4%	-15%
M-5	Pitt Town Rd, south of Glebe Rd	9,710	8,190	10,090	4%	-16%
Local Roads						
M-6	Bathurst St, north of Buckingham St	3,360	3,000	3,550	6%	-11%
M-7	Buckingham St, east of Liverpool St	900	670	890	-1%	-26%
M-4	Old Pitt Town Rd, between Cattai Rd and Airstrip Rd	1,170	890	1,220	4%	-24%

Note: Traffic volumes are rounded to the nearest 10.



Figure 3-3 Existing Weekday Daily Traffic Volumes in 2018

Following points are noted in relation to daily traffic volumes:

- On the average weekday, daily traffic volumes on Pitt Town Road, Bathurst Street, Eldon Street and Cattai Road were recorded between 4,300 and 9,700 vehicles per day depending on location
- Average weekday daily traffic on the Pitt Town Road, Bathurst Street, Eldon Street and Cattai Road varies significantly. Cattai Road carries about 4,400 vehicles per day. On Eldon Street west of Liverpool Street, about 5,400 vehicles per day are recorded. Traffic volumes increase to 9,600 to 9,700 vehicles per day on Bathurst Street east of Chatham Road, and Pitt Town Road south of Glebe Road. The significant traffic variations between Bathurst Street east of Chatham Road, and Eldon Street is contributed to by local traffic generated to and from Pitt Town
- Local roads carry a lower order of traffic volumes. Bathurst Street north of Buckingham Street carries about 3,400 vehicles. Buckingham Street and Old Pitt Town Road carry between 900 and 1,200 vehicles per day
- Traffic count data indicates that on the critical day, daily traffic volumes on Pitt Town Road, Bathurst Street, Eldon Street and Cattai Road are about 4 to 8% higher than the average weekday
- Weekend traffic is significantly lower than weekday traffic being about 8 to 16% lower on Pitt Town Road, Bathurst Street, Eldon Street and Cattai Road, and about 11 to 26% lower on Buckingham Street and Old Pitt Town Road.

3.3.2 **Heavy Vehicle Volumes**

According to the Austroads vehicle classification system, heavy vehicles include trucks with two or more axles, buses, semi-trailers and B-doubles.

Table 3-4 summarises the average weekday daily heavy vehicle volumes counted at key locations. Previous Figure 3-3 showed daily heavy vehicle volumes and proportions of total traffic at key locations.

Table 3-5 shows average weekday heavy vehicle volumes by rigid trucks, semi-trailers and B-doubles.

Table 3-4 Daily Heavy Vehicle Volumes and Proportions in 2018

ID	Site Location	Heavy Vehicles		Heavy Vehicle Proportion to Total Traffic
		All Vehicles	Heavy Vehicles	
State Roads				
M-8	Cattai Rd, north of Buckingham St	4,430	640	14%
M-1	Cattai Rd, between Buckingham Rd and Old Pitt Town Rd	4,280	640	15%
M-2	Eldon St, between Liverpool St and Chatham St	5,430	840	15%
M-3	Bathurst St, between Chatham St and Lagoon Rd	9,580	940	10%
M-5	Pitt Town Rd, south of Glebe Rd	9,710	950	10%
Local Roads				
M-6	Bathurst St, north of Buckingham St	3,360	260	8%
M-7	Buckingham St, east of Liverpool St	900	50	6%
M-4	Old Pitt Town Rd, between Cattai Rd and Airstrip Rd	1,170	60	5%

Note: Traffic volumes are rounded to the nearest 10.

Table 3-5 Daily Heavy Vehicle Volumes by Vehicle Type in 2018

ID	Site Location	Volumes by Type			% by Type		
		Rigid	Semi	B double	Rigid	Semi	B double
State Roads							
M-8	Cattai Rd, north of Buckingham St	350	180	110	55%	28%	18%
M-1	Cattai Rd, between Buckingham Rd and Old Pitt Town Rd	420	110	110	65%	18%	17%
M-2	Eldon St, between Liverpool St and Chatham St	740	50	50	87%	7%	6%
M-3	Bathurst St, between Chatham St and Lagoon Rd	690	140	110	74%	14%	12%
M-5	Pitt Town Rd, south of Glebe Rd	550	270	120	58%	29%	13%
Local Roads							
M-6	Bathurst St, north of Buckingham St	180	70	10	68%	27%	5%
M-7	Buckingham St, east of Liverpool St	50	0	0	100%	0%	0%
M-4	Old Pitt Town Rd, between Cattai Rd and Airstrip Rd	50	0	0	96%	3%	1%

Note: Traffic volumes are rounded to the nearest 10.

The following points are noted in relation to heavy vehicle data:

- Pitt Town Road, Bathurst Street, Eldon Street and Cattai Road are designated B-double routes and are allowed for use by vehicles with a maximum vertical height clearance of 4.6 metres. About 640 to 950 heavy vehicles per day are recorded on Pitt Town Road, Bathurst Street, Eldon Street and Cattai Road, accounting for approximately 10 to 17% of total traffic
- To the north, Cattai Road carries about 640 heavy vehicles per day, about 15 to 17 % of total traffic. Of the total vehicles counted on Cattai Road, a majority are rigid trucks (55 %). Semi-trailers and B-double trucks are between 28% and 18% of total heavy vehicles respectively
- About 840 heavy vehicles travel on Eldon Street west of Liverpool Street per day, accounting for about 16% of total traffic. The majority of heavy vehicles observed on Eldon Street are rigid trucks, at about 87% of the total heavy vehicle volumes. Semi-trailers and B-double trucks were found be about 6% of total heavy vehicles
- About 950 heavy vehicles per day are recorded on Bathurst Street east of Chatham Street and Pitt Town Road south of Glebe Road, representing about 10 to11 % of total traffic. Majority are rigid trucks being about 58 to 74% of total heavy vehicles.

3.3.3 **Hourly Traffic Variation**

This section examines morning (AM) and afternoon (PM) peak hour traffic variations for the study area road network. Figure 3-4 to Figure 3-11 below shows hourly traffic variations on average weekday by direction at key locations.

The following points are noted in relation to peak hour traffic variation:

- The AM peak hour occurs between 8AM and 9AM at most locations
- The PM peak also occurs between 3PM and 4PM at most locations
- During the AM peak period, the major traffic flow is southbound towards Pitt Town Road. This is mirrored in the PM peak with a similar volume of traffic heading northbound through Pitt Town.

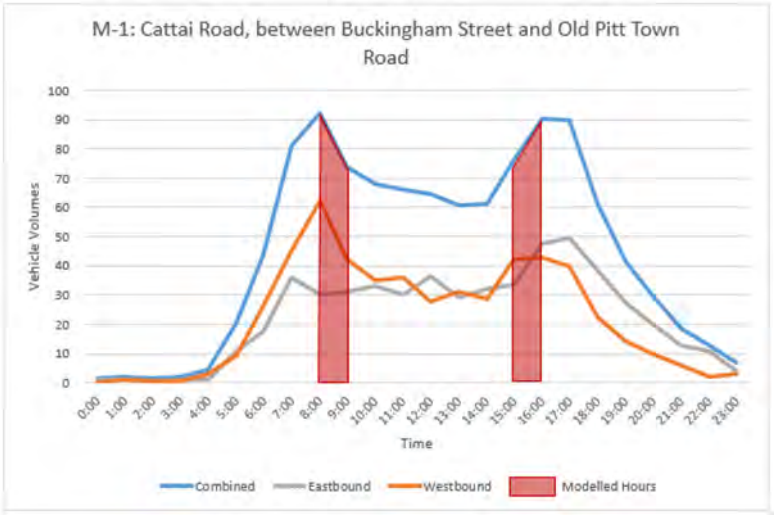


Figure 3-4 M-1 Hourly Traffic Variation in 2018

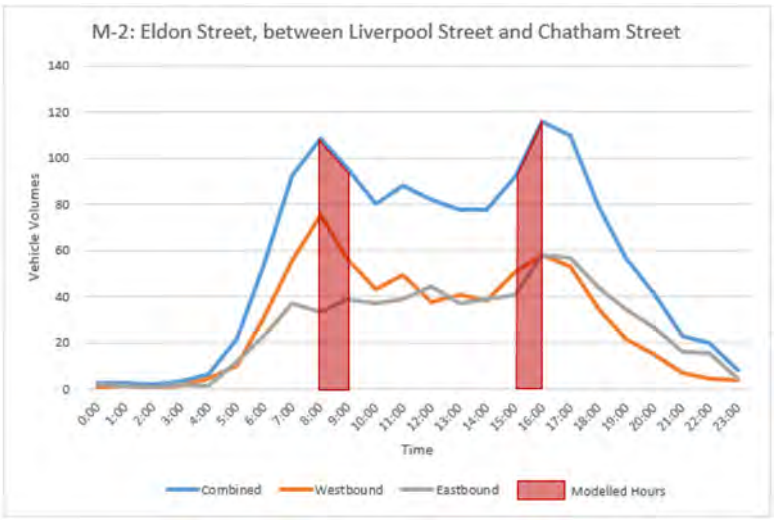


Figure 3-5 M-2 Hourly Traffic Variation in 2018

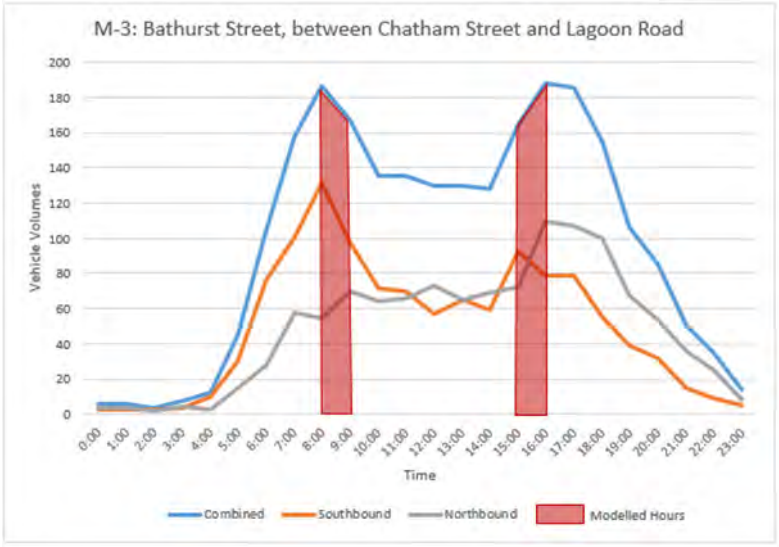


Figure 3-6 M-3 Hourly Traffic Variation in 2018

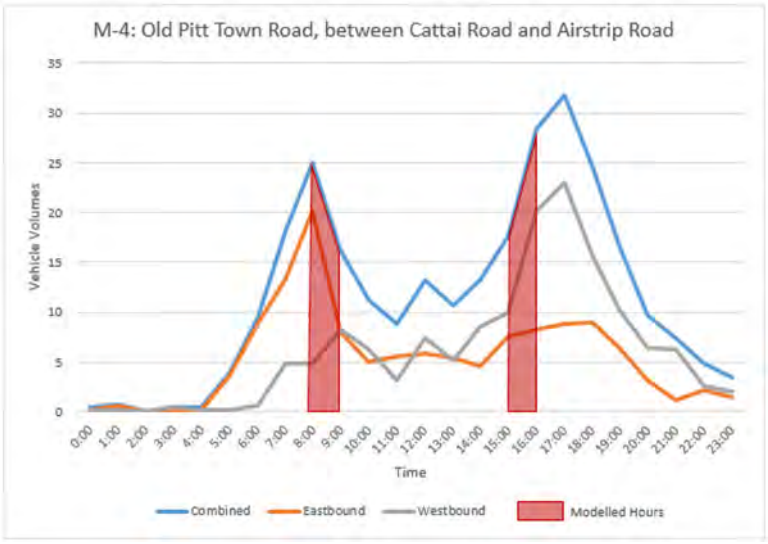


Figure 3-7 M-4 Hourly Traffic Variation in 2018

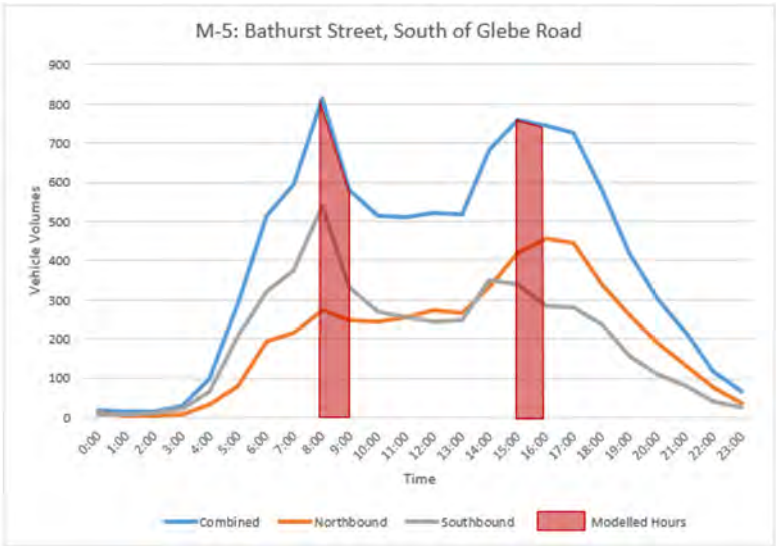


Figure 3-8 M-5 Hourly Traffic Variation in 2018

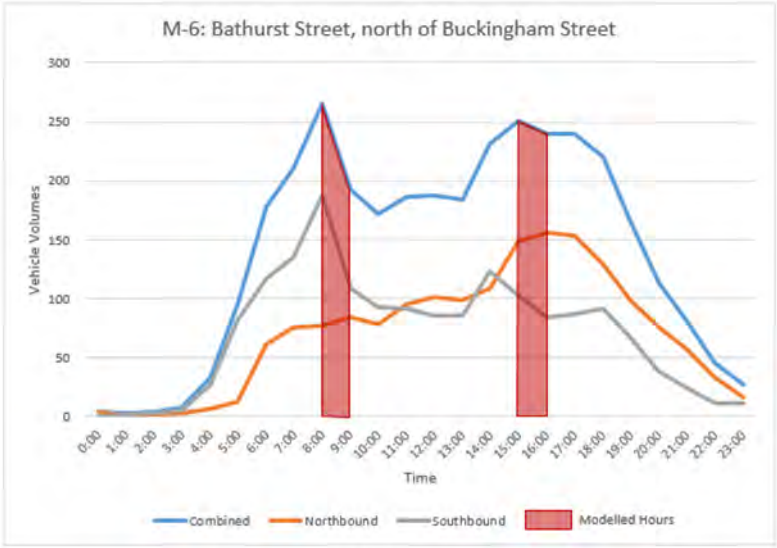


Figure 3-9 M-6 Hourly Traffic Variation in 2018

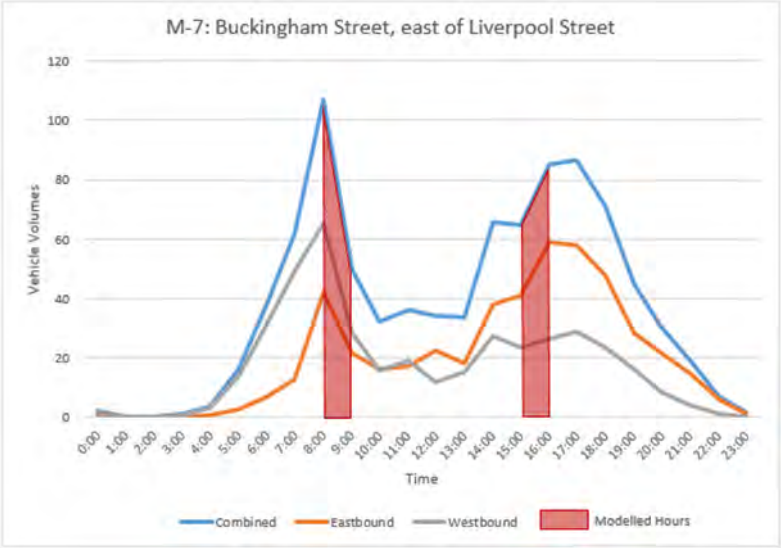


Figure 3-10 M-7 Hourly Traffic Variation in 2018

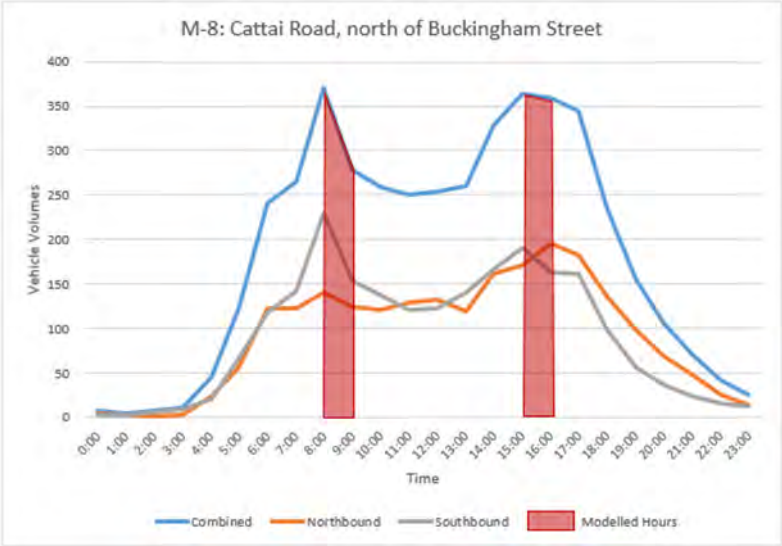


Figure 3-11 M-7 Hourly Traffic Variation in 2018

3.3.4 **Peak Hour Traffic Volumes**

Table 3-6 summarises the average weekday morning (AM) peak one hour (8AM to 9AM) and afternoon (PM) peak one hour (3PM to 4PM) traffic volumes by travel directions at key locations.

Table 3-6 Existing AM and PM Peak Hour Traffic Volumes in 2018

ID	Site Location	AM Peak (8AM to 9AM)			PM Peak (3PM to 4PM)		
		NB	SB	Two way	NB	SB	Two way
State Roads							
M-8	Cattai Rd, north of Buckingham St	140	230	370	180	190	370
M-1	Cattai Rd, between Buckingham Rd and Old Pitt Town Rd	120	230	350	180	160	330
M-2	Eldon St, between Liverpool St and Chatham St	300	150	450	220	210	430
M-3	Bathurst St, between Chatham St and Lagoon Rd	560	290	860	330	400	730
M-5	Pitt Town Rd, south of Glebe Rd	270	540	810	420	340	760
Local Roads							
M-6	Bathurst St, north of Buckingham St	80	190	270	150	100	250
M-7	Buckingham St, east of Liverpool St	40	70	110	40	20	70
M-4	Old Pitt Town Rd, between Cattai Rd and Airstrip Rd	60	50	110	30	80	110

Note: Traffic volumes are rounded to the nearest 10.

3.3.5 **Peak Hour Traffic Flows Across the Network**

This section examines AM and PM peak traffic flows across the entire network. Figure 3-12 and Figure 3-13 show 2018 AM peak one hour (8AM to 9AM) and PM peak one hour (3PM to 4PM) intersection turning movements at six key intersections and directional midblock traffic volumes at key locations. The yellow arrow represents the southbound morning peak traffic direction, and the blue arrow represents the northbound afternoon peak traffic direction.

The following points are noted in relation to traffic volumes in Figure 3-12 and Figure 3-13.

- During the morning peak, the peak directional flow is in the southbound direction
- During the afternoon peak, the peak directional flow is in the northbound direction
- Currently in the morning peak hour, there are high volumes of right turning traffic out of Bathurst Street, travelling southbound at the Bathurst Street / Chatham Street intersection (about 280 vehicles per hour).

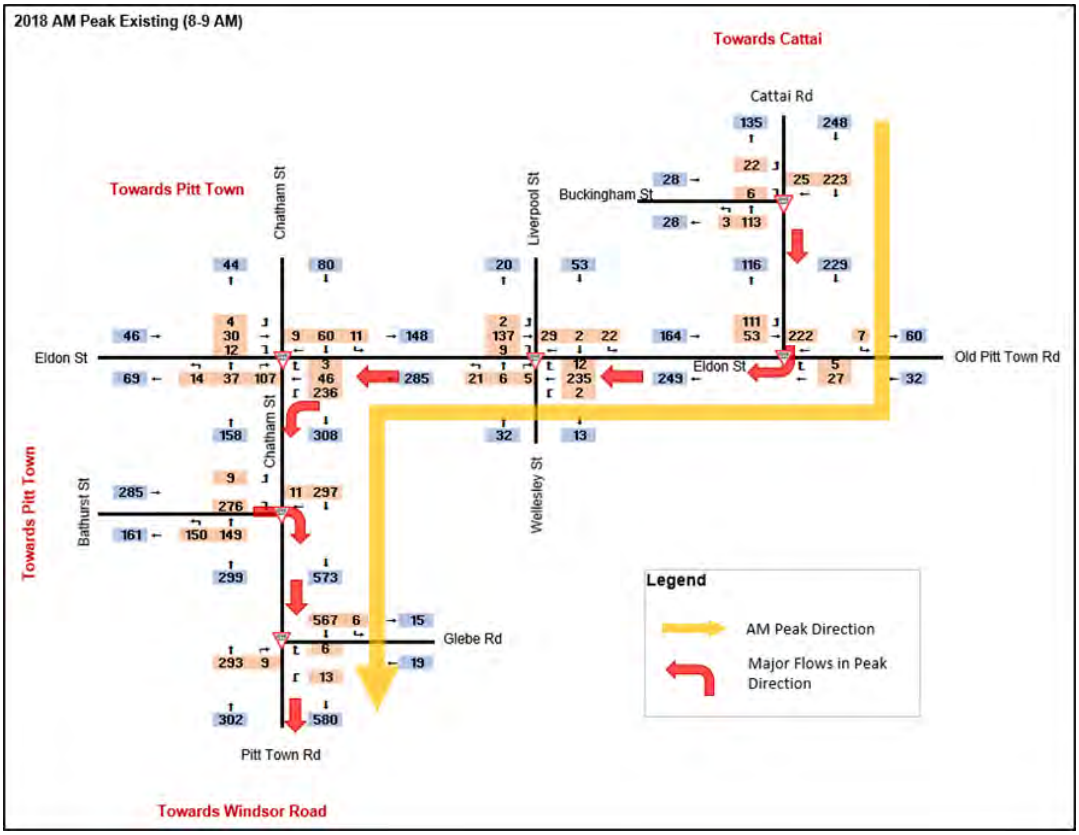


Figure 3-12 Peak hour traffic flows during the AM peak (8AM to 9AM) in 2018

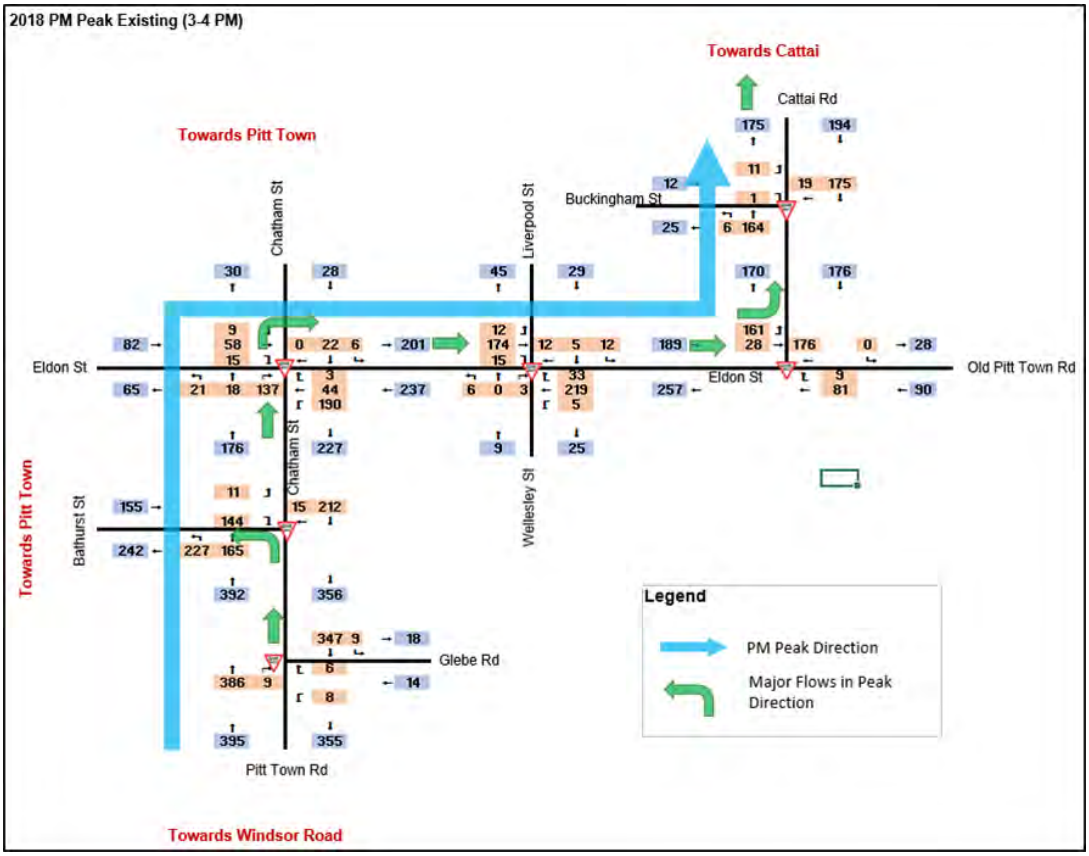


Figure 3-13 Peak hour traffic flows during the PM peak (3PM to 4PM) in 2018

3.3.6 **Origin Destination Analysis**

The traffic along Pitt Town Road, Bathurst Street, Eldon Street and Cattai Road through the Pitt Town study area consists of both through and local traffic. In determining the potential use of a new bypass, both types of traffic were quantified.

An origin-destination (OD) analysis determines through traffic and local traffic distribution across the study area network. Trips are defined as one-way movement from trip starts (origin) to trip ends (destination).

Figure 3-14 to Figure 3-17 graphically shows OD traffic distributions for all vehicles at the following key locations:

- Pitt Town Road (station 1) northbound traffic (see Figure 3-14)
- Pitt Town Road (station 1) southbound traffic (see Figure 3-15)
- Cattai Road (station 3) southbound traffic (see Figure 3-16); and
- Cattai Road (station 3) northbound traffic (see Figure 3-17).

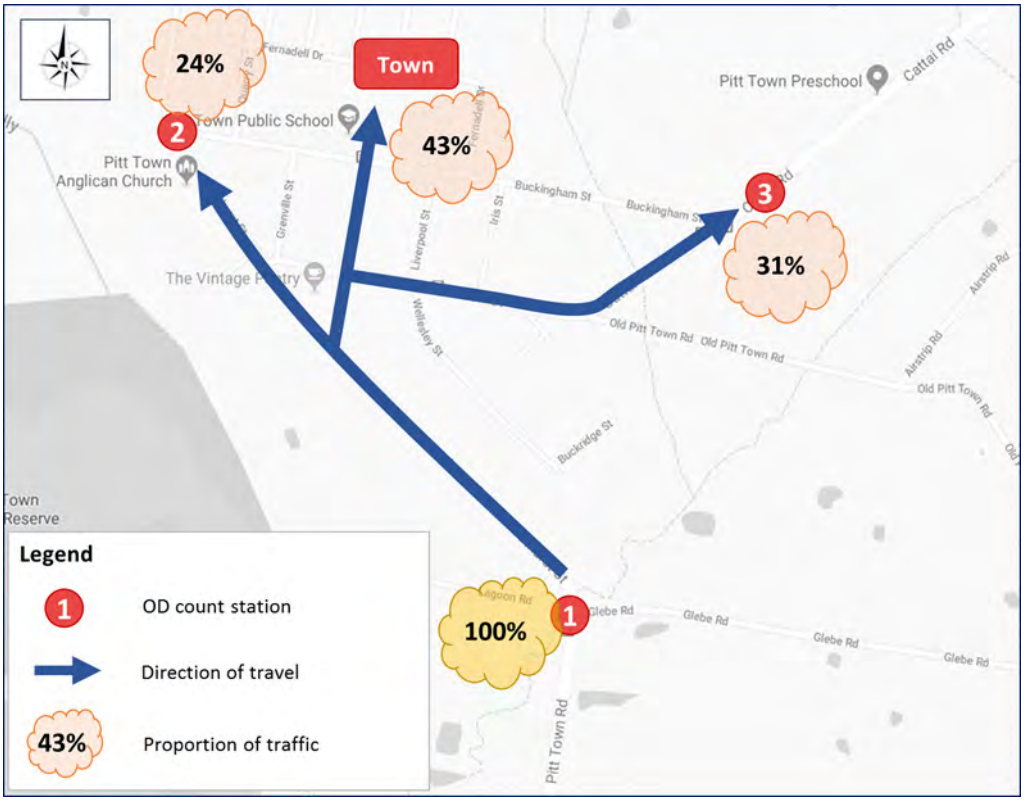


Figure 3-14 OD Traffic Distribution Pitt Town Road Northbound (All Vehicles)

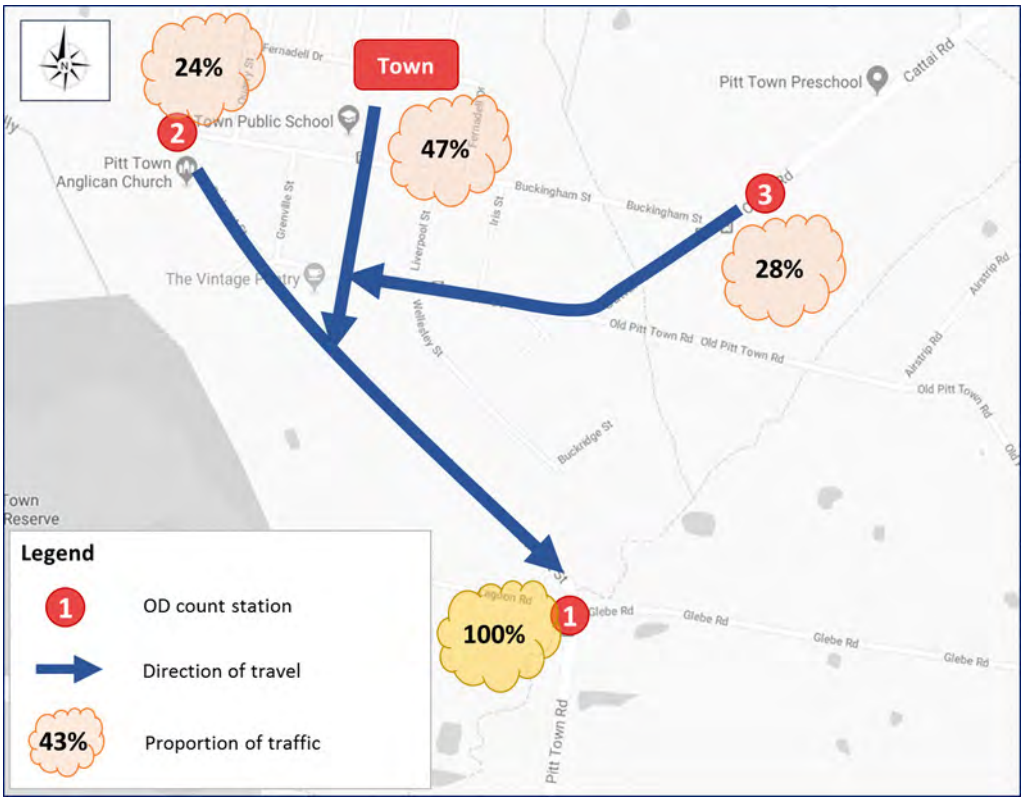


Figure 3-15 OD Traffic Distribution Pitt Town Road Southbound (All Vehicles)

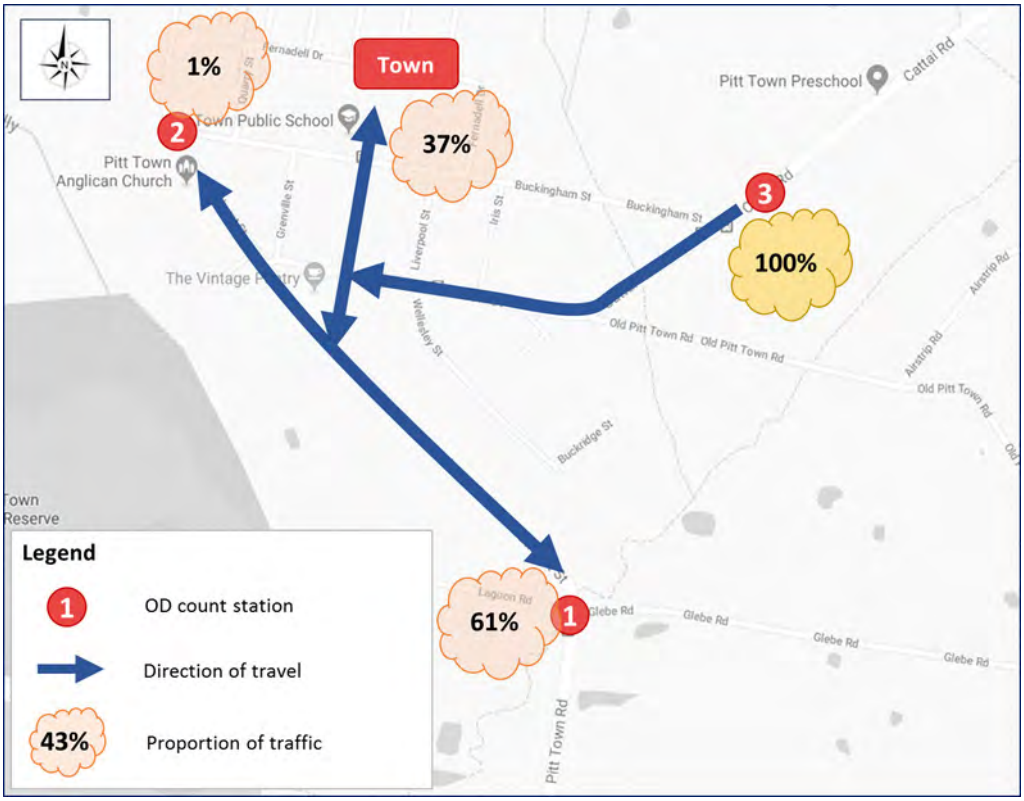


Figure 3-16 OD Traffic Distribution Cattai Road Southbound (All Vehicles)

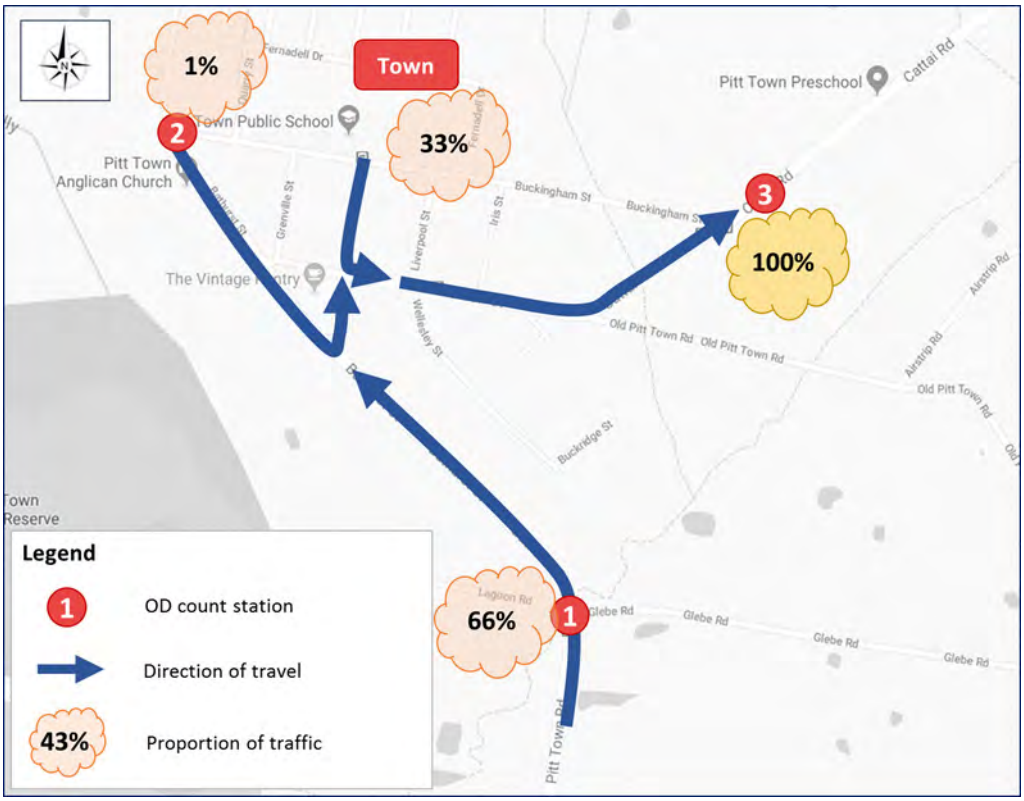


Figure 3-17 OD Traffic Distribution Cattai Road Northbound (All Vehicles)

The following points are noted in relation to OD traffic distributions on Pitt Town Road and Cattai Road:

On Pitt Town Road (station 1) northbound:

- Of the total northbound traffic volumes observed on Pitt Town Road (Station 1), about 31% are through traffic and have destination at Cattai Road (Station 3)
- About 24% travel via Bathurst Street (Station 2) and have a destination within the town centre
- About 43% travel via other roads including Grenville Street, Chatham Street, Eldon Street and have a destination within town centre.

On Pitt Town Road (station 1) southbound:

- Of the total southbound traffic volumes observed on Pitt Town Road (Station 1), about 28% are through traffic and have an origin at Cattai Road (Station 3)
- About 24% travel via Bathurst Street (Station 2) and have an origin within the town centre
- About 47% travel via other roads including Grenville Street, Chatham Street, Eldon Street and have an origin within town centre.

On Cattai Road (station 3) southbound:

- Of the total southbound traffic volumes observed on Cattai Road (Station 3), about 61% are through traffic that have a destination at Pitt Town Road (Station 1)
- About 39% are local traffic and have destinations within the town centre.

On Cattai Road (station 3) northbound:

- Of the total northbound traffic volumes observed on Cattai Road (Station 3), about 66% are through traffic that have an origin at Pitt Town Road (Station 1)
- About 34% are local traffic and originate within the town centre.

4 EXISTING SIDRA NETWORK MODEL DEVELOPMENT

This section reports SIDRA Network model development and model validation undertaken for the study area.

4.1 Key Modelling Assumptions

4.1.1 Modelling Platform

A road based traffic model has been developed for the study area using SIDRA Network version 7. Figure 4-1 shows existing SIDRA Network model developed for the study area.

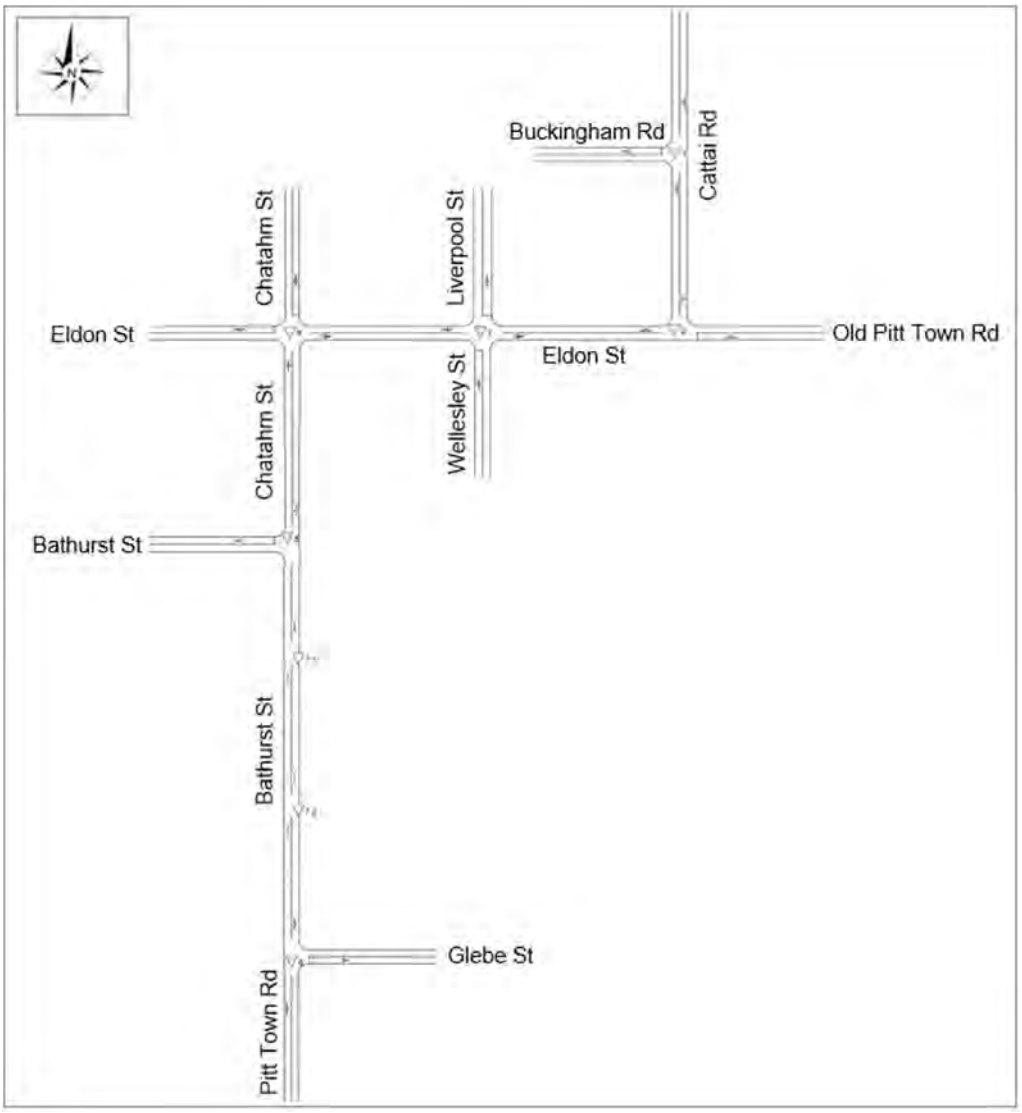


Figure 4-1 Existing SIDRA Network Model for the Study Area

4.1.2 Time Periods

The base SIDRA model represents existing 2018 morning and afternoon peak traffic conditions. The modelled time periods are:

- AM Peak – 8AM to 9AM
- PM Peak – 3PM to 4PM.

4.1.3 Gap Acceptance

Critical gap acceptance and follow-up headway values in SIDRA models are based on Appendix E - Recommended gap acceptance parameters of *Roads and Maritime's Traffic Modelling Guidelines, version 1, February 2013* (Roads and Maritime guidelines). The critical gap acceptance and follow up headway values used in the SIDRA model for sign control intersections represented worst case values.

Table 4-1 Recommended Critical Gap and Following-up Headway Values used in SIDRA Model

Type of movement	Values used in SIDRA Model for Pitt Town	
	Critical Gap (seconds)	Following up Headway (seconds)
Left turn	6.0	3.5
Right turn from major road - Across 1 lane	4.5	3.0
Right turn from minor road - 2-lane two-way	6.0	4.0
Through movement crossing two-way road - 2-lane two-way	5.5	3.5
Source: (1) Appendix E - Recommended gap acceptance parameters of *Roads and Maritime's Traffic Modelling Guidelines, version 1, February 2013*		

4.1.4 Vehicle Types

Traffic volumes input to the SIDRA models are based on traffic counts data. Table 4-2 summarises vehicle types and the passenger car equivalent units (PCU) used in the SIDRA model. The passenger car equivalent unit for rigid trucks, semi-trailers and B-doubles are based on Table 10.1 of *Roads and Maritime's Traffic Modelling Guidelines, version 1, February 2013* (Roads and Maritime guidelines).

Table 4-2 Vehicle Type and Passenger Car Unit used in the SIDRA Model

Vehicle Type	Passenger Car Unit (PCU)
Light vehicles	1
Heavy vehicles (i.e. rigid trucks	2
Large heavy vehicles (i.e. semi-trailer and B-double)	4

4.2 SIDRA Model Validation

The existing base case SIDRA model includes the AM peak period between 8AM and 9AM, and the PM peak period between 3PM and 4PM.

Base SIDRA model validation has been carried out for the following key areas:

- Queue length validation – modelled queue lengths by approach are compared to the observations made during the site visit. The existing condition network does not show substantial queues, hence there is no mandatory requirement for queue length validation. Nevertheless, supplementary queues data observed on site were used
- Travel time validation – modelled travel time and speed on the entire 1.5km section of the Pitt Town network have been compared with survey travel time data and supplementary travel time data observed on site.

4.2.1 Travel Time Validation

For the purpose of model validation, supplementary travel time survey was observed during on Wednesday, 28th March 2018 during the AM peak (8AM to 9AM) and the PM peak (3PM to 4PM). The modelled travel times from SIDRA are compared against the observed travel time for the 1.5km section of the Pitt Town network between Cattai Road / Buckingham Street and Pitt Town Road / Glebe Road. Figure 4-2 shows the route on which travel time data was collected. Table 4-3 summarises observed travel time on Pitt Town Road, Bathurst Street, Eldon Street and Cattai Road routes for the AM peak (8AM to 9AM) and the PM peak (3PM to 4PM).

Currently, motorists take about 1.8 to 1.9 minutes to travel 1.5 km southbound between Cattai Road / Buckingham Street and Pitt Town Road / Glebe Road. Average travel speed is about 47 to 50 km/h, about 10 to 13 km/h slower than posted speed limit of 60 km/h. The travel time and traffic speed are similar for the northbound direction in the afternoon peak.

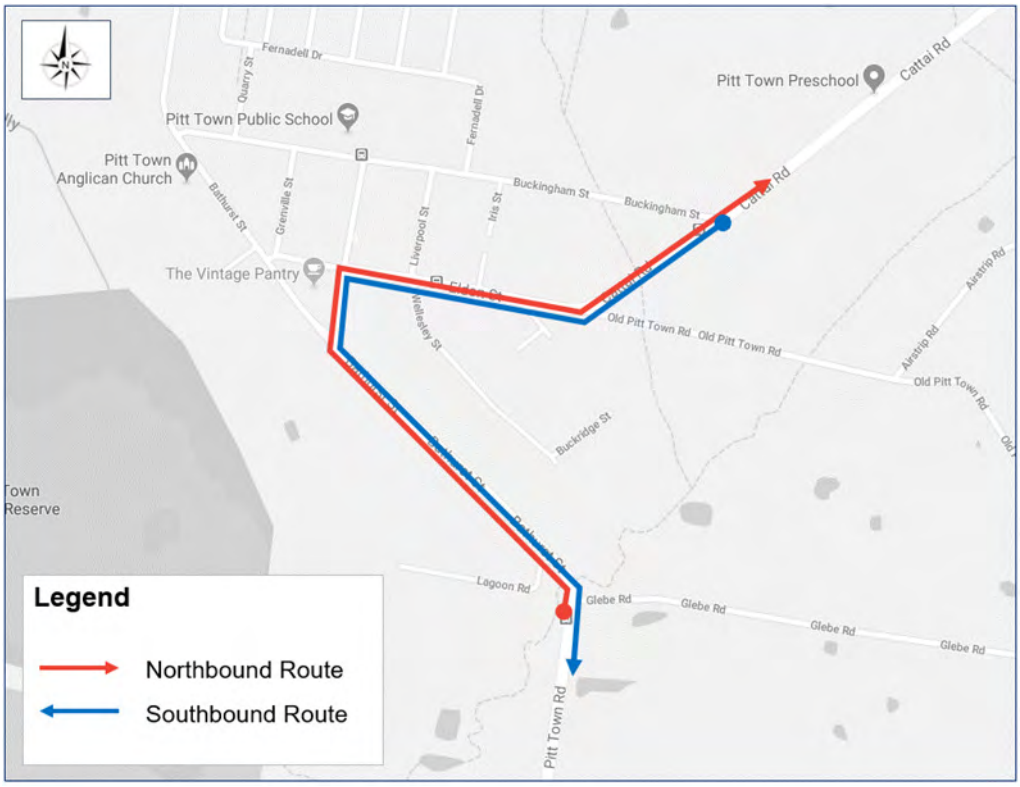


Figure 4-2 Travel Time Route

Table 4-3 below shows the travel time comparison between what was observed and modelled in the AM and PM peak periods. The travel time validation results indicate that AM and PM peak model travel times are close to observed values for both northbound and southbound directions.

Table 4-3 Travel Time Validation Results

Route	Peak Hour	Direction	Observed Travel Time (min)	Modelled Travel Time SIDRA (min)	Observed vs Modelled Difference (min)
Cattai Road / Buckingham Street to Pitt Town Road / Glebe Road (1.5km)	AM Peak (8AM to 9AM)	Northbound	1.8	1.8	0
		Southbound	1.9	2.0	0.1
	PM Peak (3PM to 4PM)	Northbound	1.8	1.9	0.1
		Southbound	1.8	2.0	0.2

Source: OD travel survey, supplementary travel time observation March 2018.

4.2.2 Queue Length Validation

As stated in the Roads and Maritime modelling guidelines, counting or calculating queue lengths is subjective, as queued vehicles will often still be moving slowly, making the criteria used to define a queue unclear when conducting surveys. Roads and Maritime do not have mandatory statistical guidelines or criteria for queue length comparison. The modelled queue lengths by approach were compared to the observed data during the site visit. Appendix A includes queue length validation results.

4.3 Existing Intersection LoS

The existing traffic performance of the study area road network is governed by capacity and traffic performance at key intersection along Pitt Town Road, Bathurst Street, Eldon Street and Cattai Road. This section reports LoS results at the six key intersections including:

- (I-1) Cattai Road / Buckingham Street (priority)
- (I-2) Cattai Road / Eldon Street / Old Pitt Town Road (priority)
- (I-3) Eldon Street / Liverpool Street / Wellesley Street (priority)
- (I-4) Eldon Street / Chatham Street (priority)
- (I-5) Chatham Street / Bathurst Street (priority)
- (I-6) Bathurst Street / Pitt Town Road / Glebe Road (priority).

Intersection operational performance is evaluated by assessing the intersection turning volumes, vehicle delays and LoS. LoS is a measure used to determine the effectiveness of intersection operation and is mostly common used to analyse intersections by categorising traffic flow conditions.

LoS for this study is reported in accordance with the Roads and Maritime guidelines. It recommends that for priority intersections such as roundabout and sign-controlled intersections, the LoS value is determined by the critical movement with the highest delay. With these types of intersection controls (roundabout, Stop and Give Way sign controls), some movements may experience high levels of delay while other movements may experience minimal delay. For a signalised intersection, LoS criteria is related to the average intersection delay measured in seconds per vehicle.

Table 4-4 below shows the Roads and Maritime standard LoS criteria for intersection operation.

Table 4-4 LoS Criteria for Intersections

LoS	Average Delay per Vehicle (secs/veh)	Traffic Signals, Roundabout	Give Way & Stop Signs
A	<14	Good operation	Good operation
B	15 to 28	Good with acceptable delays & spare capacity	Acceptable delays & spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity & accident study required
E	57 to 70	At capacity; at signals, incidents will cause excessive delays Roundabouts require other control mode	At capacity, requires other control mode
F	>70	Unsatisfactory with excessive queuing	Unsatisfactory with excessive queuing

Table 4-5 below shows the existing 2018 LoS at six analysed intersections. The analysis determined LoS between A to B depending on assessed six intersections. Due to priority control, the highest delays to critical movement is reported.

The existing condition LoS in 2018 are reported for the following six analysed intersections including:

- Cattai Road / Buckingham Street intersection (LoS A, delay of 8 seconds)
- Cattai Road / Eldon Street / Old Pitt Town Road intersection (LoS A, delays 10 seconds)
- Eldon Street / Liverpool Street / Wellesley Street intersection (LoS A, delays 9 seconds)
- Eldon Street / Chatham Street intersection (LoS A, delays 10 seconds)
- Chatham Street / Bathurst Street intersection (LoS B, delays 17 seconds)
- Bathurst Street / Pitt Town Road / Glebe Road (LoS B, delays 20 seconds).

Table 4-5 Existing LoS in 2018

ID	Intersection	Control	Existing 2018			
			AM Peak		PM Peak	
			Delay (sec)	LoS	Delay (sec)	LoS
I-1	Cattai Road / Buckingham Street	Priority	8.4	A	8.2	A
I-2	Cattai Road / Eldon Street / Old Pitt Town Road	Priority	10.8	A	9.5	A
I-3	Eldon Street / Liverpool Street / Wellesley Street	Priority	8.6	A	8.8	A
I-4	Eldon Street / Chatham Street	Priority	9.6	A	8.8	A
I-5	Chatham Street / Bathurst Street	Priority	16.7	B	10.9	A
I-6	Bathurst Street / Pitt Town Road / Glebe Road	Priority	19.7	B	15.2	B

Note: For priority controlled intersections such as sign controlled intersection and roundabout, the LoS value is determined by the critical movement with the highest delay. Source: SIDRA model: 2018 Pitt Town Bypass_revG.sip7

Appendix B documents existing 2018 intersection turning volumes for AM and PM peal. Appendix C includes detailed SIDRA results output for the 2018 existing conditions.

5 FUTURE TRAFFIC GROWTH

The future background traffic growth within the Pitt Town study network has been estimated using Roads and Maritime's Sydney Traffic Forecasting Model (STFM, built in EMME software). The STFM has used 2016 land use projections (LU2016V1.3).

The 2016 land use projection identified that population of the Hawkesbury LGA would grow by approximately 19,000, from 67,000 in 2016 to 86,000 in 2041. Employment would grow by more than 12,000 jobs, from about 31,000 jobs in 2016 to 43,000 jobs in 2041.

The population within the Pitt Town catchment area is forecasted to grow by about 1,800 from 4,000 in 2016 to 5,800 in 2041. Employment is expected to almost double between 2016 and 2041, from approximately 1,000 jobs to over 2,000 jobs.

The catchment area for population and employment growth within the Pitt Town catchment area is defined by three travel zones (TZ) as shown in Figure 5-1.

Figure 5-1 projected population and employment growth for the Hawkesbury LGA and Pitt Town catchment area separately between 2016 and 2041.

The population growth for the entire LGA is predicted to be 1.1% per annum. The employment growth for the entire LGA is projected to be 1.6% per annum.

The growth projections within the Pitt Town catchment area is higher than the total LGA growth, being 1.8 % for population growth and 3.5% for employment growth. On average, the population and employment growth for the study area is predicted to be approximately 2.6% per annum.

Table 5-1 Population and Employment Growth for Within the Catchment Area

Catchment	2016	2041	Growth per Annum 2016 2041 (25 years)
Windsor/Hawkesbury			
Population	67,240	86,053	1.1%
Employment	30,845	43,044	1.6%
Pitt Town Catchment Area (TZ: 4400, 4401, 4402)			
Population	3,956	5,743	1.8%
Employment	1,155	2,162	3.5%
Average	2,556	3,953	2.6%

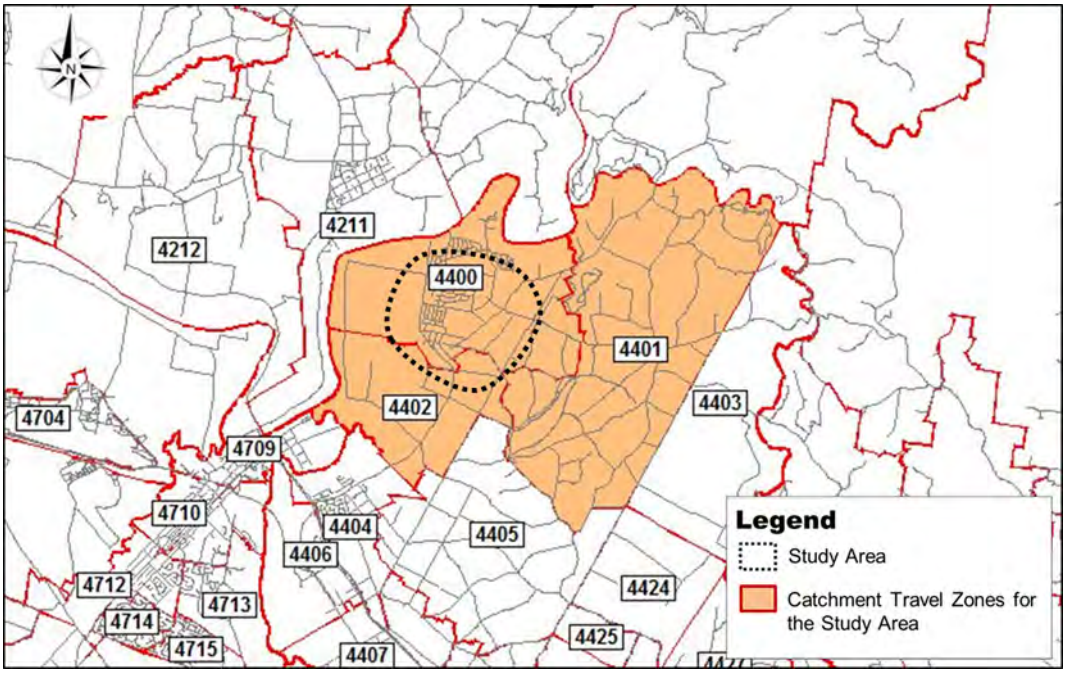


Figure 5-1 Catchment Area of Pitt Town Population and Employment Growth

The SFTM produces traffic volumes for two hours in the AM peak and two hours in the PM peak for total vehicles. In line with SFTM, traffic volumes for the study area network are reported for two hours for AM and PM respectively.

Table 5-2 shows predicted AM peak two hour (7AM to 9AM) and PM peak two hour (4PM to 6PM) traffic volumes within the study area for 2016 and 2041 sourced from Roads and Maritime's SFTM.

Table 5-2 STMF's Forecasts for Two hour AM and PM Peak Periods

Road Sections	SFTM s Forecasts (Total Vehicles)		Growth per Annum
	2017	2041	2017 2041 (24 years)
AM two hours (7AM to 9AM)			
Cattai Road	676	984	1.9%
Pitt Town Road	1,253	2,005	2.5%
PM two hours (4PM to 6PM)			
Cattai Road	649	1,062	2.7%
Pitt Town Road	1,262	2,127	2.9%
Average			**2.5%**

Source: Roads and Maritime's STFM (LU2016V1.3)

The STFM indicates that future traffic growth (between 2016 and 2041) on the Pitt Town study network is about 1.9 to 2.9 % per annum depending on the section.

On average, STFM suggested a growth rate of 2.5 % per annum along the Pitt Town network until 2041.

5.1 Future Traffic Growth in SIDRA Modelling

For the purposes of traffic modelling, a linear growth rate of 2.5% per annum is assumed between 2018 and 2041 for all vehicles (including light and heavy vehicle classes) for the study area road network including Cattai Road, Eldon Street, Chatham Street, Bathurst Street and Pitt Town Road.

Table 5-3 below shows future growth rates between 2018 and 2041 used in the SIDRA modelling.

Table 5-3 Future Growth Rates used in SIDRA Modelling

Time period	Growth rate per annum (Light and Heavy Vehicles)
2018 to 2021	2.5%
2021 to 2031	2.5%
2031 to 2041	2.5%

Detailed intersection turning volumes for years 2021, 2031 and 2041 with the bypass are included in Appendix B.

5.2 Forecast Daily Traffic Volumes

Table 5-4 shows forecast average weekday daily traffic volumes on key locations for the do-nothing condition for future years 2021, 2031 and 2041. Existing 2018 volumes are included for comparison. Future traffic volumes are grown by 2.5% per annum. The future traffic volumes are reported at the following locations including:

- Traffic volumes on Cattai Road north of Buckingham Road are forecast to grow from 4,430 vehicles per day (current) to 7,000 vehicles per day in 2041. On Cattai Road between Buckingham Road and Old Pitt Town Road, traffic volumes are forecast to grow from 4,290 vehicles per day (current) to 6,700 vehicles per day in 2041
- Traffic volumes on Eldon Street between Liverpool Street and Chatham Street are forecast to grow from the current 5,430 vehicles per day to 7,200 vehicles per day in 2041
- Traffic volumes on Bathurst Street between Chatham Street and Lagoon Road are forecast to grow from the current 9,580 vehicles per day to 12,700 vehicles per day in 2041
- Traffic volumes on Pitt Town Road south of Glebe Road are forecast to grow from the current 9,710 vehicles per day to 12,900 vehicles per day in 2041.

Table 5-4 Forecast Traffic Volumes on Key Locations (Do Nothing)

Site ID	Road / Location	Average Weekday Traffic (Total Vehicles) (Do Nothing)			
		Existing 2018	2021	2031	2041
M-8	Cattai Road, north of Buckingham Street	4,430	4,800	5,900	7,000
M-1	Cattai Road, between Buckingham Road and Old Pitt Town Road	4,280	4,600	5,700	6,700
M-2	Eldon Street, between Liverpool Street and Chatham Street	5,430	5,800	7,200	8,600
M-3	Bathurst Street, between Chatham Street and Lagoon Road	9,580	10,300	12,700	15,100
M-5	Pitt Town Road, south of Glebe Road	9,710	10,400	12,900	15,300

6 FUTURE TRAFFIC VOLUMES ON BYPASS AND IMPACTS TO ROAD NETWORK

The proposed Pitt Town bypass would provide motorists with faster trips between the Cattai Road / Buckingham Street and Pitt Town Road / Bathurst Street / Glebe Road intersections, with a posted speed limit of 70 km/h. The bypass would divert a substantial proportion of through traffic onto the new bypass, allowing the existing Pitt Town network through Eldon Street, Chatham Street and Bathurst Street to mainly cater for local traffic. The bypass would improve the safety and efficiency of the road network.

This chapter provides future traffic volumes on the proposed bypass and the impacts to road network anticipated to occur as a result of the bypass.

6.1 Traffic Volumes on Bypass

Future traffic volumes on the Pitt Town bypass were estimated using an origin-destination (OD) analysis result documented in previous Section 3.3.6. The OD data indicate that of the total northbound traffic observed on Pitt Town Road, about 31% are through traffic. Of the total southbound traffic observed on Cattai Road, about 66% are through traffic. Daily heavy vehicle volumes on the Pitt Town bypass were estimated using current proportions of heavy vehicles observed on Cattai Road and Eldon Street being about 14% of total traffic.

Table 6-1 shows predicted average weekday daily traffic volumes on the Pitt Town bypass for 2021 (opening year), 2031 (10 years after opening) and 2041 (20 years after opening).

Table 6-1 Daily Traffic Forecasts on Bypass

Vehicle Class	Forecast Average Weekday Traffic (vehicles)		
	2021 (opening year)	2031 (10 years after opening)	2041 (20 years after opening)
Light Vehicles	3,100	3,800	4,450
Heavy Vehicles	500	600	750
Total	3,600	4,400	5,200
% Heavy Vehicles	14%	14%	14%

In the opening year of 2021, the Pitt Town bypass would carry approximately 3,600 vehicles per day. Traffic volumes on the bypass would increase to approximately 5,200 vehicles per day in 2041. The proportion of heavy vehicles on the bypass is estimated to be about 14% of total traffic.

In 2041, the bypass would remove about 750 heavy vehicles daily from the town centre road network.

6.2 Impacts on Road Network

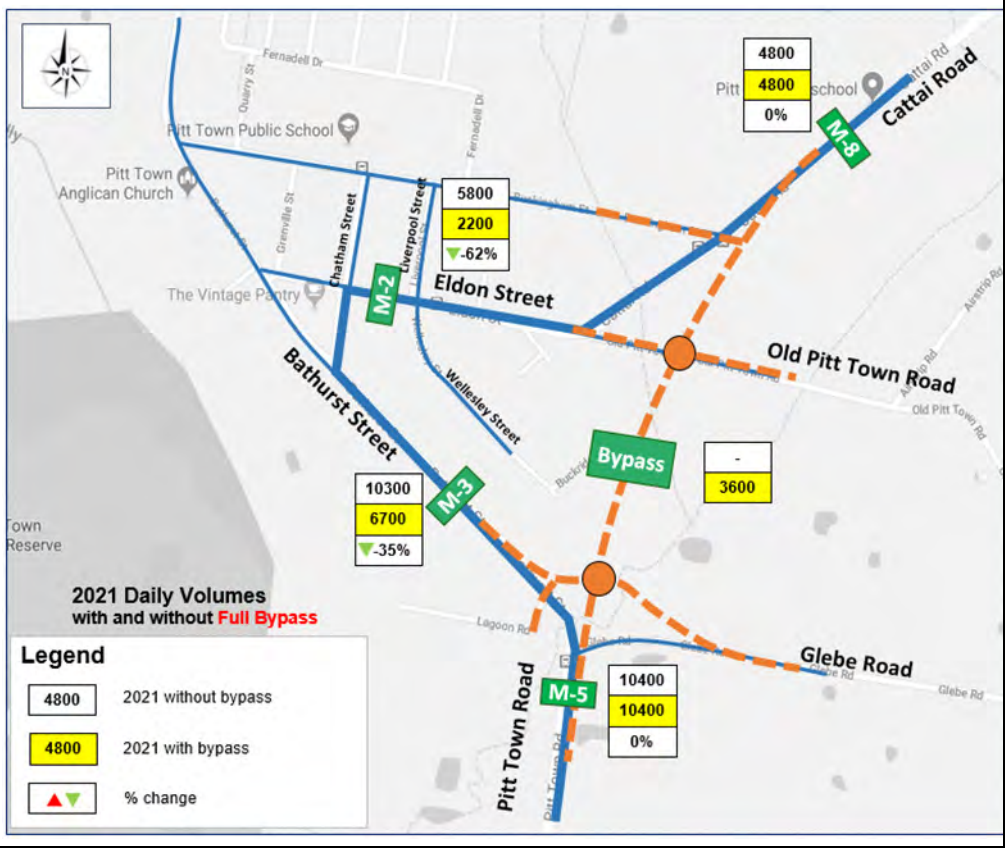
Table 6-2 to Table 6-4 respectively show traffic forecast (all vehicles) on key locations for 2021 (opening year), 2031 (10 years after opening) and 2041 (20 years after opening) for with bypass and do nothing conditions.

The bypass would be effective in reducing a significant proportion of through traffic, particularly on Eldon Street and Bathurst Street:

- In the opening year of 2021, traffic volumes on Eldon Street would be reduced by 62 percent, from 5,800 vehicles per day (do nothing) to 2,200 vehicles per day (with bypass). Traffic volumes on Bathurst Street would be reduced by 35 percent, from 10,300 vehicles per day (do nothing) to 6,800 vehicles per day (with bypass)
- In 2031 (10 years after opening), traffic volumes on Eldon Street would be reduced by 61 percent, from 7,200 vehicles per day (do nothing) to 2,800 vehicles per day (with bypass). Traffic volumes on Bathurst Street would be reduced by 34 percent, from 12,700 vehicles per day (do nothing) to 8,300 vehicles per day (with bypass)
- In 2041 (20 years after opening), traffic volumes on Eldon Street would be reduced by 60 percent, from 8,600 vehicles per day (do nothing) to 3,400 vehicles per day (with bypass). Traffic volumes on Bathurst Street would be reduced by 34 percent, from 15,100 vehicles per day (do nothing) to 9,900 vehicles per day (with bypass), similar to existing traffic volumes (see Table 5-4).

Table 6-2 Forecast Daily Traffic Volumes on Key Locations in 2021

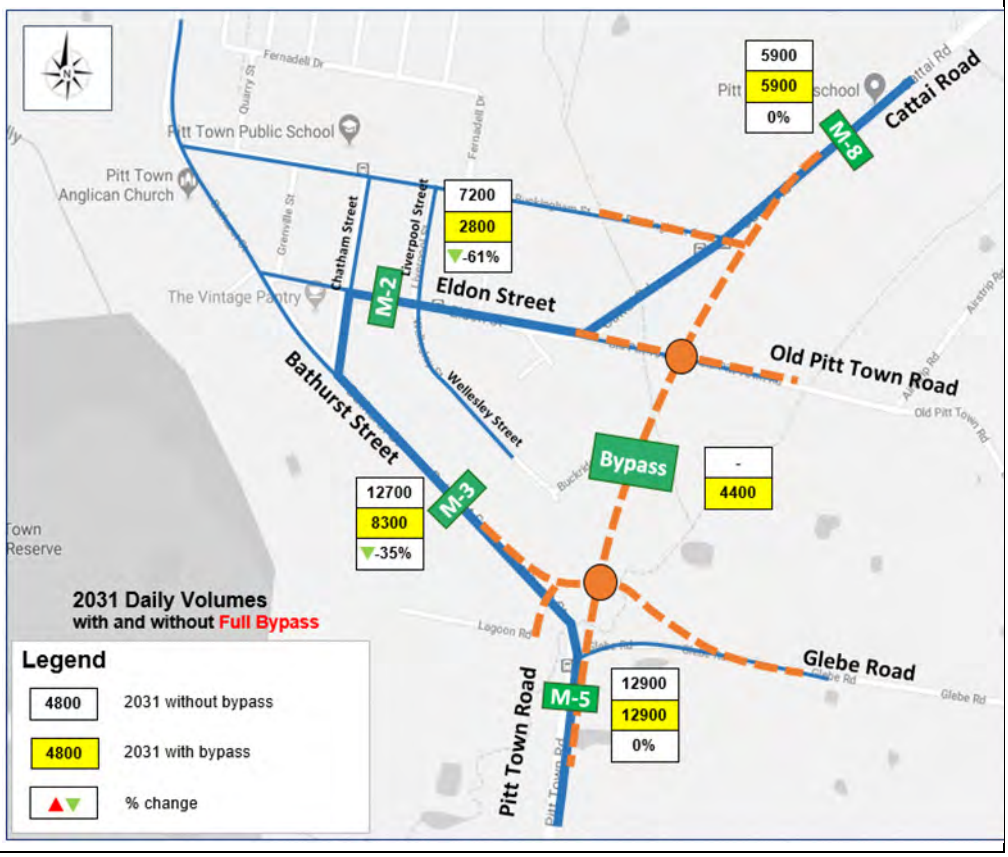
M-8	Cattai Road, north of Buckingham Street	4,800	4,800	0	0%
M-2	Eldon Street, between Liverpool Street and Chatham Street	5,800	2,200	-3,600 ▼	-62% ▼
M-3	Bathurst Street, between Chatham Street and Lagoon Road	10,300	6,700	-3,600 ▼	-35% ▼
M-5	Pitt Town Road, south of Glebe Road	10,400	10,400	0	0%
B-1	Pitt Town Bypass	-	3,600	3,600	-



Note: Values have been rounded to the nearest 100.

Table 6-3 Forecast Daily Traffic Volumes on Key Locations in 2031

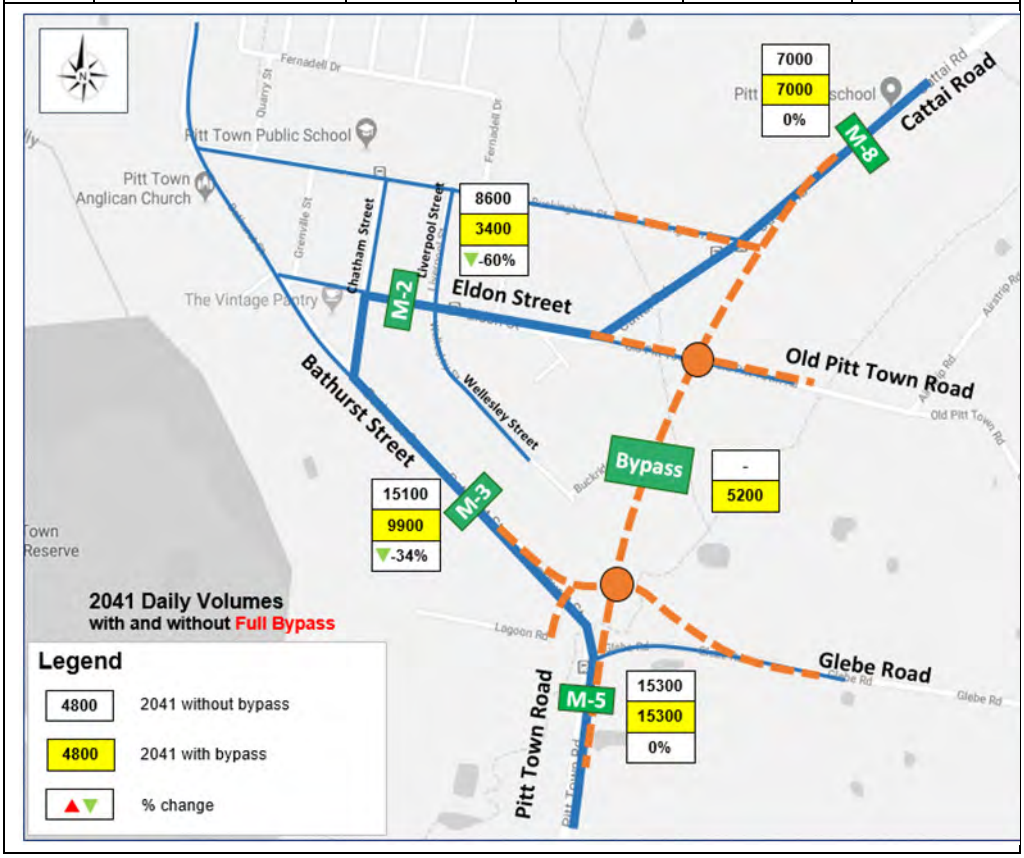
Site ID	Road / Location	Forecast Average Weekday Traffic (All Vehicles) in 2031			
		Do Nothing	With Bypass	Change	% Change
M-8	Cattai Road, north of Buckingham Street	5,900	5,900	0	0%
M-2	Eldon Street, between Liverpool Street and Chatham Street	7,200	2,800	-4,400 ▼	-61% ▼
M-3	Bathurst Street, between Chatham Street and Lagoon Road	12,700	8,300	-4,400 ▼	-35% ▼
M-5	Pitt Town Road, south of Glebe Road	12,900	12,900	0	0%
B-1	Pitt Town Bypass	-	4,400	4,400	-



Note: Values have been rounded to the nearest 100.

Table 6-4 Forecast Daily Traffic Volumes on Key Locations in 2041

Site ID	Road / Location	Forecast Average Weekday Traffic (All Vehicles) in 2041			
		Do Nothing	With Bypass	Change	% Change
M-8	Cattai Road, north of Buckingham Street	7,000	7,000	0	0%
M-2	Eldon Street, between Liverpool Street and Chatham Street	8,600	3,400	-5,200 ▼	-60% ▼
M-3	Bathurst Street, between Chatham Street and Lagoon Road	15,100	9,900	-5,200 ▼	-34% ▼
M-5	Pitt Town Road, south of Glebe Road	15,300	15,300	0	0%
B-1	Pitt Town Bypass	-	5,200	5,200	-



Note: Values have been rounded to the nearest 100.

7 FUTURE NETWORK PERFORMANCE

7.1 Travel Time Saving

Figure 7-1 shows the travel routes between Buckingham Street and Pitt Town Road (point A and point B). On the existing road network (route 1), motorists travel approximately 1.5 km

under the speed limit of 60 km/h. On the bypass (route 2), motorists travel a distance of 0.9 km, 0.6 km shorter than the existing route. The bypass offers a higher speed limit of 70 km/h.



Figure 7-1 Travel Routes via Existing Network and the Bypass

The travel time is reported for the opening year 2021 for AM and PM peak traffic conditions.

Figure 7-1 below shows future travel times via existing roads and the proposed bypass between Buckingham Street and Pitt Town Road (point A and point B in Figure 7-1). The travel time is reported for the opening year 2021 for AM and PM peak traffic conditions.

Table 7-1 Travel Time Saving in 2021 AM and PM Peak

Route between Buckingham Street and Pitt Town Road	Distance	Forecast 2021 Travel Time (minutes)			
		AM Peak		PM Peak	
		NB	SB	NB	SB
Route 1 – via existing network	1.5 km	2.1	2.2	2.0	2.1
Route 2 – via new bypass	0.9 km	1.0	1.1	1.0	1.1
Travel time saving (minutes)		-1.1 ▼	-1.1 ▼	-1.0 ▼	-1.0 ▼
% Travel time saving		-52% ▼	-50% ▼	-50% ▼	-48% ▼

In the opening year, travel times via existing roads between Buckingham Street and Pitt Town Road (point A and point B in Figure 7-1) are estimated to be between 2.0 and 2.2 minutes.

The bypass would reduce travel times by approximately 1.1 minutes in the AM peak and 1.0 minute in the PM peak.

Note: Even with the growth rate of 2.5%, the traffic volumes on the bypass remain relatively low in 2031 (10 years after opening) and 2041 (20 years after opening) and thus the travel time would be similar to the travel times in the year of opening, 2021. Travel time data for 2031 and 2041 therefore has not been included in *Table 7-1* above.

7.2 Travel Speed Improvement

The travel speeds are reported for the opening year in 2021 for AM and PM peak traffic conditions.

Travel speed data for 2031 and 2041 is not reported considering the traffic volumes are relatively low in 2031 (10 years after opening) and 2041 (20 years after opening) and travel speeds would be similar to 2021.

Table 7-2 compares the forecast average travel speed on the existing road network and on the proposed bypass between Buckingham Street and Pitt Town Road (point A and point B in Figure 7-1). The travel speeds are reported for the opening year in 2021 for AM and PM peak traffic conditions.

Travel speed data for 2031 and 2041 is not reported considering the traffic volumes are relatively low in 2031 (10 years after opening) and 2041 (20 years after opening) and travel speeds would be similar to 2021.

Table 7-2 Travel Speed Improvement in 2021 AM and PM Peak

Route between Buckingham Street and Pitt Town Road	Distance	Forecast 2021 Travel Speed (km/h)			
		AM Peak		PM Peak	
		NB	SB	NB	SB
Route 1 – via existing network	1.5 km	45.9	43.3	46.0	43.0
Route 2 – via new bypass	0.9 km	56.6	50.5	56.6	51.8
Travel speed improvement (km/h)		10.7 ▲	7.2 ▲	10.6 ▲	8.8 ▲
% Travel speed improvement		23% ▲	17% ▲	23% ▲	20% ▲

In the opening year, motorists on the existing road network (route 1) would travel at speeds between 43 and 46 km/h. On the bypass (route 2), motorists would travel between 52 and 57km/h, about 17 to 23% faster than using the existing road network.

7.3 LoS of Concept Design

The LoS for key intersections with bypass has been assessed based on the 80% concept design. It is anticipated that LoS outcomes for the 100% concept design would be similar to the outcomes of the 80% concept design.

The concept design proposes the following upgrades to the local road network including:

- Cattai Road / Buckingham Street intersection upgrade
- A new roundabout at Eldon Street / Old Pitt Town Road
- A new roundabout at Pitt Town Road / Bathurst Street / Glebe Road.

7.3.1 Cattai Road / Buckingham Street Intersection

The sections of Cattai Road and Buckingham Road connected to the bypass will be realigned. The posted speed limit on Cattai Road will be changed from the existing 60km/h to 70km/h with the bypass.

The Cattai Road / Buckingham Road intersection is proposed to be upgraded. Figure 7-2 below shows the layout of proposed intersection upgrades at Road / Buckingham Road. Proposed changes and upgrades are highlighted in yellow.

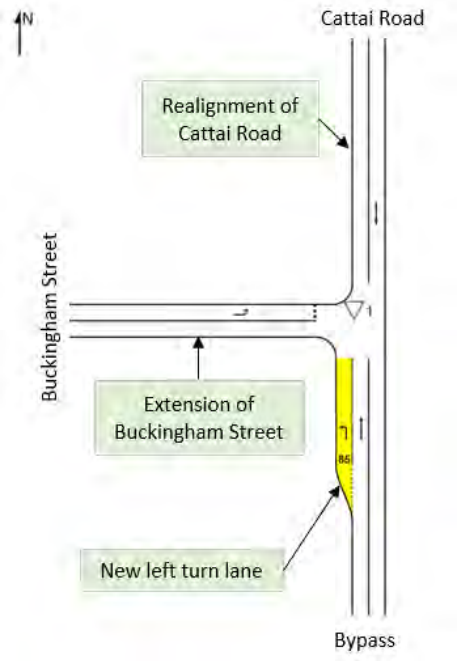


Figure 7-2 Proposed Upgrade at Cattai Road / Buckingham Street Intersection

The following lane configurations at this intersection are proposed:

Intersection	Control Type	Proposed Upgrades
Cattai Road and Buckingham Road	Upgraded priority	• Realignment of Cattai Road and Buckingham Road • Posted speed limit change on Cattai Road from 60 km/h (existing) to 70 km/h with bypass) • A 85 metre long left turn bay

7.3.2 **A New Roundabout at Eldon Street / Old Pitt Town Road (Northern Roundabout)**

The existing priority intersection at Eldon Street / Old Pitt Town Road / Cattai Road will be replaced by a new four leg single lane roundabout in which the bypass forms northern and southern legs. Figure 7-3 below shows the layout of the proposed new roundabout at Eldon Street / Old Pitt Town Road / bypass. Proposed changes and upgrades are highlighted in yellow.

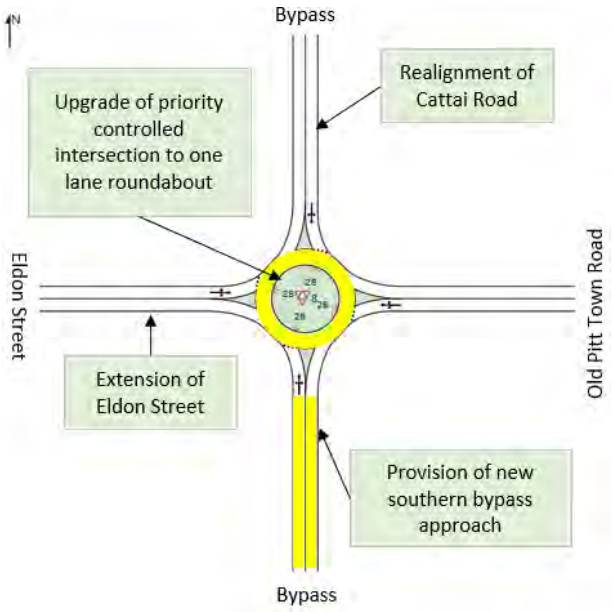


Figure 7-3 Proposed A New Roundabout at Eldon Street / Old Pitt Town Road

The following lane configurations at this intersection are proposed:

Intersection	Control Type	Proposed Upgrades
Eldon Street / Old Pitt Town Road / Bypass (Norther roundabout)	A New Roundabout	• A single lane roundabout

7.3.3 **A New Roundabout at Bathurst Street / Pitt Town Road / Glebe Road (Southern Roundabout)**

The existing priority intersection at Bathurst Street / Pitt Town Road / Glebe Road will be replaced by a new four leg single lane roundabout in which the bypass forms northern leg. The posted speed limit on Pitt Town will be changed from existing 60 km/h to 70 km/h from with the bypass. Figure 7-4 below shows the layout of the proposed new roundabout at Bathurst Street / Pitt Town Road / Glebe Road / bypass. Proposed changes and upgrades are highlighted in yellow.

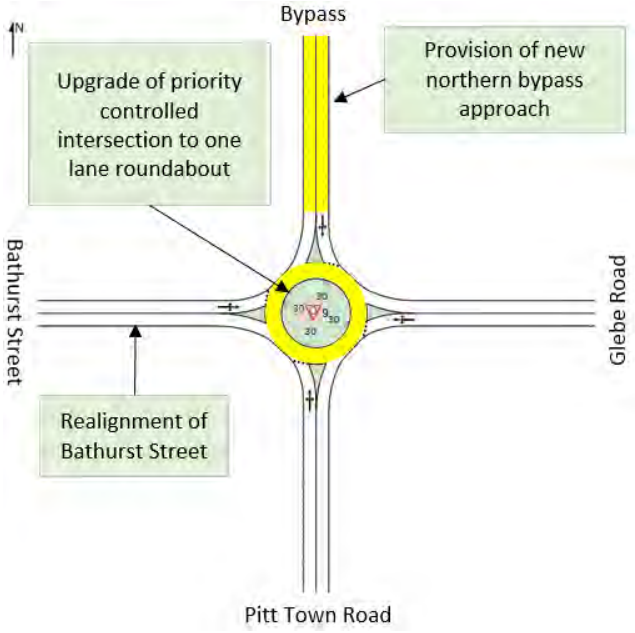


Figure 7-4 Proposed A New Roundabout at Bathurst Street / Pitt Town Road / Glebe Road

The following lane configurations at this intersection are proposed:

Intersection	Control Type	Proposed Upgrades
Bathurst Street / Pitt Town Road / Glebe Road / Bypass (Southern roundabout)	A New Roundabout	• A single lane roundabout

7.3.4 **LoS Results**

The operational performance of the bypass will be influenced by the traffic operation of the following three new / upgraded intersections with bypass including:

- Upgraded Cattai Road / Buckingham Street / Bypass intersection
- New Eldon Street / Old Pitt Town Road / Bypass roundabout
- New Pitt Town Road / Bathurst Street / Glebe Road / Bypass roundabout.

Three new / upgraded intersections were analysed using the SIDRA Network to determine LoS. The LoS for three intersections were estimated for 2021 (opening year), 2031 (10 years after opening) and 2041 (20 years opening). Appendix A documents detailed intersection turning volumes for 2021, 2031 and 2041 with the bypass.

The performance of an intersection is measured by the intersection average delay per vehicle, which in turns leads to a LoS measure for the intersection.

Table 7-3 below shows the Roads and Maritime standard LoS criteria for intersection operation.

Table 7-3 LoS Criteria for Intersections

LoS	Average Delay per Vehicle (secs/veh)	Traffic Signals, Roundabout	Give Way & Stop Signs
A	<14	Good operation	Good operation
B	15 to 28	Good with acceptable delays & spare capacity	Acceptable delays & spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity & accident study required
E	57 to 70	At capacity; at signals, incidents will cause excessive delays Roundabouts require other control mode	At capacity, requires other control mode
F	>70	Unsatisfactory with excessive queuing	Unsatisfactory with excessive queuing

LoS LoS is reported in accordance with the Roads and Maritime guideline (*Traffic Modelling Guideline, Issue 1.0, RMS, February 21013*). It recommends that for priority intersections such as roundabouts and sign controlled intersections, the LoS value is determined by the critical movement with the highest delay. With these type of intersection controls (roundabout, Stops and Give way sign controls), some movements may experience high levels of delay while other movements may experience minimum delay. For a signalised intersection LoS criteria are related to the average intersection delay measured in seconds per vehicle.

Table 7-4 to Table 7-6 how predicted LoS at the three analysed intersections for 2021, 2031 and 2041 respectively, for the AM and PM peak with the bypass.

Table 7-4 Forecast LoS Results for 2021 with Bypass

Intersection	Control	Forecast LoS 2021 with Bypass			
		AM Peak		PM Peak	
		Delay (sec)	LoS	Delay (sec)	LoS
Cattai Road / Buckingham Street / Bypass	Upgraded priority	6.4	A	6.4	A
Eldon Street / Old Pitt Town Road / Bypass (northern roundabout)	A new single lane roundabout	11.1	A	11.1	A
Town Road / Bathurst Street / Glebe Road / Bypass (southern roundabout)	A new single lane roundabout	13.2	A	11.7	A

Table 7-5 Forecast LoS Results for 2031 with Bypass

Intersection	Control	Forecast LoS 2031 with Bypass			
		AM Peak		PM Peak	
		Delay (sec)	LoS	Delay (sec)	LoS
Cattai Road / Buckingham Street / Bypass	Upgraded priority	6.4	A	6.6	A
Eldon Street / Old Pitt Town Road / Bypass (northern roundabout)	A new single lane roundabout	11.3	A	11.3	A
Town Road / Bathurst Street / Glebe Road / Bypass (southern roundabout)	A new single lane roundabout	14.1	A	12.1	A

Table 7-6 Forecast LoS Results for 2041 with Bypass

Intersection	Control	Forecast LoS 2041 with Bypass			
		AM Peak		PM Peak	
		Delay (sec)	LoS	Delay (sec)	LoS
Cattai Road / Buckingham Street / Bypass	Upgraded priority	6.5	A	6.9	A
Eldon Street / Old Pitt Town Road / Bypass (northern roundabout)	A new single lane roundabout	11.5	A	11.6	A
Town Road / Bathurst Street / Glebe Road / Bypass (southern roundabout)	A new single lane roundabout	15.6	B	12.4	A

Note: (1) Priority intersections such as a roundabout and sign controlled intersections, the LoS value is determined by the critical movement with the highest delay

The following points are noted from Table 7-4 to Table 7-6:

In the opening year of 2021, the proposed intersection upgrade at the Cattai Road / Buckingham Street intersection would operate with a LoS A (average delay of 6 seconds) in both the AM and PM peak. The new roundabout at Eldon Street / Old Pitt Town Road / Bypass would operate with a LoS A (average delay of 11 seconds), and the new roundabout at Pitt Town Road / Bathurst Street / Glebe Road / Bypass would operate with a LoS A (average delay of 12 to 13 seconds) in both the AM and PM peak.

- In 2041, the Concept Design would provide adequate capacity in both AM and PM peak. The traffic model predicted a LoS between A and B at the three new or upgraded intersections with the bypass. The upgraded Cattai Road / Buckingham Street intersection would operate with a LoS A (average delay of 7 seconds) in both the AM and PM peak. The new roundabout at Eldon Street / Old Pitt Town Road / Bypass would operate with a LoS A (average delay of 12 seconds), and the new roundabout at Town Road / Bathurst Street / Glebe Road / Bypass would operate with a LoS A (average delay of 12 to 16 seconds) in both the AM and PM peak.

Appendix C includes detailed SIDRA results for 2021, 2031 and 2041 with the bypass.

7.4 Impact on Other Travel Modes

7.4.1 Bus Services

A review of the public transport network indicates the proposal would have minimal impacts on the existing taxi, bus and rail network. The key routes via Cattai Road, Eldon Street, Chatham Street and Bathurst Street would be unaffected. For post upgrade conditions, traffic volumes are predicted to be approximately 63 % lower on Eldon Street and approximately 34 % lower on Bathurst Street. This reduction in traffic volumes along these routes would improve the travel time reliability for buses and taxis especially during peak periods. A review of bus routes for the Busways company indicated that proposed bypass would not impact regular timetabled bus routes.

7.4.2 Pedestrian and Cycle Network

The proposal is not expected to impact existing pedestrian facilities. There are no pedestrian or cyclist facilities along Pitt Town Road and Cattai Road.

7.5 Management & Mitigation Measures

The impact of the proposal can be reduced by some of the following means:

- Traffic safety audits will be conducted during detailed design to identify and address potential safety issues associated with the operation of the proposal
- A construction traffic management plan will be prepared based on the detailed design and improved understanding of construction programming and methodology. The Traffic Management Plan will include, but not be limited to:
  - Restriction of certain intersection movements, should there be an overall benefit
  - Review of proposed haulage routes to be adopted in the Plan based on updated truck movements
  - Scheduling construction efforts, where required under traffic, be completed outside of the peak period hours

  - Early and regular community and stakeholder liaison to ensure those located nearby are well informed of the proposal impacts during construction

- Traffic control measures to minimise impact of construction works on local traffic including:
  - Limiting the number of workfront access points
  - Maximising the use of the workfront (as opposed to existing roads) for the haulage of earthwork material, where practical
  - Using temporary road diversions to maintain through traffic where existing roads need to be removed or realigned
  - Undertaking works which have a significant impact on traffic outside of peak periods
  - Ensuring that appropriate design standards are adopted for temporary pavement constructions
  - Adopting appropriate design speeds on temporary roads and through areas where construction works are in close proximity to traffic
  - Ensuring construction works that impact on traffic are undertaken as quickly as practical.

7.6 Preliminary Construction Traffic Impact

Impacts on traffic during construction of the proposal would be temporary in nature. Traffic impacts would occur as a result of the movement of construction and service vehicles along access roads, for the haulage of construction materials. General use of Pitt Town, Bathurst Street, Eldon Street and Cattai Road and adjoined roads as well as access to existing properties along the road would be maintained throughout the construction phase.

Potential impacts caused by construction vehicle traffic may include:

- Increased travel times due to reduced speed limit around construction sites
- Increased travel times due to increased truck and construction machinery movements.

7.6.1 Construction Staging

The *Pitt Town Bypass Concept Design Report – 80% Design, June 2018 (80% Design Report)* documents the construction staging for the Concept Design (Arcadis, 2018). Each stage of the construction staging programme has been detailed in the construction staging drawings documented in the 80% Design Report.

The construction of the bypass broadly comprises three main stages and they are summarised in Table 7-7 below.

Table 7-7 Construction Staging

Stage	Description	Duration
Stage 1: Greenfield Construction (Pitt Town Road to Old Pitt Town Road, Old Pitt	• Set up ancillary sites off Glebe Road and Wellesley Street • Start constructing the greenfield sections, between Pitt Town Road and Old Pitt Town Road, and Old Pitt Town Road and Cattai Road	• 9-12 months

Stage	Description	Duration
Town Road to Cattai Road)	• Early works on bridge to commence including piles, abutments, headstocks etc. • Early works on the sewer rising main and Telstra utilities located at the southern roundabout • Build low flow pipes and temporary access road for the construction of the plank bridge • Creek diversion • Build culverts PTB3 and Bathurst Street culvert prior to culvert PTB2 and the southern roundabout	
Stage 2a: Southern roundabout to Cattai Road	• Close Old Pitt Town Road • Divert traffic around Old Pitt Town Road closure via Cattai Road, Pitt Town Dural Road and Airstrip Road • Build the northwest and southwest retaining walls for the northern roundabout • Build culvert OPT5 and PTB5 • Build the eastern and western legs of the northern roundabout • Complete construction of the plank bridge • Remove existing sections of Pitt Town Road to assist with cross drainage • Move bus stop at Pitt Town Bypass south during construction • Build tie-in works of the southern roundabout to Pitt Town Road, Bathurst Street and Glebe Road • Build and correct level difference between Old Pitt Town Road and Cattai Road	• 3-6 months
Stage 2b: Southern roundabout to Cattai Road	• Build culvert PTB 6 • Build the remaining sections of the northern roundabout	
Stage 3: Bathurst Street and Cattai Road Tie In	• Build permanent road barrier to close redundant section of Cattai Road • Close section of Buckingham Street to tie in the Pitt Town Bypass to Cattai Road • Maintain property access to the redundant section of Cattai Road • Detour via opened section of Pitt Town Bypass, Old Pitt Town Road and Liverpool Road • Remove existing redundant section of Glebe Road	• 2-4 months

The 80% Design Report assumes that property access will be maintained at all properties at all time. An access strategy has been developed to accomplish this and will be implemented during construction. The access strategy will:

- Maintain East – West access through the proposal corridor
- Maintain the current level of access to properties
- Ensure access to existing utility assets is not impacted, and if so provide an alternate access route
- Maintain maintenance and property owner access to redundant section of Cattai Road.

7.6.2 Construction Traffic Movement

Construction traffic volumes estimates are based on the proposed construction schedule and the estimated volume of material to be moved during the construction stages. Table 7-8 below shows estimated truck loads for each construction stage being a conservative estimate for preliminary impact assessment purpose.

Table 7-8 Estimated Truck Loads and Truck Movements by Construction Stage

Construction Stage	No. of Construction Truck Loads
Stage 1	32
Stage 2	8
Stage 3	1

The following assumptions have been used when predicting construction traffic movement:

- Construction trucks are only required for external import volumes
- Half (50%) of the topsoil will be exported off site
- In calculating pavement CCM - only the SMZ (300 mm) and UZF (300 mm) has been taken into consideration. Mainline and roundabout pavement is the only pavement type that has this
- All imported materials access the work fronts using existing roads
- All cutting material is deemed suitable for use as general fill either within the same section of work or within the adjacent section. Cut to fill haulage of this nature is deemed to largely use the footprint of the workfront, meaning that haulage does not contribute to traffic volumes on existing roads. This is with exception of material being moved from cuttings within MC12 to MC13 in Stage 1 which would require truck haulage along Old Pitt Town Road
- An equipment and productivity profile has been selected that would result in the overall project being completed within approximately 18 months (bulk earthworks completed in approximately 108 working days)
- Material hauled would using existing roads – imported materials and cut to fill
- Construction hours are assumed to be 7:00 am to 6:00 pm on Monday to Friday and 8:00 am to 1:00 pm on Saturday. No construction work will be done on Sunday.

Table 7-9 below summarises capacity and productivity assumptions of construction trucks accessing the site, and Table 7-10 summarises the number of truck movements (two-way) to and from the site each weekday for each construction stage.

Table 7-9 Construction Truck Productivity Assumptions

B Double / Semi side Tippers	
Capacity (m^3)	20 m^3
Number of Crews	2
Vehicles per Crew	3
Productivity per Crew (m^3 per day)	800 m^3 per day
Avg. cycles per working day (45 minimum round trip)	15

Table 7-10 Daily Construction Truck by Construction Stage

Construction Stage	Daily Truck Movements (two way)
Stage 1	64
Stage 2	16
Stage 3	2

The highest truck movements occur during Stage 1 of construction being about 64 truck movements to and from the site each working day.

Based on recent traffic data collected in 2018, Pitt Town road network currently carry between about 640 and 950 heavy vehicles movements on an average weekday. Truck movements during the construction phase are expected to increase which may have locally concentrated impacts at construction accesses. The additional truck movement during construction are however unlikely to have a substantial effect along Pitt Town, Bathurst Street, Eldon Street and Cattai Road.

7.6.3 Construction Traffic Distribution

The worst-case scenario was undertaken assuming 64 additional truck movements would be travelling to and from the site during the AM peak hour and PM peak hour.

The majority of truck movements will access the construction site via Cattai Road / Buckingham Street (I-1) and Bathurst Street / Pitt Town Road / Glebe Road (I-6) intersections.

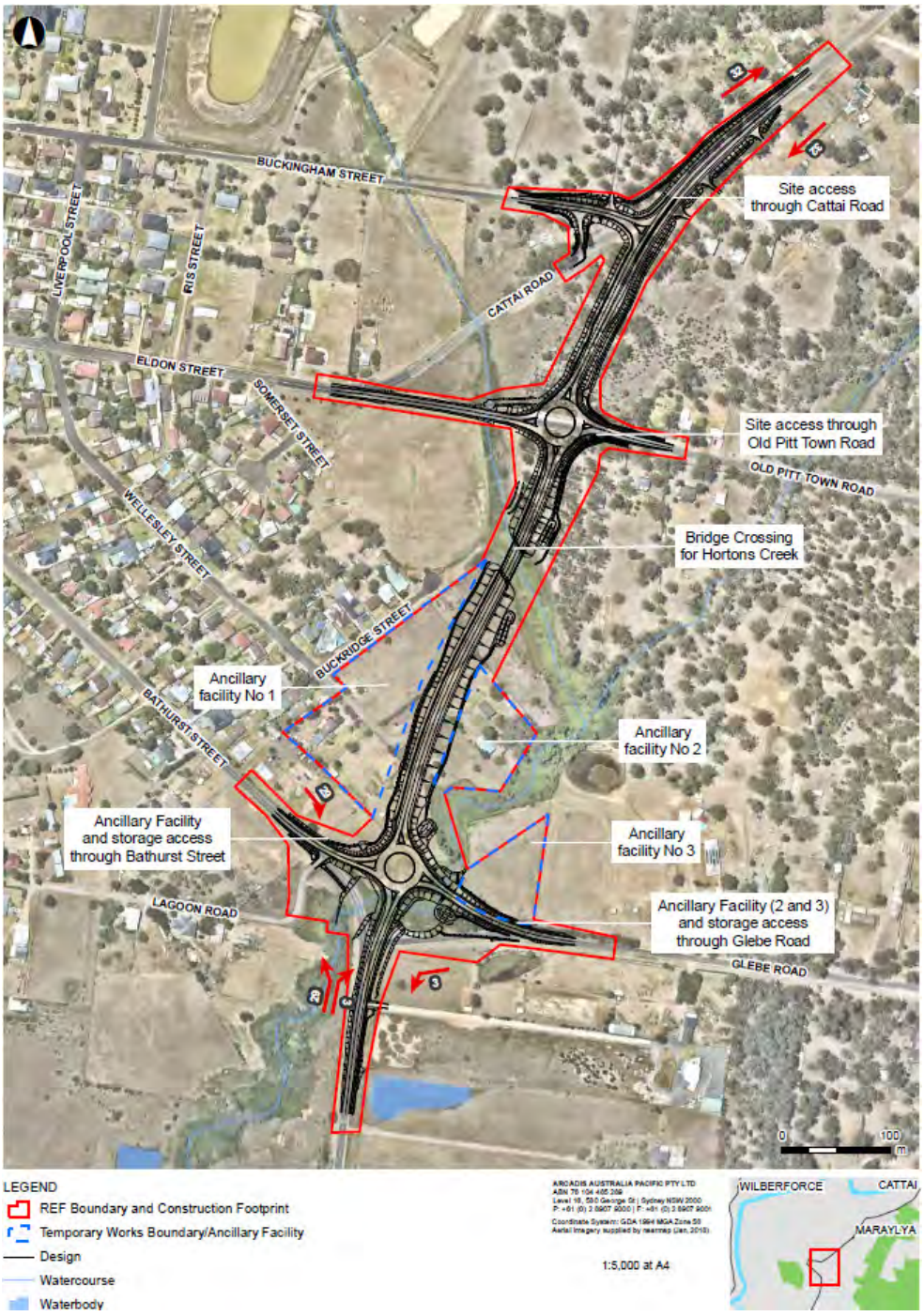


Figure 7-5 Construction Traffic and Ancillary Site Access

7.6.4 **Traffic Impact Assessment**

The analysis determined LoS of the existing network against the network with additional construction vehicle volumes at Cattai Road / Buckingham Street (I-1) and Bathurst Street / Pitt Town Road / Glebe Road (I-6) intersections. Table 7-11 the predicted delay and LoS at two analysed intersections with Stage 1 construction traffic. Existing 2018 LoS is included for comparison.

Table 7-11 Predicted LoS with Stage 1 Construction Traffic

ID	Intersection	Control	Existing 2018				Existing 2018 with Construction Vehicles			
			AM Peak		PM Peak		AM Peak		PM Peak	
			Delay (sec)	LoS	Delay (sec)	LoS	Delay (sec)	LoS	Delay (sec)	LoS
I-1	Cattai Road / Buckingham Street	Priority	8.4	A	8.2	A	10.6	A	10.2	A
I-6	Bathurst Street / Pitt Town Road / Glebe Road	Priority	19.7	B	15.2	B	26.2	B	19.8	B

Minor impact to delay and LoS are predicted at the Cattai Road / Buckingham Street (I-1) and Bathurst Street / Pitt Town Road / Glebe Road (I-6) intersections. Both intersections would operate at similar to existing LoS A to B with construction traffic from the proposal.

The analysis indicated that the construction traffic would have minor impact to traffic operation at Cattai Road / Buckingham Street (I-1) and Bathurst Street / Pitt Town Road / Glebe Road (I-6) intersections in both AM and PM peak periods.

7.6.5 Impacts on evacuation routes

The proposal would tie into Buckingham Street and Bathurst Street which are entry point roads for the regional evacuation route. Emergency services would be notified of traffic condition changes along Pitt Town Road evacuation route roads at least one week before these changes take place. Construction truck movements are not expected to impact the road network of the level of service of intersections along the regional evacuation route.

Once in operation, the proposal would expedite evacuation along the Pitt Town Road regional evacuation route. Through traffic would use the new bypass while Pitt Town traffic would use local roads to enter the regional evacuation route.

7.6.6 Management of Traffic and Transport Impacts

The preliminary analysis has determined that the construction activities associated with the proposal would have minimal impacts on the road network with only minor impact to traffic operation on Pitt Town, Bathurst Street, Eldon Street and Cattai Road. Construction methods and staging for the proposal would minimise road closures, subject to other proposal constraints, and allow staged construction to minimise any disruption to existing traffic. The contractor would be required to develop a traffic management plan as part of the construction environmental management plan, as required for proposal that would impact on existing traffic arrangements. Overall, the impact of the construction of the proposal is anticipated to be minor and appropriate management plans would be applied to mitigate the impact.

A detailed traffic management plan (TMP) would be prepared as part of the construction environmental management plan (CEMP) during the detailed design phase. The TMP would include the guidelines, general requirements and procedures to be used when activities or areas of work have a potential impact on existing traffic arrangements.

8 CONCLUSIONS

8.1 Overview

Road and Maritime is planning a bypass of Pitt Town to reduce traffic through the town centre and improve traffic flow for safety for road users.

This Traffic and Transport Assessment Report has been prepared to support the REF submission.

The proposal involves building a bypass of Pitt Town that directly connects Pitt Town Road to Cattai Road near Buckingham Street east of Pitt Town, within the City of Hawkesbury LGA. The proposed bypass is approximately 1 km and consists of a single two-lane carriageway with a posted speed limit of 70km/h. The proposal would reduce travel time for through and local traffic, improve the reliability of journeys and provide more consistent driving conditions. It would also divert a substantial proportion of through traffic onto the bypass, reducing traffic volumes on local road network through town centre. This would improve safety through the town centre, improve local amenity and access, and reduce other traffic related impacts such as noise air quality on nearby residents.

This Traffic and Transport Assessment Report details the existing 2018 traffic performance of the Pitt Town network and future traffic performance of the proposal Over the course of preparing this report, relevant documents associated with the proposal have been reviewed, and potential traffic impacts on the road network have been assessed.

For modelling purposes, 2021 was assumed to be opening year of the bypass. Future traffic volumes are reported for 2031 (10 years after opening) and 2041 (20 years after opening).

8.2 Existing Traffic Conditions

Daily traffic on the Pitt Town Road, Bathurst Street, Eldon Street and Cattai Road varies significantly. Cattai Road carries about 4,400 vehicles per day. On Eldon Street west of Liverpool Street, about 5,400 vehicles per day are recorded. Traffic volumes increase to 9,600 to 9,700 vehicles per day on Bathurst Street (east of Chatham Road), and Pitt Town Road (south of Glebe Road). The significant traffic variations between Bathurst Street (east of Chatham Road) and Eldon Street are contributed by local traffic generated to and from Pitt Town.

Pitt Town Road, Bathurst Street, Eldon Street and Cattai Road are designated B-double routes and are allowed for use by vehicles with a maximum vertical height clearance of 4.6 m. About 640 to 950 heavy vehicles per day are recorded on Pitt Town Road, Bathurst Street, Eldon Street and Cattai Road, accounting for approximately 10 to 17 % of total traffic.

Traffic on Pitt Town Road, Bathurst Street, Eldon Street and Cattai Road through Pitt Town is a mixture of through (passing) and local traffic. The proportion of through traffic on Pitt Town Road and Cattai Road was found to be about 31 % in the northbound direction and about 61 % in the southbound direction.

To assess the existing traffic performance, a SIDRA Network (version 7) model has been developed for six key intersections within the study area including:

- Cattai Road / Buckingham Street (priority)
- Cattai Road / Eldon Street / Old Pitt Town Road (priority)
- Eldon Street / Liverpool Street / Wellesley Street (priority)
- Eldon Street / Chatham Street (priority)

- Chatham Street / Bathurst Street (priority)
- Bathurst Street / Pitt Town Road / Glebe Road (priority).

The analysis determined LoS between A to B for the six key analysed intersections.

The LoS outcome for existing condition does not suggest a capacity problem at key intersections with Pitt Town Road, Bathurst Street, Eldon Street and Cattai Road.

8.3 Crash Data Analysis

This assessment is based on the crash data supplied by Roads and Maritime for a six-year period from 1 January 2011 to 31 December 2017. The crash data includes fatal, injury or vehicle damage accidents. The crash analysis has been undertaken for Pitt Town, along Cattai Road, Eldon Street, Chatham Street, Bathurst Street, Pitt Town Road and adjoining local roads.

Of the 15 recorded crashes within the study area between January 2011 and December 2017, no fatal crashes were reported, 50 % of crashes involved injury and 44 % were non-casualty crashes. The six-year crash data showed that about 8 people were injured.

The highest crash type recorded was off-road, on straight, hitting object crashes, accounting for three crashes (23 %). About two crashes (15 %) were intersection, adjacent approaches or head-on (not overtaking) crashes. It is likely that safety will deteriorate along the Pitt Town network and associated intersections in their current configuration for all road users as traffic levels and congestion increase, which is of on-going and substantial concern to Roads and Maritime and the local community.

8.4 Future Traffic Growth

The future background traffic growth on the Pitt Town road network has been sourced from Roads and Maritime's Sydney Traffic Forecasting Model (STFM, EMME). The traffic modelling data suggested an average growth rate of 2.5 % per annum until 2041.

The road network currently experiences high volumes of through traffic consisting of large proportions of heavy vehicles. If no action is taken to improve the traffic flow along the Pitt Town network, the following is likely to occur in the future:

- Increase delays to key intersections during peak periods
- Local amenity and access at Pitt Town will continue to decline due to increased traffic, as will other road related impacts such as noise and localised air quality
- Increasing volumes of freight will pose safety concerns to residents in the area.

8.5 Traffic Volumes on the Bypass

In the opening year 2021, the proposed bypass would carry approximately 3,600 vehicles per day. Traffic volumes on the bypass would increase to approximately 5,200 vehicles per day in 2041. The proportion of heavy vehicles on the bypass is estimated to be 14% of total traffic. In 2041, the bypass would remove about 750 heavy vehicles daily from the town centre road network.

8.6 Future LoS

The concept design proposes the following changes to the local road network including:

- Cattai Road / Buckingham Street intersection upgrade

- A new roundabout at Eldon Street / Old Pitt Town Road
- A new roundabout at Pitt Town Road / Bathurst Street / Glebe Road.

Traffic modelling result indicates that three new and upgrade intersections with the bypass would provide adequate capacity in both AM and PM peaks. The LoS is predicted to be between A and B until 2041.

8.7 Traffic Benefits

The proposal would provide motorists with faster trips and reduce travel times through the town centre. The bypass would remove the number of long-haul heavy vehicles (particularly large articulated heavy vehicles) which currently pass through the town centre. The bypass would fundamentally change the character of the existing road network through Pitt Town by reducing traffic volumes and noise, thereby providing the conditions for urban revitalisation.

Key benefits expected to result from the proposal include:

- Reduced traffic volumes on the town centre road network. The proposal would be effective in reducing a significant proportion of through traffic from Pitt Town, between Buckingham Street and Pitt Town Road. The proposal would reduce traffic on the existing route between Buckingham Street and Pitt Town Road by up to 34% to 63%, depending on the locations. The traffic reduction on the existing roads would improve local amenity, property access and reduce other traffic related impacts, such as noise and localised air quality, for nearby residents
- Diversion of a substantial proportion of through traffic onto the bypass, allowing the existing section of the network between Buckingham Street and Pitt Town Road to mainly cater for local traffic. The intersections along the existing roads for the post upgrade condition (with the proposal) are expected to operate with a good LoS A and B
- Increased road capacity of road network, which would support population growth in Pitt Town and the surrounding area
- Improved reliability of journey times, particularly during peak travel periods. The bypass would save travel speeds of about 1.0 to 1.1 minutes in peak periods
- Provision of opportunities to improve the public domain and amenity within the Pitt Town.

APPENDIX A SIDRA MODEL QUEUE LENGTH VALIDATION RESULTS

AM peak

Intersection	Approach / Road	AM Peak (8AM to 9AM	
		Observed Queue (vehicles)	Modelled Queue (vehicles)
(I-1) Cattai Road / Buckingham Street	North – Cattai Road	0-1	1
	South – Cattai Road	0-1	1
	West – Buckingham Street	0-1	1
(I-2) Cattai Road / Eldon Street / Old Pitt Town Road	North – Cattai Road	0-1	1
	East – Old Pitt Town Road	0-1	1
	West – Eldon Street	0-1	1
(I-3) Eldon Street / Liverpool Street / Wellesley Street	North – Liverpool Street	0-1	1
	East – Eldon Street	0-1	1
	South – Wellesley Street	0-1	1
	West – Eldon Street	0-1	1
(I-4) Eldon Street / Chatham Street	North – Chatham Street	0-1	1
	East – Eldon Street	0-1	1
	South – Chatham Street	0-1	1
	West – Eldon Street	0-1	1
(I-5) Chatham Street / Bathurst Street	North – Chatham Street	0-1	1
	South – Bathurst Street	0-1	1
	West – Bathurst Street	0-4	4
(I-6) Bathurst Street / Pitt Town Road / Glebe Road	North – Bathurst Street	0-1	1
	East – Glebe Road	0-1	1
	South – Pitt Town Road	0-1	1

Note: Modelled queues are rounded to nearest unit.

PM peak

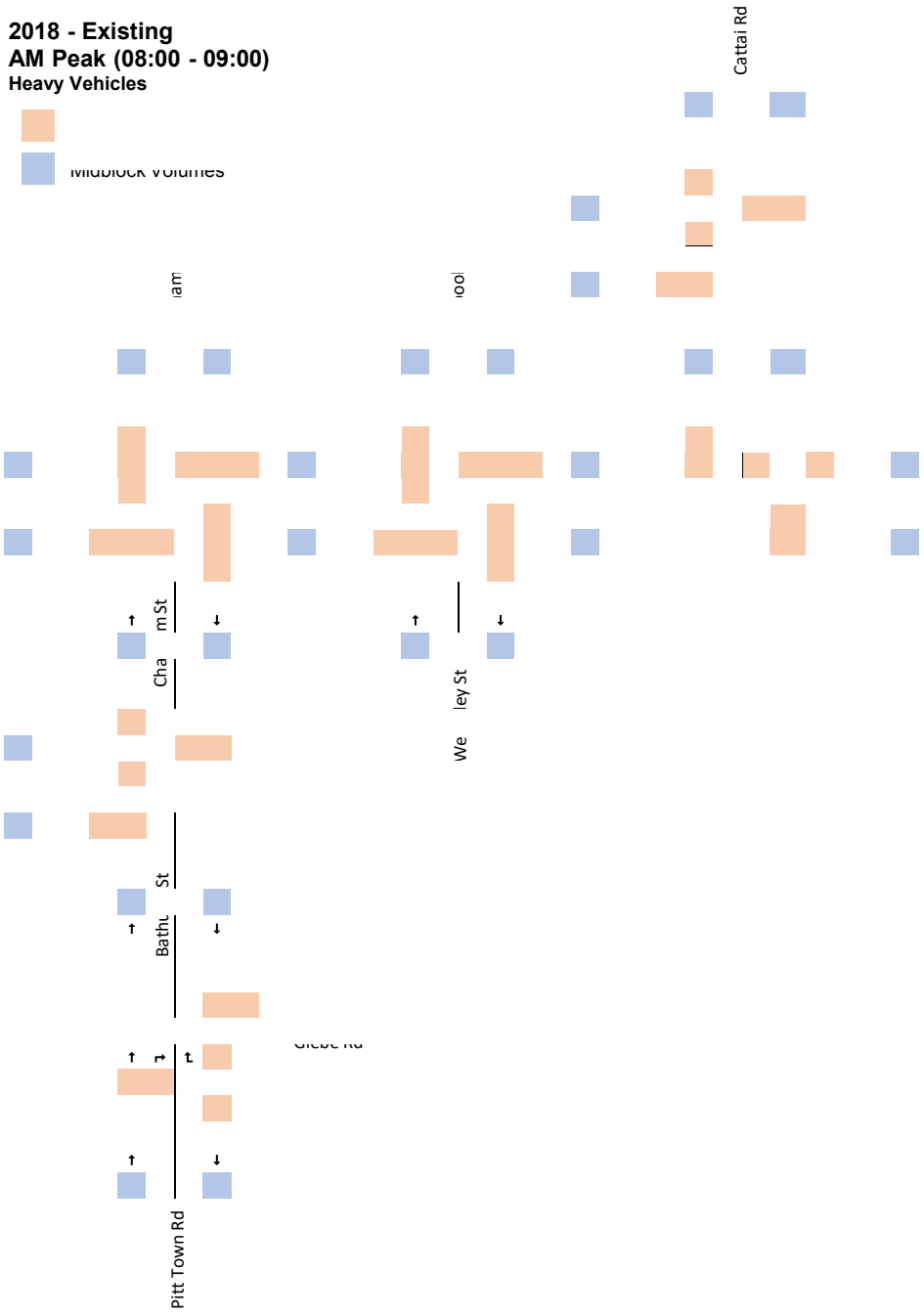
Intersection	Approach / Road	AM Peak (8AM to 9AM	
		Observed Queue (vehicles)	Modelled Queue (vehicles)
(I-1) Cattai Road / Buckingham Street	North – Cattai Road	0-1	1
	South – Cattai Road	0-1	1
	West – Buckingham Street	0-1	1
(I-2) Cattai Road / Eldon Street / Old Pitt Town Road	North – Cattai Road	0-1	1
	East – Old Pitt Town Road	0-1	1
	West – Eldon Street	0-1	1
(I-3) Eldon Street / Liverpool Street / Wellesley Street	North – Liverpool Street	0-1	1
	East – Eldon Street	0-1	1
	South – Wellesley Street	0-1	1
	West – Eldon Street	0-1	1
(I-4) Eldon Street / Chatham Street	North – Chatham Street	0-1	1
	East – Eldon Street	0-1	1
	South – Chatham Street	0-1	1
	West – Eldon Street	0-1	1
(I-5) Chatham Street / Bathurst Street	North – Chatham Street	0-1	1
	South – Bathurst Street	0-1	1
	West – Bathurst Street	0-3	2
(I-6) Bathurst Street / Pitt Town Road / Glebe Road	North – Bathurst Street	0-1	1
	East – Glebe Road	0-1	1
	South – Pitt Town Road	0-1	1

Note: Modelled queues are rounded to nearest unit.

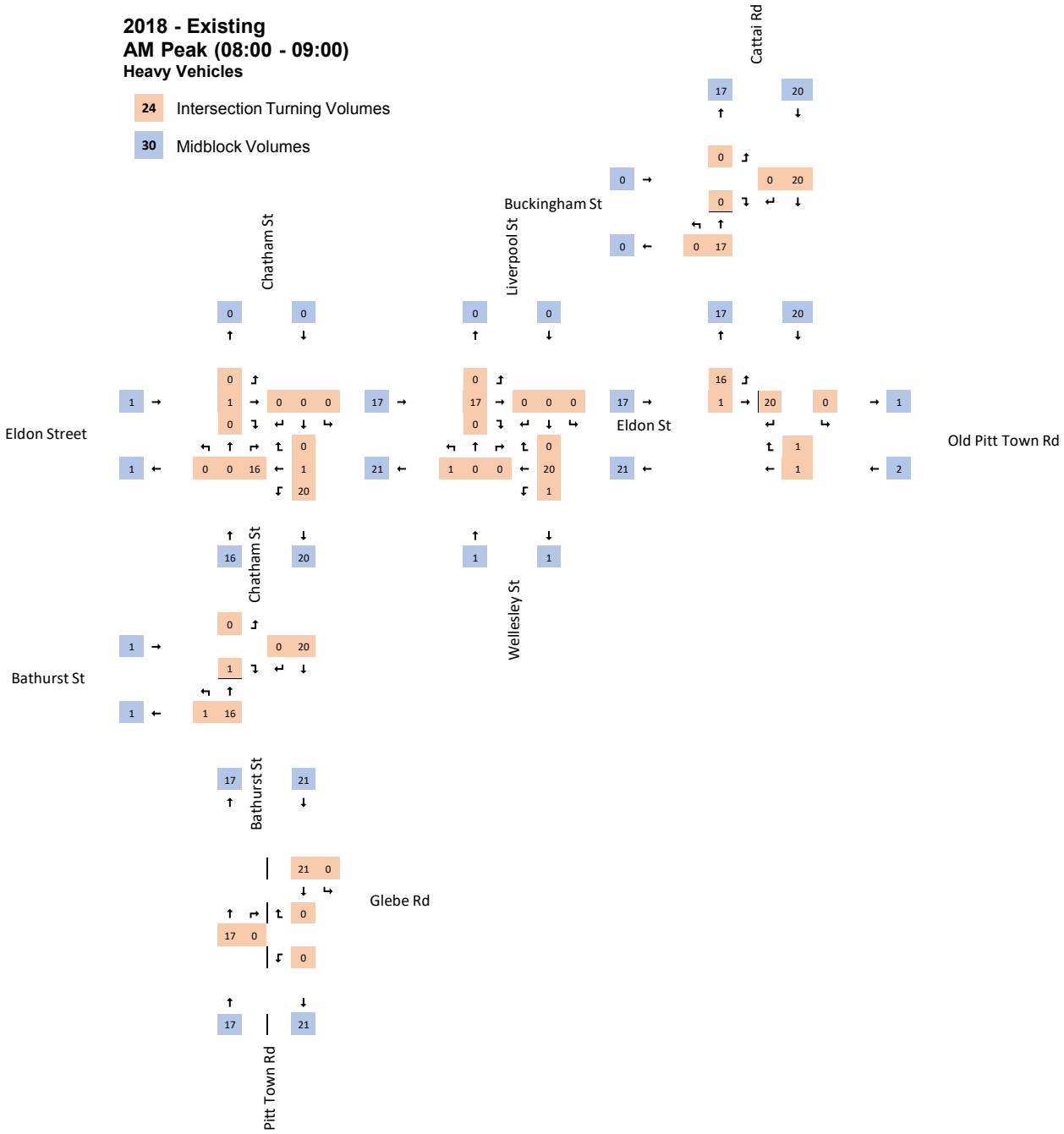
APPENDIX B EXISTING 2018 AND FORECAST 2021, 2031, 2041 TURNING VOLUMES (AM AND PM)

2018 – Existing Conditions

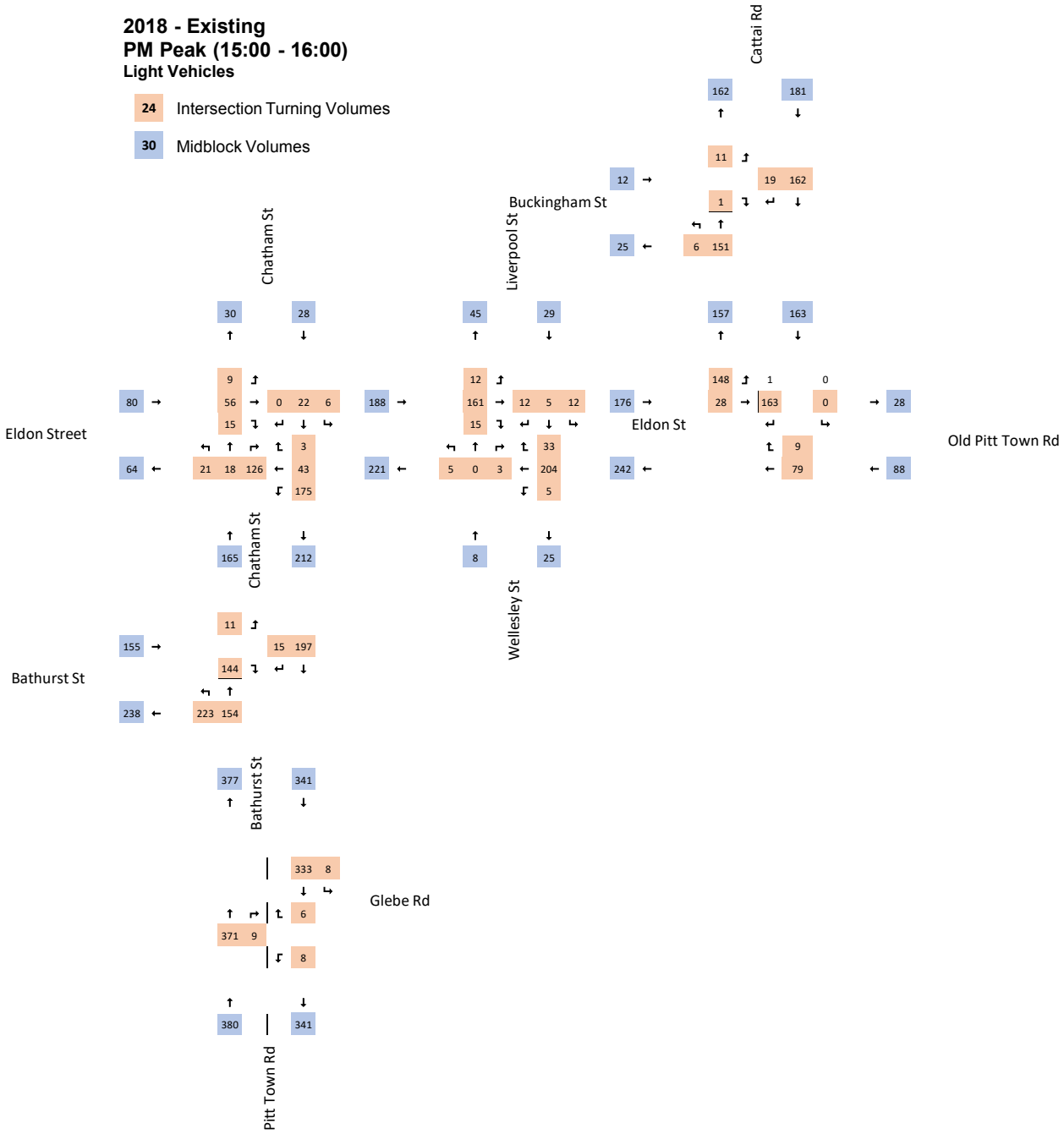
2018 AM Peak (8-9AM) – Light Vehicles



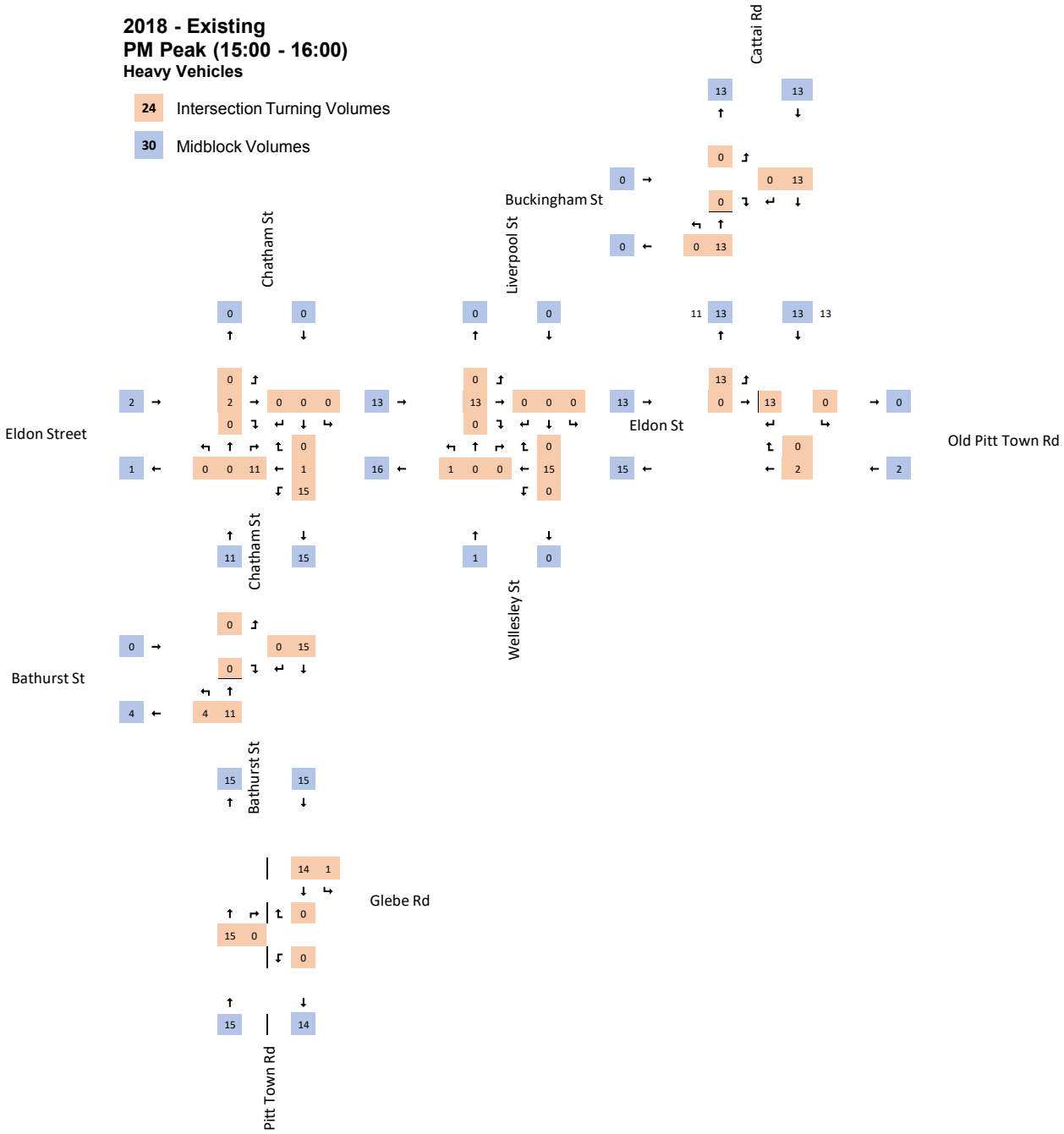
2018 AM Peak (8-9AM) – Heavy Vehicles



2018 PM Peak (3-4PM) – Light Vehicles

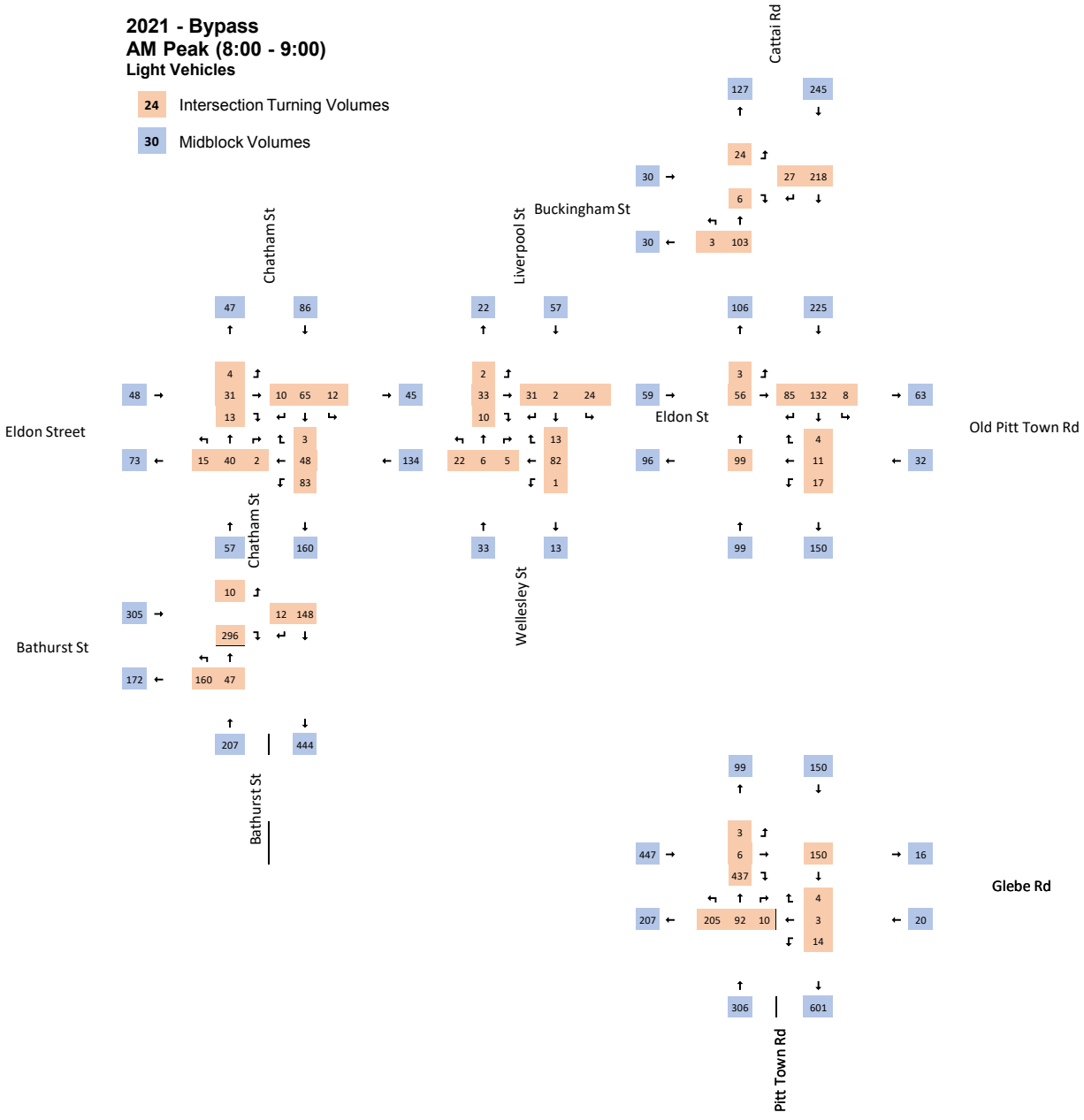


2018 PM Peak (3-4PM) – Heavy Vehicles

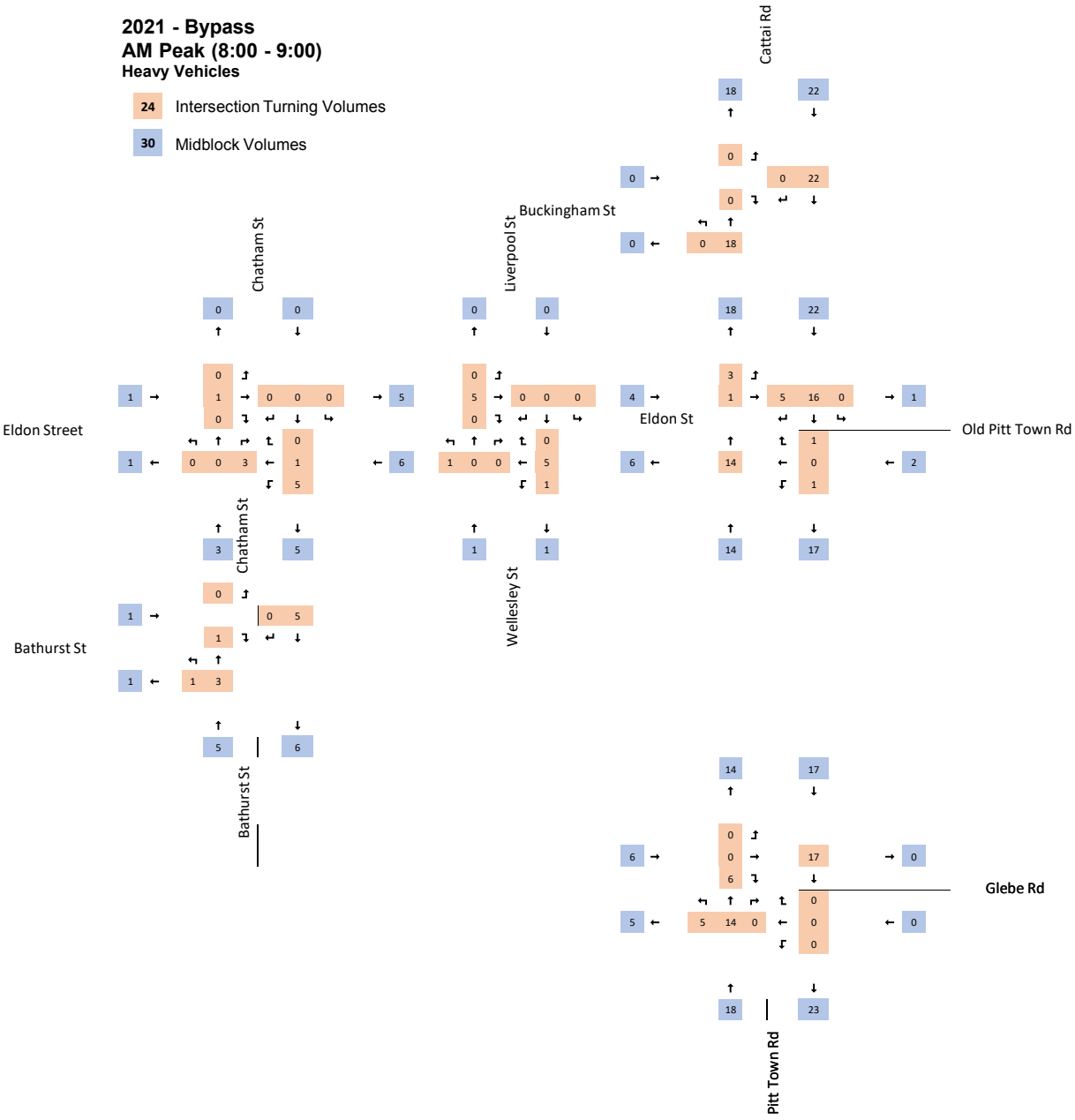


2021 – Future with Bypass

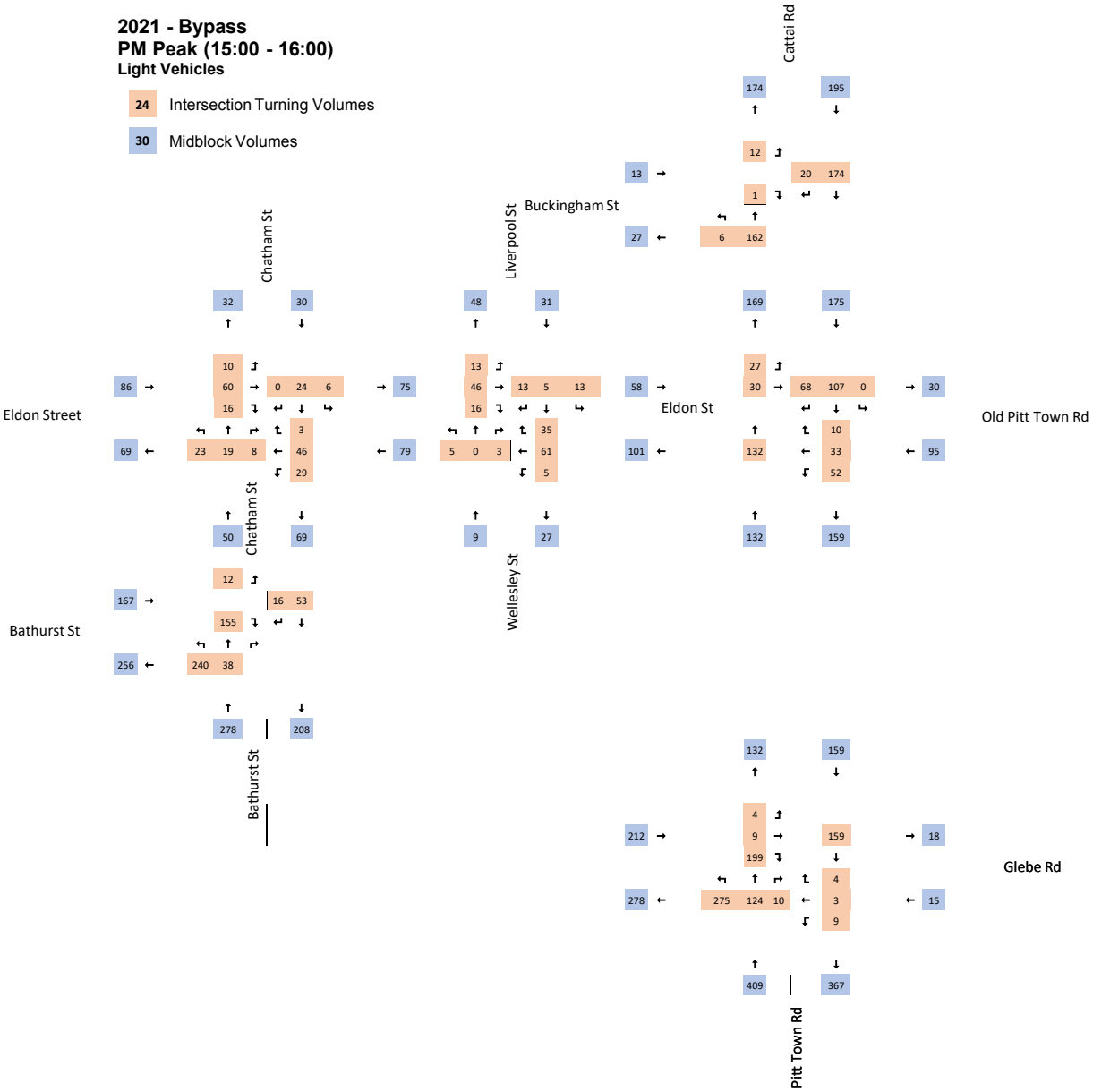
2021 AM Peak (8-9AM) – Light Vehicles



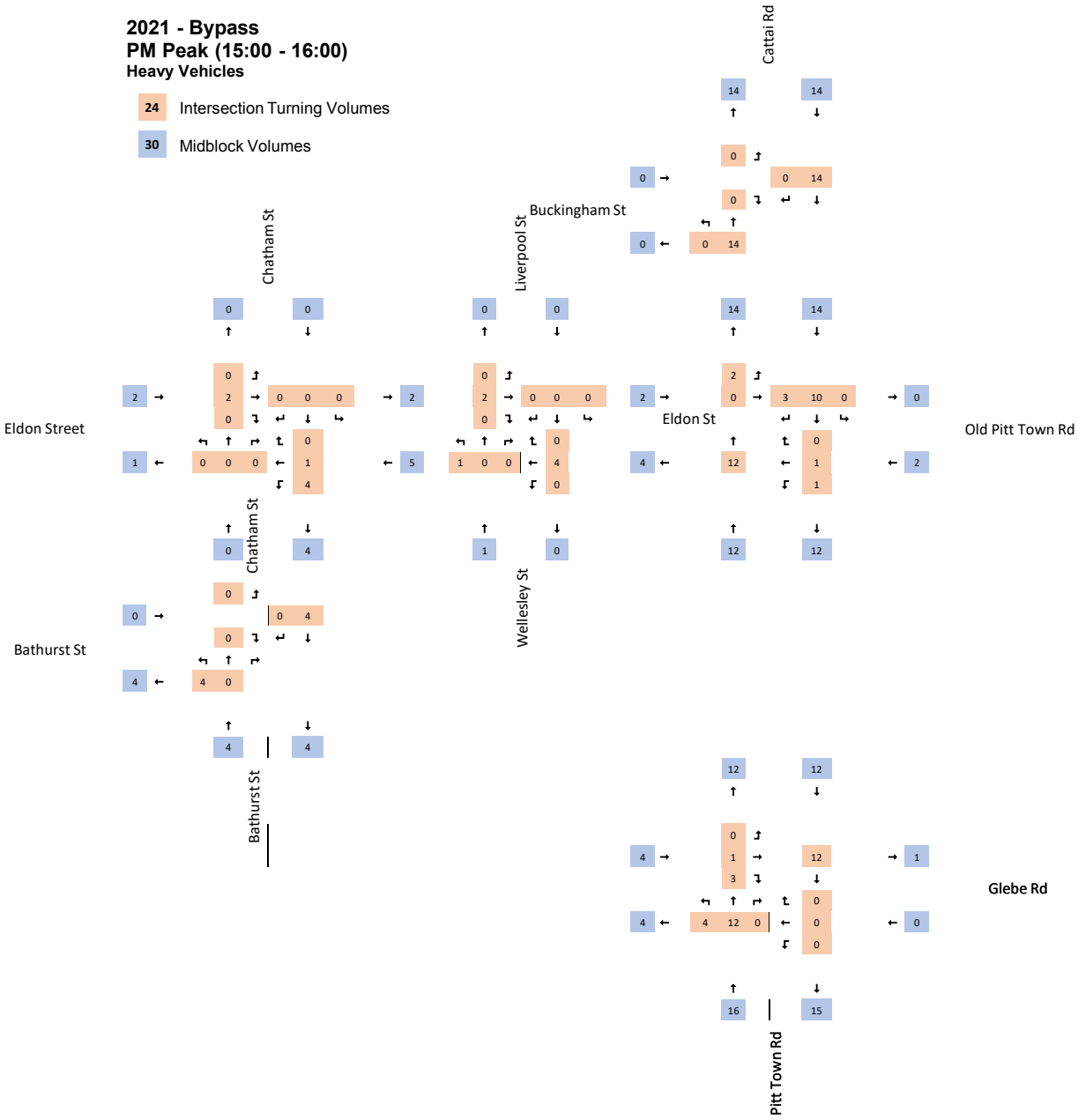
2021 AM Peak (8-9AM) – Heavy Vehicles



2021 PM Peak (3-4PM) – Light Vehicles

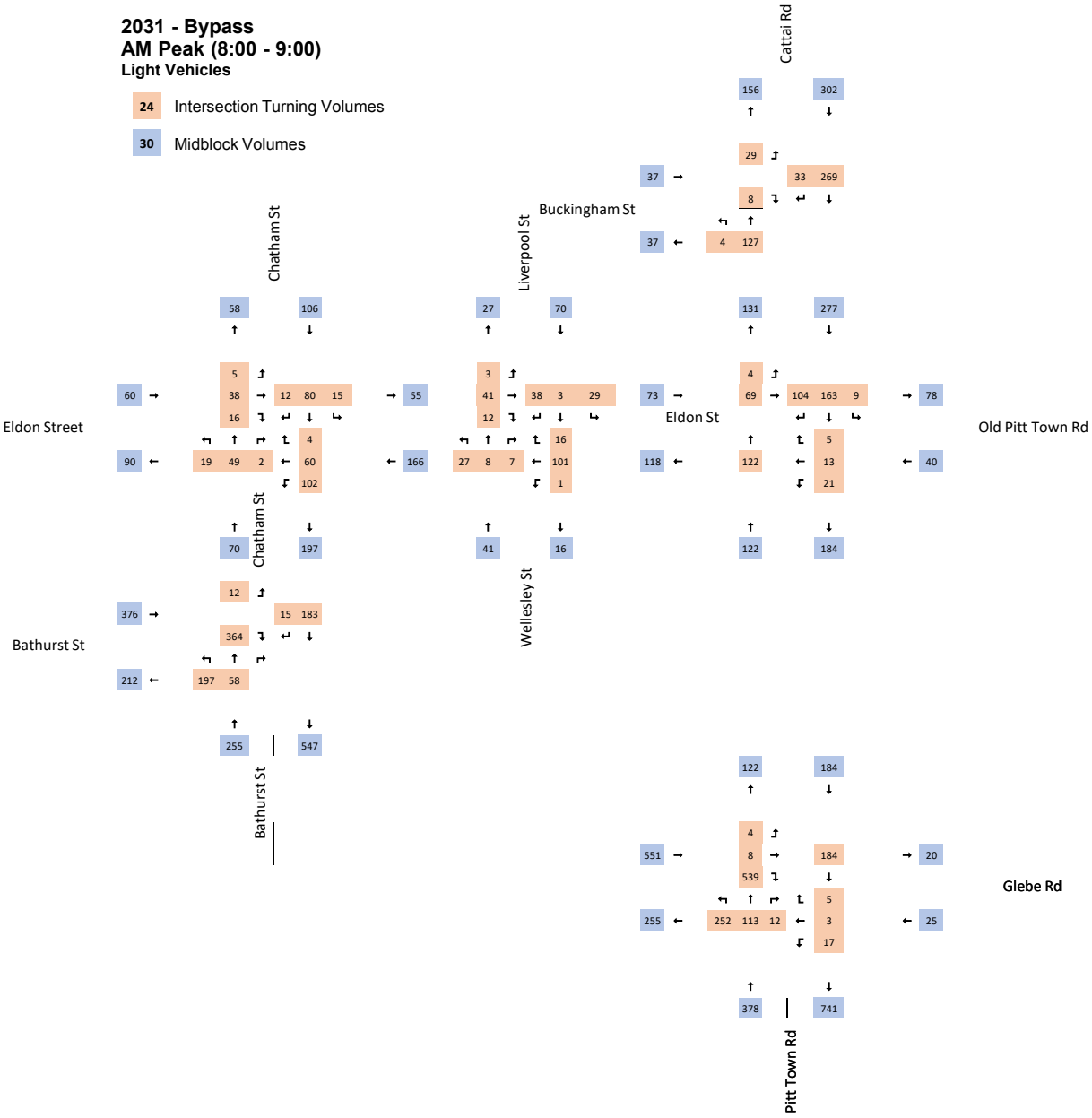


2021 PM Peak (3-4PM) – Heavy Vehicles

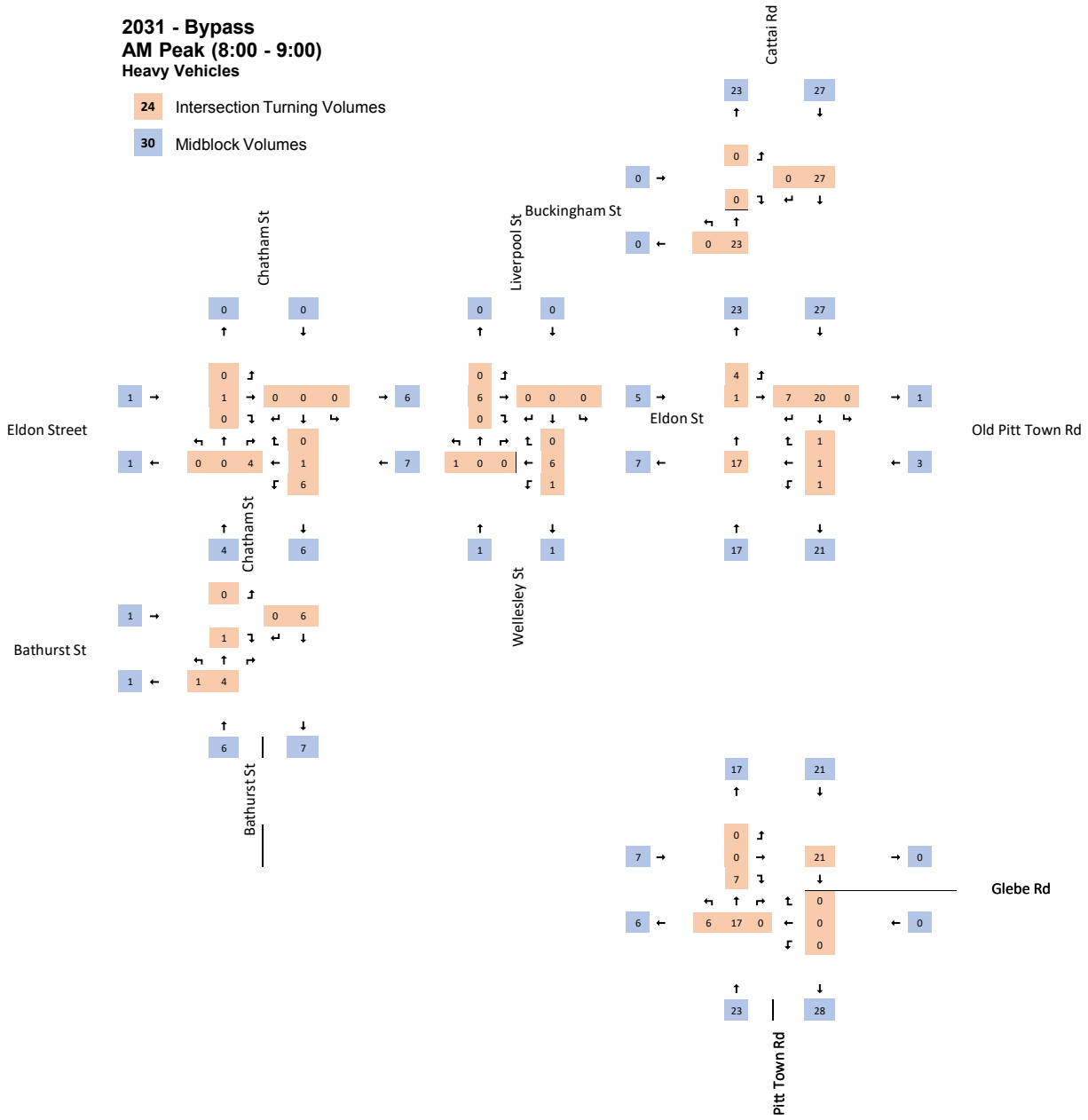


2031 – Future with Bypass

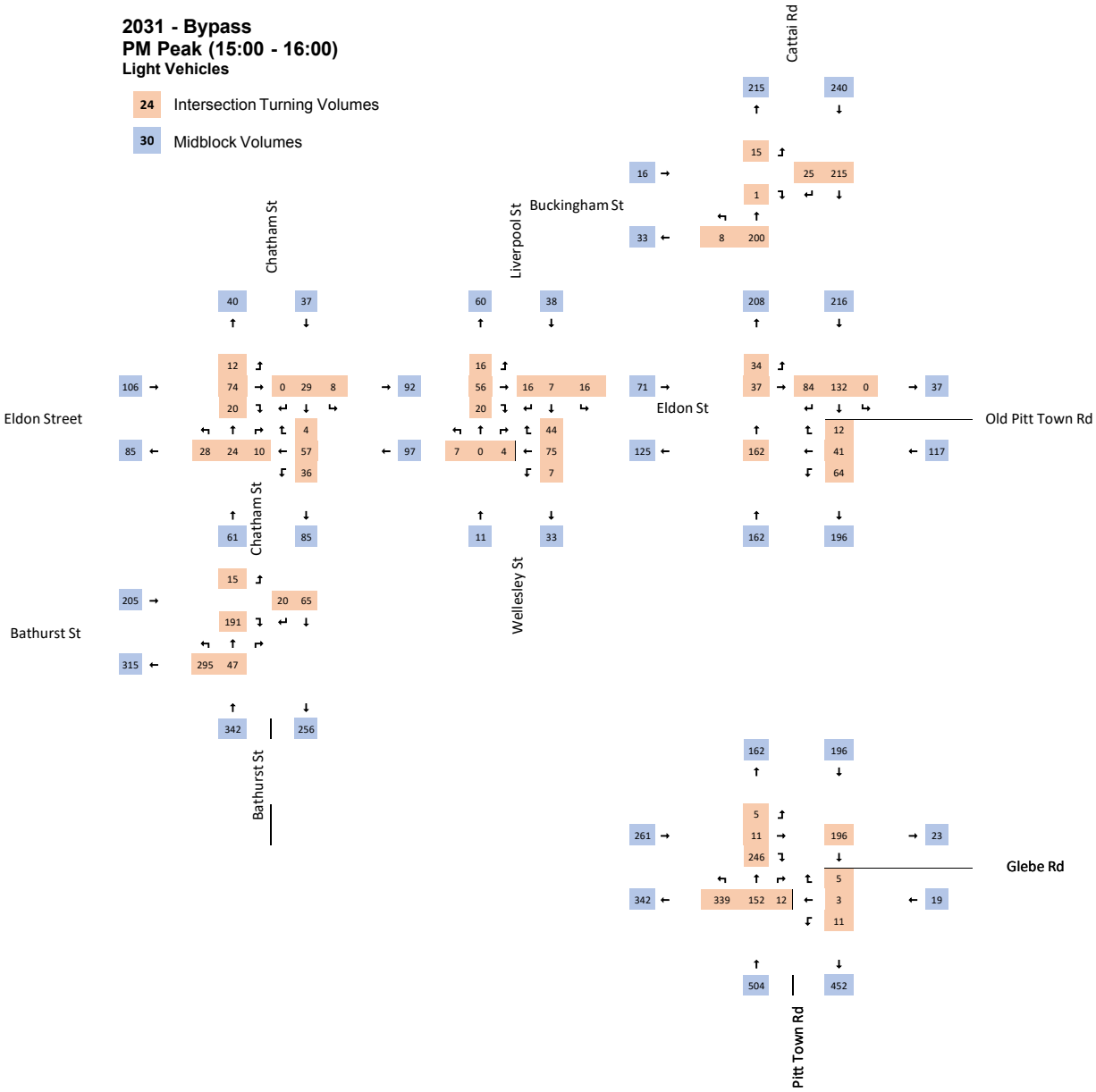
2031 AM Peak (8-9AM) – Light Vehicles



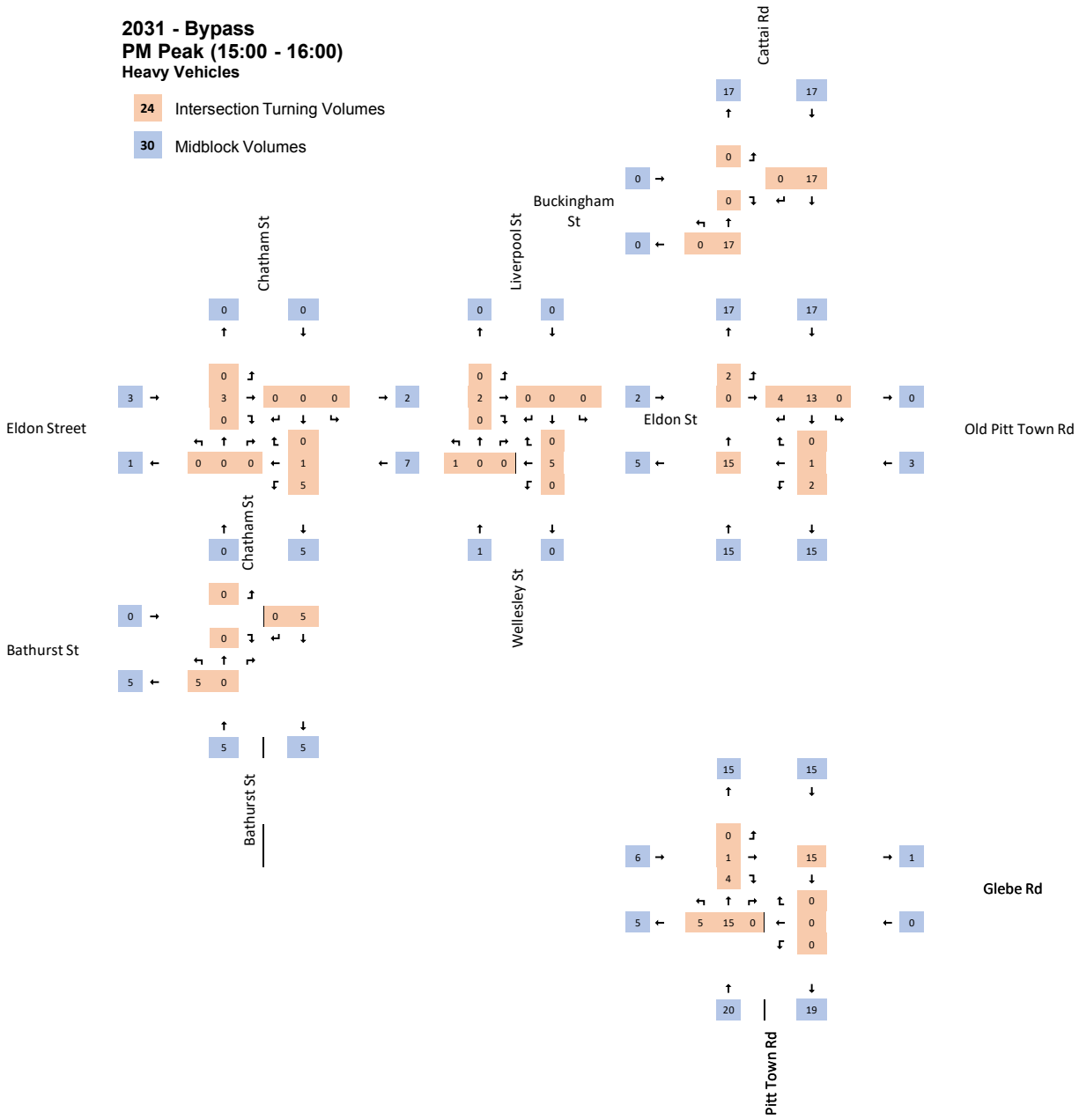
2031 AM Peak (8-9AM) – Heavy Vehicles



2031 PM Peak (3-4PM) – Light Vehicles

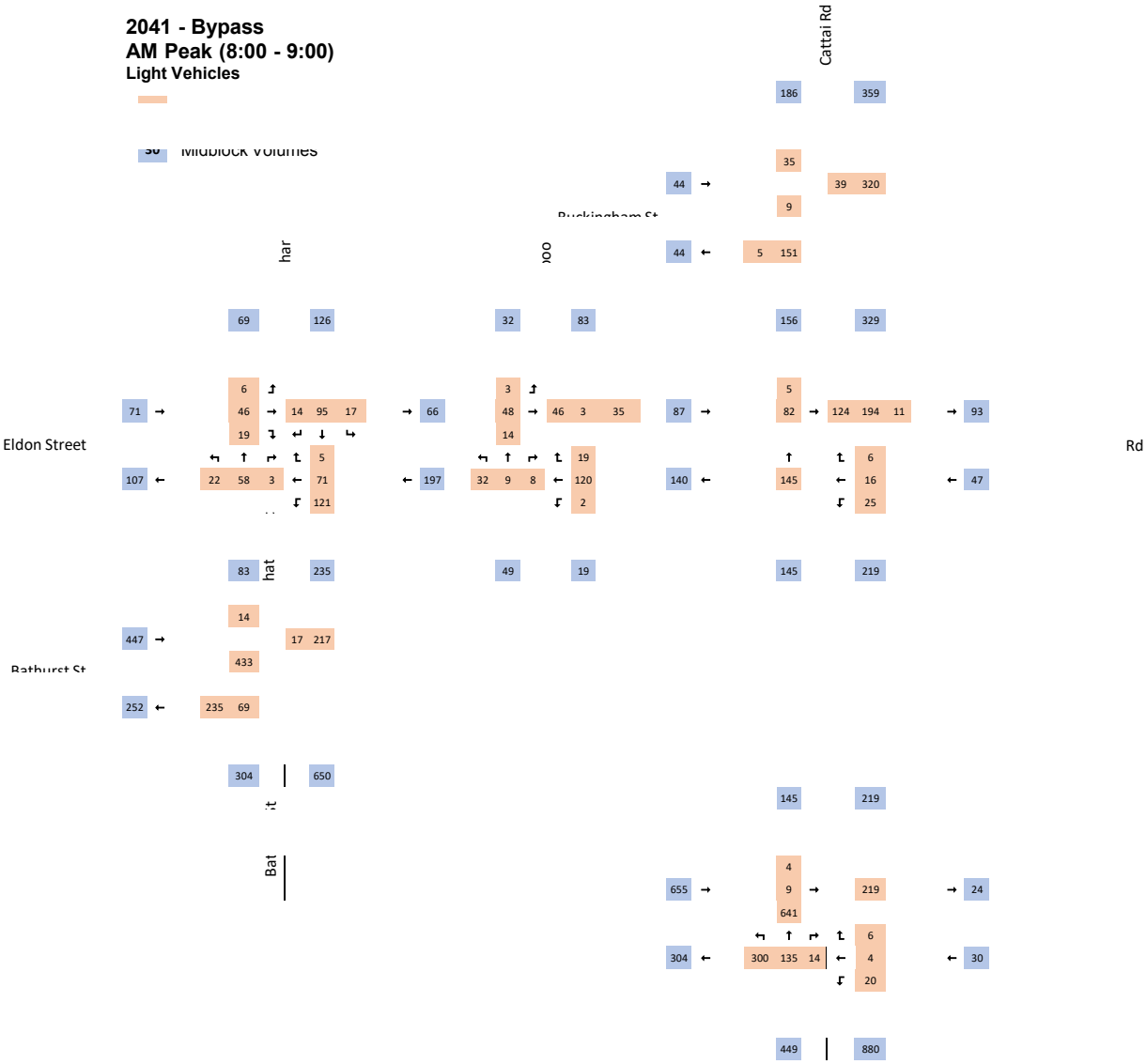


2031 PM Peak (3-4PM) – Heavy Vehicles

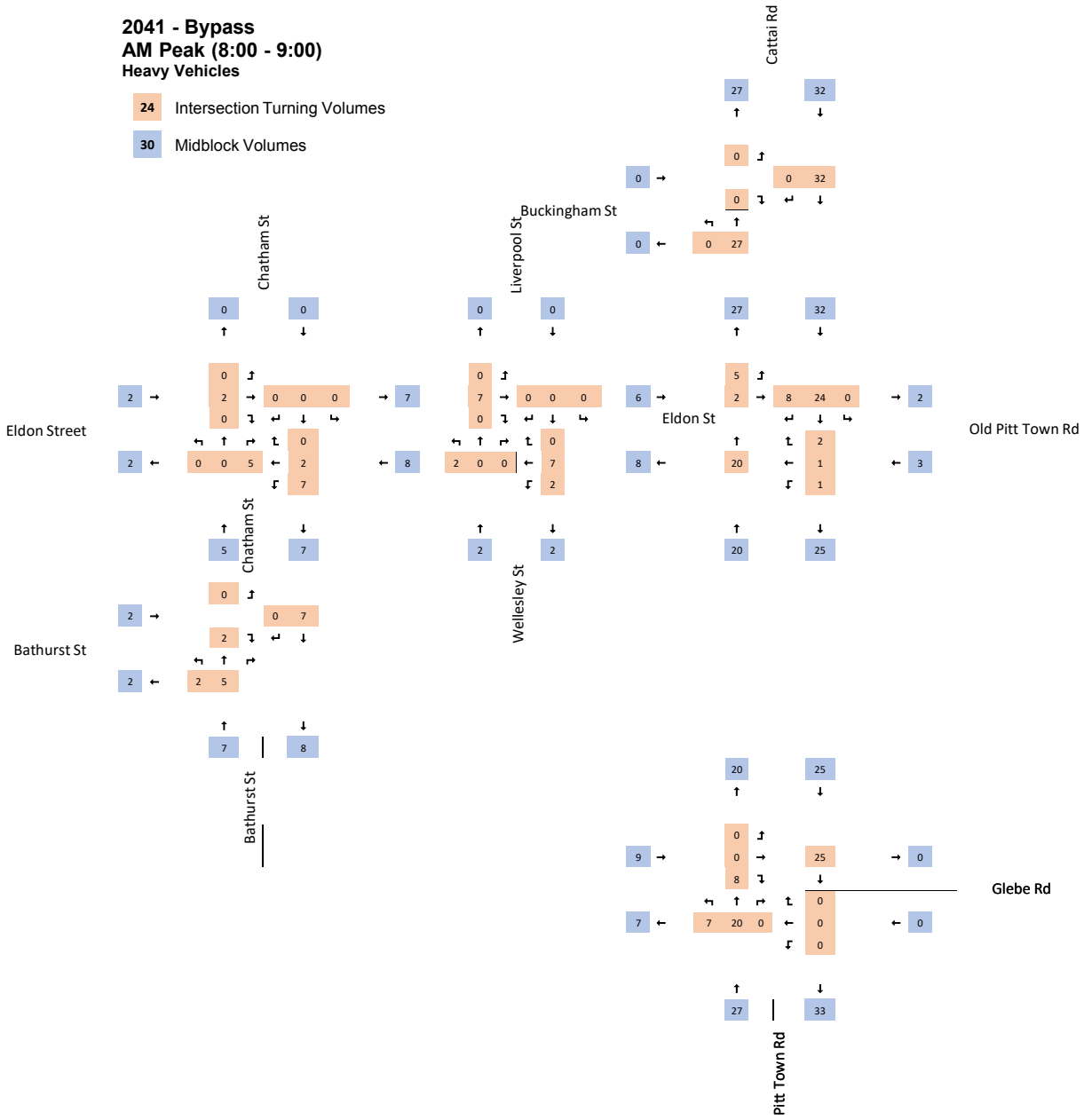


2041 – Future with Bypass

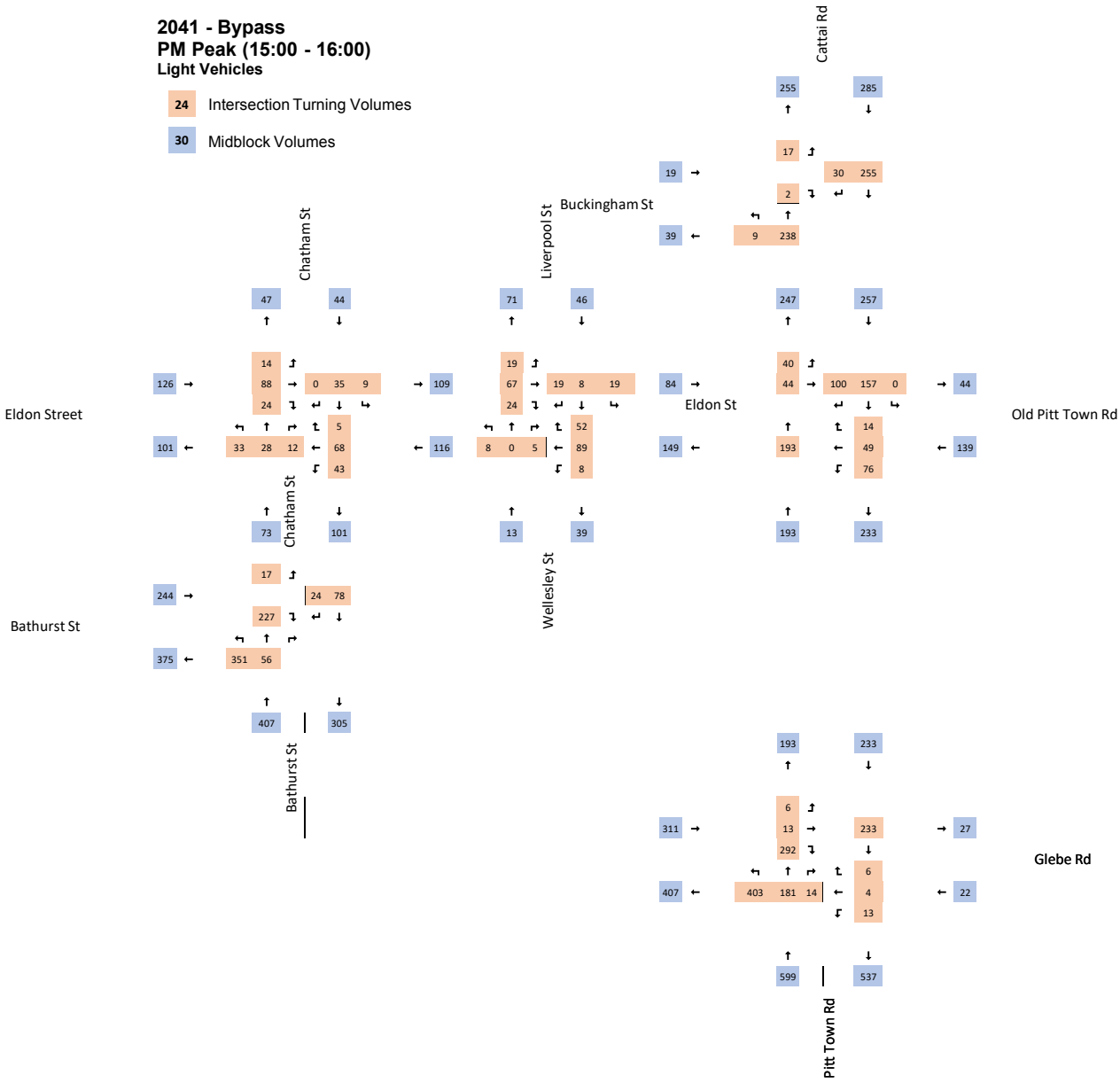
2041 AM Peak (8-9AM) – Light Vehicles



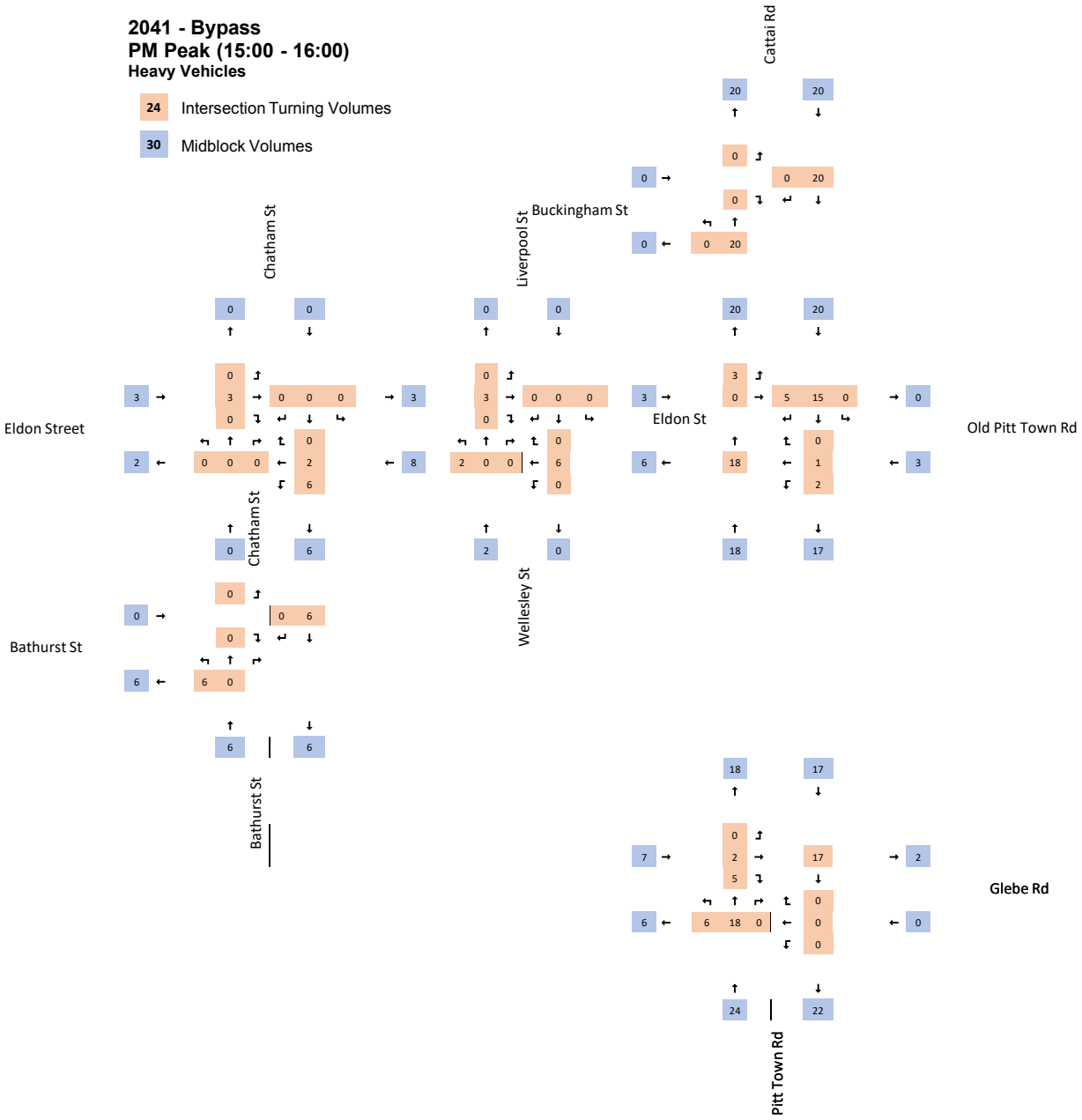
2041 AM Peak (8-9AM) – Heavy Vehicles



2041 PM Peak (3-4PM) – Light Vehicles



2041 PM Peak (3-4PM) – Heavy Vehicles



APPENDIX C EXISTING 2018 AND FORECAST 2021, 2031, 2041 SIDRA LEVEL OF SERVICE RESULTS (AM AND PM)

2018 – Existing Conditions

2018 AM Peak (8-9AM) – (I-1) Cattai Rd / Buckingham St

LANE SUMMARY

Site: 1 [Site 1 - Cattai Rd / Buckingham St 8-9AM] **Network: N101 [Pitt Town Network AM]**

Site 1 - Cattai Rd / Buckingham St
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Cattai Rd															
Lane 1	116	14.7	116	14.7	1572	0.074	100	0.1	LOS A	0.0	0.0	Full	300	0.0	0.0
Approach	116	14.7	116	14.7		0.074		0.1	NA	0.0	0.0				
North: Cattai Rd															
Lane 1	249	8.4	249	8.4	1593	0.156	100	0.7	LOS A	0.2	1.5	Full	100	0.0	0.0
Approach	249	8.4	249	8.4		0.156		0.7	NA	0.2	1.5				
West: Buckingham Street															
Lane 1	28	0.0	28	0.0	776	0.036	100	5.9	LOS A	0.1	0.9	Full	400	0.0	0.0
Approach	28	0.0	28	0.0		0.036		5.9	LOS A	0.1	0.9				
Intersection	393	9.7	393	9.7		0.156		0.9	NA	0.2	1.5				

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.0 %
Number of Iterations: 5 (maximum specified: 10)

MOVEMENT SUMMARY

Site: 1 [Site 1 - Cattai Rd / Buckingham St 8-9AM] Network: N101 [Pitt Town Network AM]

Site 1 - Cattai Rd / Buckingham St
Giveway / Yield (Two-Way)

Movement Performance Vehicles													
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Cattai Rd													
1	L2	3	0.0	3	0.0	0.074	5.5	LOS A	0.0	0.0	0.00	0.02	57.5
2	T1	113	15.0	113	15.0	0.074	0.0	LOS A	0.0	0.0	0.00	0.02	59.6
Approach		116	14.7	116	14.7	0.074	0.1	NA	0.0	0.0	0.00	0.02	59.5
North: Cattai Rd													
8	T1	223	9.0	223	9.0	0.156	0.1	LOS A	0.2	1.5	0.05	0.06	53.3
9	R2	26	3.8	26	3.8	0.156	6.1	LOS A	0.2	1.5	0.05	0.06	48.5
Approach		249	8.4	249	8.4	0.156	0.7	NA	0.2	1.5	0.05	0.06	51.5
West: Buckingham Street													
10	L2	22	0.0	22	0.0	0.036	5.4	LOS A	0.1	0.9	0.27	0.55	32.9
12	R2	6	0.0	6	0.0	0.036	7.8	LOS A	0.1	0.9	0.27	0.55	41.7
Approach		28	0.0	28	0.0	0.036	5.9	LOS A	0.1	0.9	0.27	0.55	34.2
All Vehicles		393	9.7	393	9.7	0.156	0.9	NA	0.2	1.5	0.05	0.08	51.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.0 %
Number of Iterations: 5 (maximum specified: 10)

2018 AM Peak (8-9AM) – (I-2) Cattai Rd / Eldon St / Old Pitt Town Rd

LANE SUMMARY

Site: 2 [Site 2 - Cattai Rd / Eldon St / Old Pitt Town Rd 8-9AM] **Network: N101 [Pitt Town Network AM]**

Site 2 - Cattai Rd / Eldon St / Old Pitt Town Rd
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: Old Pitt Town Road															
Lane 1	32	6.3	32	6.3	687	0.047	100	5.5	LOS A	0.2	1.1	Full	550	0.0	0.0
Approach	32	6.3	32	6.3		0.047		5.5	LOS A	0.2	1.1				
North: Cattai Road															
Lane 1	229	8.7	229	8.7	1568	0.146	100	5.8	LOS A	0.7	5.7	Full	300	0.0	0.0
Approach	229	8.7	229	8.7		0.146		5.8	NA	0.7	5.7				
West: Eldon Street															
Lane 1	164	10.4	164	10.4	1578	0.104	100	4.3	LOS A	0.0	0.0	Full	300	0.0	0.0
Approach	164	10.4	164	10.4		0.104		4.3	NA	0.0	0.0				
Intersection	425	9.2	425	9.2		0.146		5.2	NA	0.7	5.7				

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.0 %
Number of Iterations: 5 (maximum specified: 10)

MOVEMENT SUMMARY

Site: 2 [Site 2 - Cattai Rd / Eldon St / Old Pitt Town Rd 8-9AM]

Network: N101 [Pitt Town Network AM]

Site 2 - Cattai Rd / Eldon St / Old Pitt Town Rd
Giveway / Yield (Two-Way)

Movement Performance Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Old Pitt Town Road													
5	T1	27	3.7	27	3.7	0.047	4.8	LOS A	0.2	1.1	0.36	0.56	44.1
6	R2	5	20.0	5	20.0	0.047	9.2	LOS A	0.2	1.1	0.36	0.56	44.1
Approach		32	6.3	32	6.3	0.047	5.5	LOS A	0.2	1.1	0.36	0.56	44.1
North: Cattai Road													
7	L2	7	0.0	7	0.0	0.146	5.9	LOS A	0.7	5.7	0.16	0.56	47.7
9	R2	222	9.0	222	9.0	0.146	5.8	LOS A	0.7	5.7	0.16	0.56	45.3
Approach		229	8.7	229	8.7	0.146	5.8	NA	0.7	5.7	0.16	0.56	45.5
West: Eldon Street													
10	L2	111	14.4	111	14.4	0.104	5.8	LOS A	0.0	0.0	0.00	0.46	49.6
11	T1	53	1.9	53	1.9	0.104	1.1	LOS A	0.0	0.0	0.00	0.46	56.1
Approach		164	10.4	164	10.4	0.104	4.3	NA	0.0	0.0	0.00	0.46	53.1
All Vehicles		425	9.2	425	9.2	0.146	5.2	NA	0.7	5.7	0.11	0.52	48.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.0 %
Number of Iterations: 5 (maximum specified: 10)

2018 AM Peak (8-9AM) – (I-3) Eldon St / Liverpool St / Wellesley St

LANE SUMMARY

Site: 3 [Site 3 - Eldon St / Liverpool St / Wellesley St 8-9AM] **Network: N101 [Pitt Town Network AM]**

Site 3 - Eldon St / Liverpool St / Wellesley St
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Wellesley Street															
Lane 1	32	3.1	32	3.1	654	0.049	100	6.8	LOS A	0.2	1.2	Full	400	0.0	0.0
Approach	32	3.1	32	3.1		0.049		6.8	LOS A	0.2	1.2				
East: Eldon Street															
Lane 1	249	8.4	249	8.4	1634	0.152	100	0.4	LOS A	0.1	0.7	Full	300	0.0	0.0
Approach	249	8.4	249	8.4		0.152		0.4	NA	0.1	0.7				
North: Liverpool Street															
Lane 1	53	0.0	53	0.0	613	0.086	100	7.3	LOS A	0.3	2.0	Full	200	0.0	0.0
Approach	53	0.0	53	0.0		0.086		7.3	LOS A	0.3	2.0				
West: Eldon Street															
Lane 1	148	11.5	148	11.5	1552	0.095	100	0.6	LOS A	0.1	0.6	Full	100	0.0	0.0
Approach	148	11.5	148	11.5		0.095		0.6	NA	0.1	0.6				
Intersection	482	8.1	482	8.1		0.152		1.6	NA	0.3	2.0				

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.0 %
Number of Iterations: 5 (maximum specified: 10)

MOVEMENT SUMMARY

Site: 3 [Site 3 - Eldon St / Liverpool St / Wellesley St 8-9AM]

Network: N101 [Pitt Town Network AM]

Site 3 - Eldon St / Liverpool St / Wellesley St
Giveway / Yield (Two-Way)

Movement Performance Vehicles													
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Wellesley Street													
1	L2	21	4.8	21	4.8	0.049	6.6	LOS A	0.2	1.2	0.41	0.61	40.7
2	T1	6	0.0	6	0.0	0.049	6.2	LOS A	0.2	1.2	0.41	0.61	42.8
3	R2	5	0.0	5	0.0	0.049	8.4	LOS A	0.2	1.2	0.41	0.61	40.7
Approach		32	3.1	32	3.1	0.049	6.8	LOS A	0.2	1.2	0.41	0.61	41.3
East: Eldon Street													
4	L2	2	50.0	2	50.0	0.152	6.7	LOS A	0.1	0.7	0.03	0.03	51.0
5	T1	235	8.5	235	8.5	0.152	0.0	LOS A	0.1	0.7	0.03	0.03	58.6
6	R2	12	0.0	12	0.0	0.152	6.1	LOS A	0.1	0.7	0.03	0.03	52.8
Approach		249	8.4	249	8.4	0.152	0.4	NA	0.1	0.7	0.03	0.03	58.0
North: Liverpool Street													
7	L2	22	0.0	22	0.0	0.086	5.6	LOS A	0.3	2.0	0.37	0.63	33.9
8	T1	2	0.0	2	0.0	0.086	6.3	LOS A	0.3	2.0	0.37	0.63	42.4
9	R2	29	0.0	29	0.0	0.086	8.6	LOS A	0.3	2.0	0.37	0.63	33.9
Approach		53	0.0	53	0.0	0.086	7.3	LOS A	0.3	2.0	0.37	0.63	34.6
West: Eldon Street													
10	L2	2	0.0	2	0.0	0.095	6.6	LOS A	0.1	0.6	0.05	0.05	49.9
11	T1	137	12.4	137	12.4	0.095	0.1	LOS A	0.1	0.6	0.05	0.05	54.5
12	R2	9	0.0	9	0.0	0.095	6.6	LOS A	0.1	0.6	0.05	0.05	48.9
Approach		148	11.5	148	11.5	0.095	0.6	NA	0.1	0.6	0.05	0.05	53.0
All Vehicles		482	8.1	482	8.1	0.152	1.6	NA	0.3	2.0	0.10	0.14	51.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.0 %
Number of Iterations: 5 (maximum specified: 10)

2018 AM Peak (8-9AM) – (I-4) Eldon St / Chatham St

LANE SUMMARY

Site: 4 [Site 4 - Eldon St / Chatham St 8-9AM] **Network: N101 [Pitt Town Network AM]**

Site 4 - Eldon St / Chatham St
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Chatham Street															
Lane 1	158	10.1	158	10.1	1294	0.122	100	4.7	LOS A	0.5	4.3	Full	100	0.0	0.0
Approach	158	10.1	158	10.1		0.122		4.7	NA	0.5	4.3				
East: Eldon Street															
Lane 1	285	7.4	285	7.4	1601	0.178	100	4.8	LOS A	0.0	0.2	Full	100	0.0	0.0
Approach	285	7.4	285	7.4		0.178		4.8	NA	0.0	0.2				
North: Chatham Street															
Lane 1	80	0.0	80	0.0	639	0.125	100	6.4	LOS A	0.4	3.0	Full	180	0.0	0.0
Approach	80	0.0	80	0.0		0.125		6.4	LOS A	0.4	3.0				
West: Eldon Street															
Lane 1	46	2.2	46	2.2	694	0.066	100	5.7	LOS A	0.2	1.6	Full	100	0.0	0.0
Approach	46	2.2	46	2.2		0.066		5.7	LOS A	0.2	1.6				
Intersection	569	6.7	569	6.7		0.178		5.1	NA	0.5	4.3				

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.0 %
Number of Iterations: 5 (maximum specified: 10)

MOVEMENT SUMMARY

Site: 4 [Site 4 - Eldon St / Chatham St 8-9AM] Network: N101 [Pitt Town Network AM]

Site 4 - Eldon St / Chatham St
Giveway / Yield (Two-Way)

Movement Performance Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Chatham Street													
1	L2	14	0.0	14	0.0	0.122	5.9	LOS A	0.5	4.3	0.15	0.49	39.0
2	T1	37	0.0	37	0.0	0.122	1.3	LOS A	0.5	4.3	0.15	0.49	42.7
3	R2	107	15.0	107	15.0	0.122	5.7	LOS A	0.5	4.3	0.15	0.49	34.6
Approach		158	10.1	158	10.1	0.122	4.7	NA	0.5	4.3	0.15	0.49	38.2
East: Eldon Street													
4	L2	236	8.5	236	8.5	0.178	5.6	LOS A	0.0	0.2	0.00	0.52	35.4
5	T1	46	2.2	46	2.2	0.178	1.1	LOS A	0.0	0.2	0.00	0.52	40.9
6	R2	3	0.0	3	0.0	0.178	5.7	LOS A	0.0	0.2	0.00	0.52	40.5
Approach		285	7.4	285	7.4	0.178	4.8	NA	0.0	0.2	0.00	0.52	36.8
North: Chatham Street													
7	L2	11	0.0	11	0.0	0.125	5.7	LOS A	0.4	3.0	0.40	0.63	34.1
8	T1	60	0.0	60	0.0	0.125	6.7	LOS A	0.4	3.0	0.40	0.63	34.1
9	R2	9	0.0	9	0.0	0.125	5.7	LOS A	0.4	3.0	0.40	0.63	36.2
Approach		80	0.0	80	0.0	0.125	6.4	LOS A	0.4	3.0	0.40	0.63	34.4
West: Eldon Street													
10	L2	4	0.0	4	0.0	0.066	4.8	LOS A	0.2	1.6	0.26	0.54	38.3
11	T1	30	3.3	30	3.3	0.066	4.2	LOS A	0.2	1.6	0.26	0.54	29.3
12	R2	12	0.0	12	0.0	0.066	9.5	LOS A	0.2	1.6	0.26	0.54	29.3
Approach		46	2.2	46	2.2	0.066	5.7	LOS A	0.2	1.6	0.26	0.54	30.7
All Vehicles		569	6.7	569	6.7	0.178	5.1	NA	0.5	4.3	0.12	0.53	36.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.0 %
Number of Iterations: 5 (maximum specified: 10)

2018 AM Peak (8-9AM) – (I-5) Bathurst St / Chatham St

LANE SUMMARY

Site: 5 [Site 5 - Bathurst St / Chatham St 8-9AM] **Network: N101 [Pitt Town Network AM]**

Site 5 - Bathurst St / Chatham St
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Bathurst Street															
Lane 1	299	5.7	299	5.7	1728	0.173	100	1.4	LOS A	0.0	0.0	Full	90	0.0	0.0
Approach	299	5.7	299	5.7		0.173		1.4	NA	0.0	0.0				
North: Chatham Street															
Lane 1	308	6.5	308	6.5	1671	0.184	100	0.4	LOS A	0.1	0.8	Full	100	0.0	0.0
Approach	308	6.5	308	6.5		0.184		0.4	NA	0.1	0.8				
West: Bathurst Street															
Lane 1	285	0.4	285	0.4	428	0.666	100	16.9	LOS B	4.4	31.1	Full	160	0.0	0.0
Approach	285	0.4	285	0.4		0.666		16.9	LOS B	4.4	31.1				
Intersection	892	4.3	892	4.3		0.666		6.0	NA	4.4	31.1				

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.0 %
Number of Iterations: 5 (maximum specified: 10)

MOVEMENT SUMMARY

Site: 5 [Site 5 - Bathurst St / Chatham St 8-9AM] Network: N101 [Pitt Town Network AM]

Site 5 - Bathurst St / Chatham St
Giveway / Yield (Two-Way)

Movement Performance Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Bathurst Street													
1	L2	150	0.7	150	0.7	0.173	2.8	LOS A	0.0	0.0	0.00	0.21	34.6
2	T1	149	10.7	149	10.7	0.173	0.0	LOS A	0.0	0.0	0.00	0.21	31.0
Approach		299	5.7	299	5.7	0.173	1.4	NA	0.0	0.0	0.00	0.21	33.5
North: Chatham Street													
8	T1	297	6.7	297	6.7	0.184	0.3	LOS A	0.1	0.8	0.03	0.06	34.5
9	R2	11	0.0	11	0.0	0.184	4.7	LOS A	0.1	0.8	0.03	0.06	39.7
Approach		308	6.5	308	6.5	0.184	0.4	NA	0.1	0.8	0.03	0.06	34.9
West: Bathurst Street													
10	L2	9	0.0	9	0.0	0.666	10.4	LOS A	4.4	31.1	0.75	1.13	21.0
12	R2	276	0.4	276	0.4	0.666	17.2	LOS B	4.4	31.1	0.75	1.13	21.0
Approach		285	0.4	285	0.4	0.666	16.9	LOS B	4.4	31.1	0.75	1.13	21.0
All Vehicles		892	4.3	892	4.3	0.666	6.0	NA	4.4	31.1	0.25	0.45	28.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.0 %
Number of Iterations: 5 (maximum specified: 10)

2018 AM Peak (8-9AM) – (I-6) Bathurst St / Pitt Town Rd / Glebe Rd

LANE SUMMARY

Site: 6 [Site 6 - Bathurst St / Pitt Town Rd / Glebe Rd 8-9AM]

Network: N101 [Pitt Town Network AM]

Site 6 - Bathurst St / Pitt Town Rd / Glebe Rd
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Pitt Town Road															
Lane 1	302	5.6	302	5.6	1662	0.182	100	3.2	LOS A	0.1	1.1	Full	100	0.0	0.0
Approach	302	5.6	302	5.6		0.182		3.2	NA	0.1	1.1				
East: Glebe Road															
Lane 1	19	0.0	19	0.0	324	0.059	100	15.0	LOS B	0.2	1.3	Full	900	0.0	0.0
Approach	19	0.0	19	0.0		0.059		15.0	LOS B	0.2	1.3				
North: Bathurst Street															
Lane 1	573	3.7	573	3.7	1843	0.311	100	0.1	LOS A	0.0	0.0	Full	110	0.0	0.0
Approach	573	3.7	573	3.7		0.311		0.1	NA	0.0	0.0				
Intersection	894	4.3	894	4.3		0.311		1.4	NA	0.2	1.3				

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.0 %
Number of Iterations: 5 (maximum specified: 10)

MOVEMENT SUMMARY

Site: 6 [Site 6 - Bathurst St / Pitt Town Rd / Glebe Rd 8-9AM]

Network: N101 [Pitt Town Network AM]

Site 6 - Bathurst St / Pitt Town Rd / Glebe Rd
Giveway / Yield (Two-Way)

Movement Performance Vehicles													
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Pitt Town Road													
2	T1	293	5.8	293	5.8	0.182	3.0	LOS A	0.1	1.1	0.05	0.41	40.1
3	R2	9	0.0	9	0.0	0.182	9.6	LOS A	0.1	1.1	0.05	0.41	61.3
Approach		302	5.6	302	5.6	0.182	3.2	NA	0.1	1.1	0.05	0.41	43.4
East: Glebe Road													
4	L2	13	0.0	13	0.0	0.059	12.9	LOS A	0.2	1.3	0.67	0.86	51.7
6	R2	6	0.0	6	0.0	0.059	19.7	LOS B	0.2	1.3	0.67	0.86	53.0
Approach		19	0.0	19	0.0	0.059	15.0	LOS B	0.2	1.3	0.67	0.86	52.0
North: Bathurst Street													
7	L2	6	0.0	6	0.0	0.311	2.8	LOS A	0.0	0.0	0.00	0.01	35.5
8	T1	567	3.7	567	3.7	0.311	0.0	LOS A	0.0	0.0	0.00	0.01	36.7
Approach		573	3.7	573	3.7	0.311	0.1	NA	0.0	0.0	0.00	0.01	36.7
All Vehicles		894	4.3	894	4.3	0.311	1.4	NA	0.2	1.3	0.03	0.16	39.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.0 %
Number of Iterations: 5 (maximum specified: 10)

2018 PM Peak (3-4PM) – (I-1) Cattai Rd / Buckingham St

LANE SUMMARY

Site: 1 [Site 1 - Cattai Rd / Buckingham St 3-4PM] Network: N101 [Pitt Town Network PM]

Site 1 - Cattai Rd / Buckingham St
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Cattai Rd															
Lane 1	170	7.6	170	7.6	1724	0.099	100	0.2	LOS A	0.0	0.0	Full	300	0.0	0.0
Approach	170	7.6	170	7.6		0.099		0.2	NA	0.0	0.0				
North: Cattai Rd															
Lane 1	194	6.7	194	6.7	1623	0.120	100	0.7	LOS A	0.1	1.1	Full	100	0.0	0.0
Approach	194	6.7	194	6.7		0.120		0.7	NA	0.1	1.1				
West: Buckingham Street															
Lane 1	12	0.0	12	0.0	791	0.015	100	5.9	LOS A	0.1	0.4	Full	400	0.0	0.0
Approach	12	0.0	12	0.0		0.015		5.9	LOS A	0.1	0.4				
Intersection	376	6.9	376	6.9		0.120		0.6	NA	0.1	1.1				

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.1 %
Number of Iterations: 5 (maximum specified: 10)

MOVEMENT SUMMARY

Site: 1 [Site 1 - Cattai Rd / Buckingham St 3-4PM] Network: N101 [Pitt Town Network PM]

Site 1 - Cattai Rd / Buckingham St
Giveway / Yield (Two-Way)

Movement Performance Vehicles													
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Cattai Rd													
1	L2	6	0.0	6	0.0	0.099	5.5	LOS A	0.0	0.0	0.00	0.02	57.4
2	T1	164	7.9	164	7.9	0.099	0.0	LOS A	0.0	0.0	0.00	0.02	59.5
Approach		170	7.6	170	7.6	0.099	0.2	NA	0.0	0.0	0.00	0.02	59.3
North: Cattai Rd													
8	T1	175	7.4	175	7.4	0.120	0.1	LOS A	0.1	1.1	0.06	0.06	53.3
9	R2	19	0.0	19	0.0	0.120	6.2	LOS A	0.1	1.1	0.06	0.06	48.6
Approach		194	6.7	194	6.7	0.120	0.7	NA	0.1	1.1	0.06	0.06	51.6
West: Buckingham Street													
10	L2	11	0.0	11	0.0	0.015	5.7	LOS A	0.1	0.4	0.31	0.54	32.9
12	R2	1	0.0	1	0.0	0.015	7.6	LOS A	0.1	0.4	0.31	0.54	41.8
Approach		12	0.0	12	0.0	0.015	5.9	LOS A	0.1	0.4	0.31	0.54	33.4
All Vehicles		376	6.9	376	6.9	0.120	0.6	NA	0.1	1.1	0.04	0.06	54.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.1 %
Number of Iterations: 5 (maximum specified: 10)

2018 PM Peak (3-4PM) – (I-2) Cattai Rd / Eldon St / Old Pitt Town Rd

LANE SUMMARY

Site: 2 [Site 2 - Cattai Rd / Eldon St / Old Pitt Town Rd 3-4PM] **Network: N101 [Pitt Town Network PM]**

Site 2 - Cattai Rd / Eldon St / Old Pitt Town Rd
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: Old Pitt Town Road															
Lane 1	90	2.2	90	2.2	772	0.117	100	4.8	LOS A	0.4	2.9	Full	550	0.0	0.0
Approach	90	2.2	90	2.2		0.117		4.8	LOS A	0.4	2.9				
North: Cattai Road															
Lane 1	177	7.3	177	7.3	1651	0.107	100	5.7	LOS A	0.5	4.0	Full	300	0.0	0.0
Approach	177	7.3	177	7.3		0.107		5.7	NA	0.5	4.0				
West: Eldon Street															
Lane 1	189	6.9	189	6.9	1646	0.115	100	5.0	LOS A	0.0	0.0	Full	300	0.0	0.0
Approach	189	6.9	189	6.9		0.115		5.0	NA	0.0	0.0				
Intersection	456	6.1	456	6.1		0.117		5.2	NA	0.5	4.0				

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.1 %
Number of Iterations: 5 (maximum specified: 10)

MOVEMENT SUMMARY

Site: 2 [Site 2 - Cattai Rd / Eldon St / Old Pitt Town Rd 3-4PM]

Network: N101 [Pitt Town Network PM]

Site 2 - Cattai Rd / Eldon St / Old Pitt Town Rd
Giveway / Yield (Two-Way)

Movement Performance Vehicles													
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Old Pitt Town Road													
5	T1	81	2.5	81	2.5	0.117	4.5	LOS A	0.4	2.9	0.32	0.55	44.8
6	R2	9	0.0	9	0.0	0.117	8.0	LOS A	0.4	2.9	0.32	0.55	44.8
Approach		90	2.2	90	2.2	0.117	4.8	LOS A	0.4	2.9	0.32	0.55	44.8
North: Cattai Road													
7	L2	1	0.0	1	0.0	0.107	5.7	LOS A	0.5	4.0	0.10	0.57	47.8
9	R2	176	7.4	176	7.4	0.107	5.7	LOS A	0.5	4.0	0.10	0.57	45.7
Approach		177	7.3	177	7.3	0.107	5.7	NA	0.5	4.0	0.10	0.57	45.7
West: Eldon Street													
10	L2	161	8.1	161	8.1	0.115	5.7	LOS A	0.0	0.0	0.00	0.52	47.8
11	T1	28	0.0	28	0.0	0.115	1.1	LOS A	0.0	0.0	0.00	0.52	55.3
Approach		189	6.9	189	6.9	0.115	5.0	NA	0.0	0.0	0.00	0.52	50.0
All Vehicles		456	6.1	456	6.1	0.117	5.2	NA	0.5	4.0	0.10	0.55	47.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.1 %
Number of Iterations: 5 (maximum specified: 10)

2018 PM Peak (3-4PM) – (I-3) Eldon St / Liverpool St / Wellesley St

LANE SUMMARY

Site: 3 [Site 3 - Eldon St / Liverpool St / Wellesley St 3-4PM] **Network: N101 [Pitt Town Network PM]**

Site 3 - Eldon St / Liverpool St / Wellesley St
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Wellesley Street															
Lane 1	10	10.0	10	10.0	596	0.017	100	7.3	LOS A	0.1	0.4	Full	400	0.0	0.0
Approach	10	10.0	10	10.0		0.017		7.3	LOS A	0.1	0.4				
East: Eldon Street															
Lane 1	258	6.2	258	6.2	1579	0.163	100	1.1	LOS A	0.3	2.0	Full	300	0.0	0.0
Approach	258	6.2	258	6.2		0.163		1.1	NA	0.3	2.0				
North: Liverpool Street															
Lane 1	29	0.0	29	0.0	602	0.048	100	7.2	LOS A	0.2	1.1	Full	200	0.0	0.0
Approach	29	0.0	29	0.0		0.048		7.2	LOS A	0.2	1.1				
West: Eldon Street															
Lane 1	201	6.5	201	6.5	1631	0.123	100	1.0	LOS A	0.1	1.1	Full	100	0.0	0.0
Approach	201	6.5	201	6.5		0.123		1.0	NA	0.1	1.1				
Intersection	498	6.0	498	6.0		0.163		1.5	NA	0.3	2.0				

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.1 %
Number of Iterations: 5 (maximum specified: 10)

MOVEMENT SUMMARY

Site: 3 [Site 3 - Eldon St / Liverpool St / Wellesley St 3-4PM]

Network: N101 [Pitt Town Network PM]

Site 3 - Eldon St / Liverpool St / Wellesley St
Giveway / Yield (Two-Way)

Movement Performance Vehicles													
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Wellesley Street													
1	L2	6	16.7	6	16.7	0.017	6.7	LOS A	0.1	0.4	0.41	0.60	40.3
2	T1	1	0.0	1	0.0	0.017	6.5	LOS A	0.1	0.4	0.41	0.60	42.5
3	R2	3	0.0	3	0.0	0.017	8.7	LOS A	0.1	0.4	0.41	0.60	40.3
Approach		10	10.0	10	10.0	0.017	7.3	LOS A	0.1	0.4	0.41	0.60	40.6
East: Eldon Street													
4	L2	5	0.0	5	0.0	0.163	6.4	LOS A	0.3	2.0	0.09	0.09	51.8
5	T1	220	7.3	220	7.3	0.163	0.2	LOS A	0.3	2.0	0.09	0.09	56.2
6	R2	33	0.0	33	0.0	0.163	6.4	LOS A	0.3	2.0	0.09	0.09	51.6
Approach		258	6.2	258	6.2	0.163	1.1	NA	0.3	2.0	0.09	0.09	55.1
North: Liverpool Street													
7	L2	12	0.0	12	0.0	0.048	5.9	LOS A	0.2	1.1	0.39	0.62	34.0
8	T1	5	0.0	5	0.0	0.048	6.7	LOS A	0.2	1.1	0.39	0.62	42.5
9	R2	12	0.0	12	0.0	0.048	8.8	LOS A	0.2	1.1	0.39	0.62	34.0
Approach		29	0.0	29	0.0	0.048	7.2	LOS A	0.2	1.1	0.39	0.62	36.8
West: Eldon Street													
10	L2	12	0.0	12	0.0	0.123	6.2	LOS A	0.1	1.1	0.07	0.08	49.0
11	T1	174	7.5	174	7.5	0.123	0.1	LOS A	0.1	1.1	0.07	0.08	51.7
12	R2	15	0.0	15	0.0	0.123	6.5	LOS A	0.1	1.1	0.07	0.08	48.4
Approach		201	6.5	201	6.5	0.123	1.0	NA	0.1	1.1	0.07	0.08	50.5
All Vehicles		498	6.0	498	6.0	0.163	1.5	NA	0.3	2.0	0.10	0.13	51.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.1 %
Number of Iterations: 5 (maximum specified: 10)

2018 PM Peak (3-4PM) – (I-4) Eldon St / Chatham St

LANE SUMMARY

Site: 4 [Site 4 - Eldon St / Chatham St 3-4PM] **Network: N101 [Pitt Town Network PM]**

Site 4 - Eldon St / Chatham St
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Chatham Street															
Lane 1	176	6.3	176	6.3	1416	0.124	100	5.2	LOS A	0.6	4.3	Full	100	0.0	0.0
Approach	176	6.3	176	6.3		0.124		5.2	NA	0.6	4.3				
East: Eldon Street															
Lane 1	238	7.1	238	7.1	1605	0.148	100	4.7	LOS A	0.0	0.2	Full	100	0.0	0.0
Approach	238	7.1	238	7.1		0.148		4.7	NA	0.0	0.2				
North: Chatham Street															
Lane 1	29	0.0	29	0.0	632	0.046	100	6.3	LOS A	0.2	1.1	Full	180	0.0	0.0
Approach	29	0.0	29	0.0		0.046		6.3	LOS A	0.2	1.1				
West: Eldon Street															
Lane 1	82	2.4	82	2.4	746	0.110	100	5.2	LOS A	0.4	2.8	Full	100	0.0	0.0
Approach	82	2.4	82	2.4		0.110		5.2	LOS A	0.4	2.8				
Intersection	525	5.7	525	5.7		0.148		5.1	NA	0.6	4.3				

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.1 %
Number of Iterations: 5 (maximum specified: 10)

MOVEMENT SUMMARY

Site: 4 [Site 4 - Eldon St / Chatham St 3-4PM]

Network: N101 [Pitt Town Network PM]

Site 4 - Eldon St / Chatham St
Giveway / Yield (Two-Way)

Movement Performance Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Chatham Street													
1	L2	21	0.0	21	0.0	0.124	5.9	LOS A	0.6	4.3	0.15	0.53	37.8
2	T1	18	0.0	18	0.0	0.124	1.3	LOS A	0.6	4.3	0.15	0.53	41.7
3	R2	137	8.0	137	8.0	0.124	5.6	LOS A	0.6	4.3	0.15	0.53	32.8
Approach		176	6.3	176	6.3	0.124	5.2	NA	0.6	4.3	0.15	0.53	35.2
East: Eldon Street													
4	L2	191	8.4	191	8.4	0.148	5.6	LOS A	0.0	0.2	0.00	0.51	35.7
5	T1	44	2.3	44	2.3	0.148	1.1	LOS A	0.0	0.2	0.00	0.51	41.2
6	R2	3	0.0	3	0.0	0.148	5.6	LOS A	0.0	0.2	0.00	0.51	40.7
Approach		238	7.1	238	7.1	0.148	4.7	NA	0.0	0.2	0.00	0.51	37.3
North: Chatham Street													
7	L2	6	0.0	6	0.0	0.046	6.0	LOS A	0.2	1.1	0.42	0.61	34.3
8	T1	22	0.0	22	0.0	0.046	6.4	LOS A	0.2	1.1	0.42	0.61	34.3
9	R2	1	0.0	1	0.0	0.046	5.7	LOS A	0.2	1.1	0.42	0.61	36.4
Approach		29	0.0	29	0.0	0.046	6.3	LOS A	0.2	1.1	0.42	0.61	34.4
West: Eldon Street													
10	L2	9	0.0	9	0.0	0.110	4.7	LOS A	0.4	2.8	0.20	0.53	39.0
11	T1	58	3.4	58	3.4	0.110	4.4	LOS A	0.4	2.8	0.20	0.53	30.2
12	R2	15	0.0	15	0.0	0.110	8.7	LOS A	0.4	2.8	0.20	0.53	30.2
Approach		82	2.4	82	2.4	0.110	5.2	LOS A	0.4	2.8	0.20	0.53	32.0
All Vehicles		525	5.7	525	5.7	0.148	5.1	NA	0.6	4.3	0.10	0.52	35.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.1 %
Number of Iterations: 5 (maximum specified: 10)

2018 PM Peak (3-4PM) – (I-5) Bathurst St / Chatham St

LANE SUMMARY

Site: 5 [Site 5 - Bathurst St / Chatham St 3-4PM] **Network: N101 [Pitt Town Network PM]**

Site 5 - Bathurst St / Chatham St
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Bathurst Street															
Lane 1	392	3.8	392	3.8	1770	0.221	100	1.6	LOS A	0.0	0.0	Full	90	0.0	0.0
Approach	392	3.8	392	3.8		0.221		1.6	NA	0.0	0.0				
North: Chatham Street															
Lane 1	228	7.0	228	7.0	1591	0.143	100	0.8	LOS A	0.2	1.2	Full	100	0.0	0.0
Approach	228	7.0	228	7.0		0.143		0.8	NA	0.2	1.2				
West: Bathurst Street															
Lane 1	155	0.0	155	0.0	461	0.336	100	11.1	LOS A	1.4	9.8	Full	160	0.0	0.0
Approach	155	0.0	155	0.0		0.336		11.1	LOS A	1.4	9.8				
Intersection	775	4.0	775	4.0		0.336		3.3	NA	1.4	9.8				

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.1 %
Number of Iterations: 5 (maximum specified: 10)

MOVEMENT SUMMARY

Site: 5 [Site 5 - Bathurst St / Chatham St 3-4PM] Network: N101 [Pitt Town Network PM]

Site 5 - Bathurst St / Chatham St
Giveway / Yield (Two-Way)

Movement Performance Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Bathurst Street													
1	L2	227	1.8	227	1.8	0.221	2.8	LOS A	0.0	0.0	0.00	0.24	34.2
2	T1	165	6.7	165	6.7	0.221	0.0	LOS A	0.0	0.0	0.00	0.24	30.5
Approach		392	3.8	392	3.8	0.221	1.6	NA	0.0	0.0	0.00	0.24	33.3
North: Chatham Street													
8	T1	213	7.5	213	7.5	0.143	0.5	LOS A	0.2	1.2	0.07	0.08	33.6
9	R2	15	0.0	15	0.0	0.143	5.2	LOS A	0.2	1.2	0.07	0.08	39.2
Approach		228	7.0	228	7.0	0.143	0.8	NA	0.2	1.2	0.07	0.08	34.3
West: Bathurst Street													
10	L2	11	0.0	11	0.0	0.336	6.8	LOS A	1.4	9.8	0.57	0.85	26.3
12	R2	144	0.0	144	0.0	0.336	11.4	LOS A	1.4	9.8	0.57	0.85	26.3
Approach		155	0.0	155	0.0	0.336	11.1	LOS A	1.4	9.8	0.57	0.85	26.3
All Vehicles		775	4.0	775	4.0	0.336	3.3	NA	1.4	9.8	0.13	0.31	31.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.1 %
Number of Iterations: 5 (maximum specified: 10)

2018 PM Peak (3-4PM) – (I-6) Bathurst St / Pitt Town Rd / Glebe Rd

LANE SUMMARY

Site: 6 [Site 6 - Bathurst St / Pitt Town Rd / Glebe Rd 3-4PM] **Network: N101 [Pitt Town Network PM]**

Site 6 - Bathurst St / Pitt Town Rd / Glebe Rd
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Pitt Town Road															
Lane 1	396	4.0	396	4.0	1745	0.227	100	3.0	LOS A	0.1	0.7	Full	100	0.0	0.0
Approach	396	4.0	396	4.0		0.227		3.0	NA	0.1	0.7				
East: Glebe Road															
Lane 1	14	0.0	14	0.0	425	0.033	100	11.8	LOS A	0.1	0.7	Full	900	0.0	0.0
Approach	14	0.0	14	0.0		0.033		11.8	LOS A	0.1	0.7				
North: Bathurst Street															
Lane 1	356	4.2	356	4.2	1829	0.195	100	0.1	LOS A	0.0	0.0	Full	110	0.0	0.0
Approach	356	4.2	356	4.2		0.195		0.1	NA	0.0	0.0				
Intersection	766	4.0	766	4.0		0.227		1.8	NA	0.1	0.7				

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.1 %
Number of Iterations: 5 (maximum specified: 10)

MOVEMENT SUMMARY

Site: 6 [Site 6 - Bathurst St / Pitt Town Rd / Glebe Rd 3-4PM]

Network: N101 [Pitt Town Network PM]

Site 6 - Bathurst St / Pitt Town Rd / Glebe Rd
Giveway / Yield (Two-Way)

Movement Performance Vehicles													
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Pitt Town Road													
2	T1	387	4.1	387	4.1	0.227	2.9	LOS A	0.1	0.7	0.03	0.41	41.2
3	R2	9	0.0	9	0.0	0.227	7.7	LOS A	0.1	0.7	0.03	0.41	61.5
Approach		396	4.0	396	4.0	0.227	3.0	NA	0.1	0.7	0.03	0.41	43.7
East: Glebe Road													
4	L2	8	0.0	8	0.0	0.033	9.3	LOS A	0.1	0.7	0.52	0.75	54.1
6	R2	6	0.0	6	0.0	0.033	15.2	LOS B	0.1	0.7	0.52	0.75	55.9
Approach		14	0.0	14	0.0	0.033	11.8	LOS A	0.1	0.7	0.52	0.75	54.8
North: Bathurst Street													
7	L2	9	11.1	9	11.1	0.195	2.9	LOS A	0.0	0.0	0.00	0.02	35.5
8	T1	347	4.0	347	4.0	0.195	0.0	LOS A	0.0	0.0	0.00	0.02	36.7
Approach		356	4.2	356	4.2	0.195	0.1	NA	0.0	0.0	0.00	0.02	36.6
All Vehicles		766	4.0	766	4.0	0.227	1.8	NA	0.1	0.7	0.02	0.24	40.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.1 %
Number of Iterations: 5 (maximum specified: 10)

2021 – Future with Bypass

2021 AM Peak (8-9AM) – (I-1) Cattai Rd / Buckingham St

LANE SUMMARY

Site: 1 [Upgraded Site 1 - Cattai Rd / Buckingham St 8-9AM]

Network: N101 [2021 AM - bypass]

Site 1 - Cattai Rd / Buckingham St
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Cattai Road															
Lane 1	3	0.0	3	0.0	1854	0.002	100	6.4	LOS A	0.0	0.0	Short	85	0.0	NA
Lane 2	121	14.9	121	14.9	1581	0.077	100	0.0	LOS A	0.0	0.0	Full	200	0.0	0.0
Approach	124	14.5	124	14.5		0.077		0.2	NA	0.0	0.0				
North: Cattai Road															
Lane 1	239	8.8	239	8.8	1714	0.139	100	0.0	LOS A	0.0	0.0	Full	100	0.0	0.0
Approach	239	8.8	239	8.8		0.139		0.0	NA	0.0	0.0				
West: Buckingham Street															
Lane 1	24	0.0	24	0.0	1457	0.016	100	5.9	LOS A	0.1	0.5	Full	430	0.0	0.0
Approach	24	0.0	24	0.0		0.016		5.9	LOS A	0.1	0.5				
Intersection	387	10.1	387	10.1		0.139		0.4	NA	0.1	0.5				

MOVEMENT SUMMARY

Site: 1 [Upgraded Site 1 - Cattai Rd / Buckingham St 8-9AM]

Network: N101 [2021 AM - bypass]

Site 1 - Cattai Rd / Buckingham St
Giveway / Yield (Two-Way)

Movement Performance Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Cattai Road													
1	L2	3	0.0	3	0.0	0.002	6.4	LOS A	0.0	0.0	0.00	0.61	55.1
31	T1	121	14.9	121	14.9	0.077	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
Approach		124	14.5	124	14.5	0.077	0.2	NA	0.0	0.0	0.00	0.01	69.1
North: Cattai Road													
25	T1	239	8.8	239	8.8	0.139	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
Approach		239	8.8	239	8.8	0.139	0.0	NA	0.0	0.0	0.00	0.00	70.0
West: Buckingham Street													
10	L2	24	0.0	24	0.0	0.016	5.9	LOS A	0.1	0.5	0.23	0.54	47.1
Approach		24	0.0	24	0.0	0.016	5.9	LOS A	0.1	0.5	0.23	0.54	47.1
All Vehicles		387	10.1	387	10.1	0.139	0.4	NA	0.1	0.5	0.01	0.04	64.4

2021 AM Peak (8-9AM) – (I-2) Cattai Rd / Eldon St / Old Pitt Town Rd

LANE SUMMARY

Site: 8 [Upgraded Site 2 - Cattai Rd / Eldon St / Old Pitt Town Rd 8-9AM]

Network: N101 [2021 AM - bypass]

Upgraded Site 2 - Cattai Rd / Eldon St / Old Pitt Town Rd
Roundabout

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Bypass															
Lane 1 d	115	12.2	115	12.2	1153	0.100	100	5.8	LOS A	0.6	4.5	Full	450	0.0	0.0
Approach	115	12.2	115	12.2		0.100		5.8	LOS A	0.6	4.5				
East: Old Pitt Town Road															
Lane 1 d	33	3.0	33	3.0	1107	0.030	100	5.8	LOS A	0.2	1.2	Full	370	0.0	0.0
Approach	33	3.0	33	3.0		0.030		5.8	LOS A	0.2	1.2				
North: Cattai Road															
Lane 1 d	274	8.0	274	8.0	1363	0.201	100	7.7	LOS A	1.3	10.0	Full	200	0.0	0.0
Approach	274	8.0	274	8.0		0.201		7.7	LOS A	1.3	10.0				
West: Eldon Street															
Lane 1 d	69	5.8	69	5.8	1222	0.056	100	4.8	LOS A	0.3	2.3	Full	490	0.0	0.0
Approach	69	5.8	69	5.8		0.056		4.8	LOS A	0.3	2.3				
Intersection	491	8.4	491	8.4		0.201		6.7	LOS A	1.3	10.0				

MOVEMENT SUMMARY

Site: 8 [Upgraded Site 2 - Cattai Rd / Eldon St / Old Pitt Town Rd 8-9AM]

Network: N101 [2021 AM - bypass]

Upgraded Site 2 - Cattai Rd / Eldon St / Old Pitt Town Rd
Roundabout

Movement Performance Vehicles													
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Bypass													
1	L2	1	0.0	1	0.0	0.100	5.1	LOS A	0.6	4.5	0.34	0.46	54.8
2	T1	113	12.4	113	12.4	0.100	5.7	LOS A	0.6	4.5	0.34	0.46	54.8
3	R2	1	0.0	1	0.0	0.100	11.1	LOS A	0.6	4.5	0.34	0.46	59.0
Approach		115	12.2	115	12.2	0.100	5.8	LOS A	0.6	4.5	0.34	0.46	54.9
East: Old Pitt Town Road													
4	L2	17	0.0	17	0.0	0.030	4.8	LOS A	0.2	1.2	0.45	0.50	47.4
5	T1	11	0.0	11	0.0	0.030	4.9	LOS A	0.2	1.2	0.45	0.50	47.4
6	R2	5	20.0	5	20.0	0.030	10.9	LOS A	0.2	1.2	0.45	0.50	47.4
Approach		33	3.0	33	3.0	0.030	5.8	LOS A	0.2	1.2	0.45	0.50	47.4
North: Cattai Road													
7	L2	8	0.0	8	0.0	0.201	4.8	LOS A	1.3	10.0	0.24	0.53	51.0
8	T1	148	10.8	148	10.8	0.201	5.3	LOS A	1.3	10.0	0.24	0.53	42.3
9	R2	118	5.1	118	5.1	0.201	10.9	LOS A	1.3	10.0	0.24	0.53	42.3
Approach		274	8.0	274	8.0	0.201	7.7	LOS A	1.3	10.0	0.24	0.53	42.8
West: Eldon Street													
10	L2	6	50.0	6	50.0	0.056	5.2	LOS A	0.3	2.3	0.32	0.42	50.6
11	T1	57	1.8	57	1.8	0.056	4.2	LOS A	0.3	2.3	0.32	0.42	55.5
12	R2	6	0.0	6	0.0	0.056	9.7	LOS A	0.3	2.3	0.32	0.42	50.6
Approach		69	5.8	69	5.8	0.056	4.8	LOS A	0.3	2.3	0.32	0.42	54.9
All Vehicles		491	8.4	491	8.4	0.201	6.7	LOS A	1.3	10.0	0.29	0.50	49.4

2021 AM Peak (8-9AM) – (I-3) Eldon St / Liverpool St / Wellesley St

LANE SUMMARY

Site: 3 [Upgraded Site 3 - Eldon St / Liverpool St / Wellesley St 8-9AM]

Network: N101 [2021 AM - bypass]

Site 3 - Eldon St / Liverpool St / Wellesley St
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Wellesley Street															
Lane 1	34	2.9	34	2.9	836	0.041	100	5.3	LOS A	0.1	1.0	Full	400	0.0	0.0
Approach	34	2.9	34	2.9		0.041		5.3	LOS A	0.1	1.0				
East: Eldon Street															
Lane 1	141	12.8	141	12.8	1274	0.111	100	2.4	LOS A	0.4	3.0	Full	490	0.0	0.0
Approach	141	12.8	141	12.8		0.111		2.4	NA	0.4	3.0				
North: Liverpool Street															
Lane 1	87	27.6	87	27.6	703	0.124	100	5.9	LOS A	0.5	4.5	Full	200	0.0	0.0
Approach	87	27.6	87	27.6		0.124		5.9	LOS A	0.5	4.5				
West: Eldon Street															
Lane 1	49	8.2	49	8.2	1528	0.032	100	1.5	LOS A	0.1	0.5	Full	100	0.0	0.0
Approach	49	8.2	49	8.2		0.032		1.5	NA	0.1	0.5				
Intersection	311	15.1	311	15.1		0.124		3.6	NA	0.5	4.5				

MOVEMENT SUMMARY

Site: 3 [Upgraded Site 3 - Eldon St / Liverpool St / Wellesley St 8-9AM]

Network: N101 [2021 AM - bypass]

Site 3 - Eldon St / Liverpool St / Wellesley St
Giveway / Yield (Two-Way)

Movement Performance Vehicles													
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Wellesley Street													
1	L2	23	4.3	23	4.3	0.041	5.2	LOS A	0.1	1.0	0.23	0.52	42.5
2	T1	6	0.0	6	0.0	0.041	4.4	LOS A	0.1	1.0	0.23	0.52	44.2
3	R2	5	0.0	5	0.0	0.041	6.6	LOS A	0.1	1.0	0.23	0.52	42.5
Approach		34	2.9	34	2.9	0.041	5.3	LOS A	0.1	1.0	0.23	0.52	42.9
East: Eldon Street													
4	L2	2	50.0	2	50.0	0.111	6.3	LOS A	0.4	3.0	0.09	0.22	51.2
5	T1	86	4.7	86	4.7	0.111	0.1	LOS A	0.4	3.0	0.09	0.22	55.9
6	R2	53	24.5	53	24.5	0.111	6.0	LOS A	0.4	3.0	0.09	0.22	49.0
Approach		141	12.8	141	12.8	0.111	2.4	NA	0.4	3.0	0.09	0.22	52.4
North: Liverpool Street													
7	L2	54	44.4	54	44.4	0.124	5.6	LOS A	0.5	4.5	0.16	0.54	36.8
8	T1	2	0.0	2	0.0	0.124	4.6	LOS A	0.5	4.5	0.16	0.54	43.9
9	R2	31	0.0	31	0.0	0.124	6.4	LOS A	0.5	4.5	0.16	0.54	36.8
Approach		87	27.6	87	27.6	0.124	5.9	LOS A	0.5	4.5	0.16	0.54	37.1
West: Eldon Street													
10	L2	2	0.0	2	0.0	0.032	5.8	LOS A	0.1	0.5	0.07	0.15	47.5
11	T1	37	10.8	37	10.8	0.032	0.1	LOS A	0.1	0.5	0.07	0.15	47.4
12	R2	10	0.0	10	0.0	0.032	5.8	LOS A	0.1	0.5	0.07	0.15	47.5
Approach		49	8.2	49	8.2	0.032	1.5	NA	0.1	0.5	0.07	0.15	47.4
All Vehicles		311	15.1	311	15.1	0.124	3.6	NA	0.5	4.5	0.12	0.33	47.8

2021 AM Peak (8-9AM) – (I-4) Eldon St / Chatham St

LANE SUMMARY

Site: 4 [Site 4 - Eldon St / Chatham St 8-9AM]

Network: N101 [2021 AM - bypass]

Site 4 - Eldon St / Chatham St
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Chatham Street															
Lane 1	60	5.0	60	5.0	1011	0.059	100	2.0	LOS A	0.2	1.6	Full	50	0.0	0.0
Approach	60	5.0	60	5.0		0.059		2.0	NA	0.2	1.6				
East: Eldon Street															
Lane 1	139	3.6	139	3.6	1369	0.102	100	4.0	LOS A	0.5	3.3	Full	100	0.0	0.0
Approach	139	3.6	139	3.6		0.102		4.0	NA	0.5	3.3				
North: Chatham Street															
Lane 1	87	0.0	87	0.0	844	0.103	100	4.6	LOS A	0.4	2.5	Full	180	0.0	0.0
Approach	87	0.0	87	0.0		0.103		4.6	LOS A	0.4	2.5				
West: Eldon Street															
Lane 1	49	2.0	49	2.0	852	0.058	100	4.5	LOS A	0.2	1.4	Full	100	0.0	0.0
Approach	49	2.0	49	2.0		0.058		4.5	LOS A	0.2	1.4				
Intersection	335	2.7	335	2.7		0.103		3.9	NA	0.5	3.3				

MOVEMENT SUMMARY

Site: 4 [Site 4 - Eldon St / Chatham St 8-9AM]

Network: N101 [2021 AM - bypass]

Site 4 - Eldon St / Chatham St
Giveway / Yield (Two-Way)

Movement Performance Vehicles													
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Chatham Street													
1	L2	15	0.0	15	0.0	0.059	4.2	LOS A	0.2	1.6	0.14	0.33	42.9
2	T1	40	0.0	40	0.0	0.059	0.9	LOS A	0.2	1.6	0.14	0.33	46.8
3	R2	5	60.0	5	60.0	0.059	4.0	LOS A	0.2	1.6	0.14	0.33	39.3
Approach		60	5.0	60	5.0	0.059	2.0	NA	0.2	1.6	0.14	0.33	45.7
East: Eldon Street													
4	L2	87	4.6	87	4.6	0.102	5.6	LOS A	0.5	3.3	0.04	0.44	37.4
5	T1	49	2.0	49	2.0	0.102	1.1	LOS A	0.5	3.3	0.04	0.44	42.4
6	R2	3	0.0	3	0.0	0.102	5.7	LOS A	0.5	3.3	0.04	0.44	41.6
Approach		139	3.6	139	3.6	0.102	4.0	NA	0.5	3.3	0.04	0.44	39.9
North: Chatham Street													
7	L2	12	0.0	12	0.0	0.103	4.8	LOS A	0.4	2.5	0.23	0.51	37.5
8	T1	65	0.0	65	0.0	0.103	4.3	LOS A	0.4	2.5	0.23	0.51	37.5
9	R2	10	0.0	10	0.0	0.103	5.8	LOS A	0.4	2.5	0.23	0.51	38.7
Approach		87	0.0	87	0.0	0.103	4.6	LOS A	0.4	2.5	0.23	0.51	37.7
West: Eldon Street													
10	L2	4	0.0	4	0.0	0.058	4.8	LOS A	0.2	1.4	0.15	0.50	40.1
11	T1	32	3.1	32	3.1	0.058	3.5	LOS A	0.2	1.4	0.15	0.50	32.1
12	R2	13	0.0	13	0.0	0.058	6.6	LOS A	0.2	1.4	0.15	0.50	32.1
Approach		49	2.0	49	2.0	0.058	4.5	LOS A	0.2	1.4	0.15	0.50	33.3
All Vehicles		335	2.7	335	2.7	0.103	3.9	NA	0.5	3.3	0.12	0.45	39.5

2021 AM Peak (8-9AM) – (I-5) Bathurst St / Chatham St

LANE SUMMARY

Site: 5 [Site 5 - Bathurst St / Chatham St 8-9AM]

Network: N101 [2021 AM - bypass]

Site 5 - Bathurst St / Chatham St
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
SouthEast: Bathurst															
Lane 1	211	1.9	211	1.9	1856	0.114	100	2.7	LOS A	0.0	0.0	Full	90	0.0	0.0
Approach	211	1.9	211	1.9		0.114		2.7	NA	0.0	0.0				
North: Chatham Street															
Lane 1	164	2.4	164	2.4	1697	0.097	100	3.0	LOS A	0.1	0.7	Full	50	0.0	0.0
Approach	164	2.4	164	2.4		0.097		3.0	NA	0.1	0.7				
West: Bathurst Street															
Lane 1	307	0.3	307	0.3	1041	0.295	100	4.9	LOS A	0.8	5.6	Full	160	0.0	0.0
Approach	307	0.3	307	0.3		0.295		4.9	LOS A	0.8	5.6				
Intersection	682	1.3	682	1.3		0.295		3.8	NA	0.8	5.6				

MOVEMENT SUMMARY

Site: 5 [Site 5 - Bathurst St / Chatham St 8-9AM]

Network: N101 [2021 AM - bypass]

Site 5 - Bathurst St / Chatham St
Giveway / Yield (Two-Way)

Movement Performance Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Bathurst													
21a	L1	161	0.6	161	0.6	0.114	2.8	LOS A	0.0	0.0	0.00	0.43	31.8
23a	R1	50	6.0	50	6.0	0.114	2.4	LOS A	0.0	0.0	0.00	0.43	27.7
Approach		211	1.9	211	1.9	0.114	2.7	NA	0.0	0.0	0.00	0.43	31.3
North: Chatham Street													
7a	L1	152	2.6	152	2.6	0.097	2.9	LOS A	0.1	0.7	0.05	0.42	23.5
9	R2	12	0.0	12	0.0	0.097	3.9	LOS A	0.1	0.7	0.05	0.42	35.6
Approach		164	2.4	164	2.4	0.097	3.0	NA	0.1	0.7	0.05	0.42	25.5
West: Bathurst Street													
10	L2	10	0.0	10	0.0	0.295	5.0	LOS A	0.8	5.6	0.25	0.59	35.5
12a	R1	297	0.3	297	0.3	0.295	4.9	LOS A	0.8	5.6	0.25	0.59	35.5
Approach		307	0.3	307	0.3	0.295	4.9	LOS A	0.8	5.6	0.25	0.59	35.5
All Vehicles		682	1.3	682	1.3	0.295	3.8	NA	0.8	5.6	0.13	0.50	32.3

2021 AM Peak (8-9AM) – (I-6) Bathurst St / Pitt Town Rd / Glebe Rd

LANE SUMMARY

Site: 9 [Upgraded Site 6 - Bathurst St / Pitt Town Rd / Glebe Rd 8-9AM]

Network: N101 [2021 AM - bypass]

Upgraded Site 6 - Bathurst St / Pitt Town Rd / Glebe Rd 8-9AM
Roundabout

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Pitt Town Rd															
Lane 1 d	325	5.5	325	5.5	1638	0.198	100	4.0	LOS A	1.4	10.7	Full	100	0.0	0.0
Approach	325	5.5	325	5.5		0.198		4.0	LOS A	1.4	10.7				
East: glebe															
Lane 1 d	21	0.0	21	0.0	865	0.024	100	7.9	LOS A	0.1	1.0	Full	890	0.0	0.0
Approach	21	0.0	21	0.0		0.024		7.9	LOS A	0.1	1.0				
North: Bypass															
Lane 1 d	175	9.7	175	9.7	889	0.197	100	7.8	LOS A	1.2	9.7	Full	450	0.0	0.0
Approach	175	9.7	175	9.7		0.197		7.8	LOS A	1.2	9.7				
West: Bathurst St															
Lane 1 d	452	1.3	452	1.3	1363	0.332	100	9.8	LOS A	2.2	16.0	Full	110	0.0	0.0
Approach	452	1.3	452	1.3		0.332		9.8	LOS A	2.2	16.0				
Intersection	973	4.2	973	4.2		0.332		7.5	LOS A	2.2	16.0				

MOVEMENT SUMMARY

Site: 9 [Upgraded Site 6 - Bathurst St / Pitt Town Rd / Glebe Rd 8-9AM]

Network: N101 [2021 AM - bypass]

Upgraded Site 6 - Bathurst St / Pitt Town Rd / Glebe Rd 8-9AM
Roundabout

Movement Performance Vehicles													
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Pitt Town Rd													
1	L2	209	1.9	209	1.9	0.198	3.7	LOS A	1.4	10.7	0.08	0.45	42.1
2	T1	106	13.2	106	13.2	0.198	4.1	LOS A	1.4	10.7	0.08	0.45	42.1
3	R2	10	0.0	10	0.0	0.198	9.9	LOS A	1.4	10.7	0.08	0.45	59.0
Approach		325	5.5	325	5.5	0.198	4.0	LOS A	1.4	10.7	0.08	0.45	44.7
East: glebe													
4	L2	14	0.0	14	0.0	0.024	6.8	LOS A	0.1	1.0	0.66	0.60	52.3
5	T1	3	0.0	3	0.0	0.024	6.8	LOS A	0.1	1.0	0.66	0.60	52.4
6	R2	4	0.0	4	0.0	0.024	12.5	LOS A	0.1	1.0	0.66	0.60	52.4
Approach		21	0.0	21	0.0	0.024	7.9	LOS A	0.1	1.0	0.66	0.60	52.3
North: Bypass													
7	L2	1	0.0	1	0.0	0.197	7.0	LOS A	1.2	9.7	0.64	0.66	56.7
8	T1	173	9.8	173	9.8	0.197	7.8	LOS A	1.2	9.7	0.64	0.66	52.1
9	R2	1	0.0	1	0.0	0.197	13.2	LOS A	1.2	9.7	0.64	0.66	51.9
Approach		175	9.7	175	9.7	0.197	7.8	LOS A	1.2	9.7	0.64	0.66	52.1
West: Bathurst St													
10	L2	3	0.0	3	0.0	0.332	4.2	LOS A	2.2	16.0	0.37	0.61	30.1
11	T1	6	0.0	6	0.0	0.332	4.2	LOS A	2.2	16.0	0.37	0.61	52.6
12	R2	443	1.4	443	1.4	0.332	10.0	LOS A	2.2	16.0	0.37	0.61	34.1
Approach		452	1.3	452	1.3	0.332	9.8	LOS A	2.2	16.0	0.37	0.61	34.7
All Vehicles		973	4.2	973	4.2	0.332	7.5	LOS A	2.2	16.0	0.33	0.56	42.0

2021 PM Peak (3-4PM) – (I-1) Cattai Rd / Buckingham St

LANE SUMMARY

Site: 1 [Upgraded Site 1 - Cattai Rd / Buckingham St 3-4PM]

Network: N101 [2021 PM - bypass]

Site 1 - Cattai Rd / Buckingham St
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Cattai Road															
Lane 1	6	0.0	6	0.0	1854	0.003	100	6.4	LOS A	0.0	0.0	Short	85	0.0	NA
Lane 2	176	8.0	176	8.0	1730	0.102	100	0.0	LOS A	0.0	0.0	Full	200	0.0	0.0
Approach	182	7.7	182	7.7		0.102		0.2	NA	0.0	0.0				
North: Cattai Road															
Lane 1	188	7.4	188	7.4	1746	0.108	100	0.0	LOS A	0.0	0.0	Full	100	0.0	0.0
Approach	188	7.4	188	7.4		0.108		0.0	NA	0.0	0.0				
West: Buckingham Street															
Lane 1	12	0.0	12	0.0	1388	0.009	100	6.1	LOS A	0.0	0.2	Full	430	0.0	0.0
Approach	12	0.0	12	0.0		0.009		6.1	LOS A	0.0	0.2				
Intersection	382	7.3	382	7.3		0.108		0.3	NA	0.0	0.2				

MOVEMENT SUMMARY

Site: 1 [Upgraded Site 1 - Cattai Rd / Buckingham St 3-4PM]

Network: N101 [2021 PM - bypass]

Site 1 - Cattai Rd / Buckingham St
Giveway / Yield (Two-Way)

Movement Performance Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Cattai Road													
1	L2	6	0.0	6	0.0	0.003	6.4	LOS A	0.0	0.0	0.00	0.61	55.1
31	T1	176	8.0	176	8.0	0.102	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
Approach		182	7.7	182	7.7	0.102	0.2	NA	0.0	0.0	0.00	0.02	68.7
North: Cattai Road													
25	T1	188	7.4	188	7.4	0.108	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
Approach		188	7.4	188	7.4	0.108	0.0	NA	0.0	0.0	0.00	0.00	70.0
West: Buckingham Street													
10	L2	12	0.0	12	0.0	0.009	6.1	LOS A	0.0	0.2	0.27	0.54	46.9
Approach		12	0.0	12	0.0	0.009	6.1	LOS A	0.0	0.2	0.27	0.54	46.9
All Vehicles		382	7.3	382	7.3	0.108	0.3	NA	0.0	0.2	0.01	0.03	66.7

2021 PM Peak (3-4PM) – (I-2) Cattai Rd / Eldon St / Old Pitt Town Rd

LANE SUMMARY

Site: 8 [Upgraded Site 2 - Cattai Rd / Eldon St / Old Pitt Town Rd 3-4PM]

Network: N101 [2021 PM - bypass]

Upgraded Site 2 - Cattai Rd / Eldon St / Old Pitt Town Rd
Roundabout

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Bypass															
Lane 1 d	147	8.8	147	8.8	1189	0.124	100	5.7	LOS A	0.7	5.4	Full	450	0.0	0.0
Approach	147	8.8	147	8.8		0.124		5.7	LOS A	0.7	5.4				
East: Old Pitt Town Road															
Lane 1 d	97	2.1	97	2.1	1185	0.082	100	5.2	LOS A	0.4	3.2	Full	370	0.0	0.0
Approach	97	2.1	97	2.1		0.082		5.2	LOS A	0.4	3.2				
North: Cattai Road															
Lane 1 d	210	6.2	210	6.2	1460	0.144	100	7.5	LOS A	0.9	6.8	Full	200	0.0	0.0
Approach	210	6.2	210	6.2		0.144		7.5	LOS A	0.9	6.8				
West: Eldon Street															
Lane 1 d	60	3.3	60	3.3	1198	0.050	100	4.5	LOS A	0.3	2.0	Full	490	0.0	0.0
Approach	60	3.3	60	3.3		0.050		4.5	LOS A	0.3	2.0				
Intersection	514	5.8	514	5.8		0.144		6.2	LOS A	0.9	6.8				

MOVEMENT SUMMARY

Site: 8 [Upgraded Site 2 - Cattai Rd / Eldon St / Old Pitt Town Rd 3-4PM]

Network: N101 [2021 PM - bypass]

Upgraded Site 2 - Cattai Rd / Eldon St / Old Pitt Town Rd
Roundabout

Movement Performance Vehicles													
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Bypass													
1	L2	1	0.0	1	0.0	0.124	5.2	LOS A	0.7	5.4	0.34	0.46	54.9
2	T1	145	9.0	145	9.0	0.124	5.7	LOS A	0.7	5.4	0.34	0.46	54.9
3	R2	1	0.0	1	0.0	0.124	11.1	LOS A	0.7	5.4	0.34	0.46	59.1
Approach		147	8.8	147	8.8	0.124	5.7	LOS A	0.7	5.4	0.34	0.46	54.9
East: Old Pitt Town Road													
4	L2	53	1.9	53	1.9	0.082	4.6	LOS A	0.4	3.2	0.40	0.50	47.9
5	T1	34	2.9	34	2.9	0.082	4.7	LOS A	0.4	3.2	0.40	0.50	47.9
6	R2	10	0.0	10	0.0	0.082	10.2	LOS A	0.4	3.2	0.40	0.50	47.9
Approach		97	2.1	97	2.1	0.082	5.2	LOS A	0.4	3.2	0.40	0.50	47.9
North: Cattai Road													
7	L2	1	0.0	1	0.0	0.144	4.6	LOS A	0.9	6.8	0.16	0.53	51.4
8	T1	117	8.5	117	8.5	0.144	5.1	LOS A	0.9	6.8	0.16	0.53	43.2
9	R2	92	3.3	92	3.3	0.144	10.6	LOS A	0.9	6.8	0.16	0.53	43.2
Approach		210	6.2	210	6.2	0.144	7.5	LOS A	0.9	6.8	0.16	0.53	43.2
West: Eldon Street													
10	L2	29	6.9	29	6.9	0.050	4.4	LOS A	0.3	2.0	0.36	0.44	50.9
11	T1	30	0.0	30	0.0	0.050	4.3	LOS A	0.3	2.0	0.36	0.44	55.9
12	R2	1	0.0	1	0.0	0.050	9.9	LOS A	0.3	2.0	0.36	0.44	50.9
Approach		60	3.3	60	3.3	0.050	4.5	LOS A	0.3	2.0	0.36	0.44	53.9
All Vehicles		514	5.8	514	5.8	0.144	6.2	LOS A	0.9	6.8	0.28	0.49	49.9

2021 PM Peak (3-4PM) – (I-3) Eldon St / Liverpool St / Wellesley St

LANE SUMMARY

Site: 3 [Upgraded Site 3 - Eldon St / Liverpool St / Wellesley St 3-4PM]

Network: N101 [2021 PM - bypass]

Site 3 - Eldon St / Liverpool St / Wellesley St
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Wellesley Street															
Lane 1	10	10.0	10	10.0	766	0.013	100	5.6	LOS A	0.0	0.3	Full	400	0.0	0.0
Approach	10	10.0	10	10.0		0.013		5.6	LOS A	0.0	0.3				
East: Eldon Street															
Lane 1	162	24.7	162	24.7	1009	0.161	100	4.0	LOS A	0.6	5.9	Full	490	0.0	0.0
Approach	162	24.7	162	24.7		0.161		4.0	NA	0.6	5.9				
North: Liverpool Street															
Lane 1	45	28.9	45	28.9	679	0.066	100	5.9	LOS A	0.2	2.3	Full	200	0.0	0.0
Approach	45	28.9	45	28.9		0.066		5.9	LOS A	0.2	2.3				
West: Eldon Street															
Lane 1	77	2.6	77	2.6	1597	0.048	100	2.2	LOS A	0.1	0.8	Full	100	0.0	0.0
Approach	77	2.6	77	2.6		0.048		2.2	NA	0.1	0.8				
Intersection	294	19.0	294	19.0		0.161		3.9	NA	0.6	5.9				

MOVEMENT SUMMARY

Site: 3 [Upgraded Site 3 - Eldon St / Liverpool St / Wellesley St 3-4PM]

Network: N101 [2021 PM - bypass]

Site 3 - Eldon St / Liverpool St / Wellesley St
Giveway / Yield (Two-Way)

Movement Performance Vehicles													
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Wellesley Street													
1	L2	6	16.7	6	16.7	0.013	5.2	LOS A	0.0	0.3	0.20	0.52	42.2
2	T1	1	0.0	1	0.0	0.013	4.8	LOS A	0.0	0.3	0.20	0.52	43.9
3	R2	3	0.0	3	0.0	0.013	6.7	LOS A	0.0	0.3	0.20	0.52	42.2
Approach		10	10.0	10	10.0	0.013	5.6	LOS A	0.0	0.3	0.20	0.52	42.4
East: Eldon Street													
4	L2	5	0.0	5	0.0	0.161	6.0	LOS A	0.6	5.9	0.16	0.34	51.5
5	T1	65	6.2	65	6.2	0.161	0.4	LOS A	0.6	5.9	0.16	0.34	53.9
6	R2	92	39.1	92	39.1	0.161	6.4	LOS A	0.6	5.9	0.16	0.34	46.0
Approach		162	24.7	162	24.7	0.161	4.0	NA	0.6	5.9	0.16	0.34	48.5
North: Liverpool Street													
7	L2	27	48.1	27	48.1	0.066	5.8	LOS A	0.2	2.3	0.19	0.54	36.8
8	T1	5	0.0	5	0.0	0.066	4.9	LOS A	0.2	2.3	0.19	0.54	43.9
9	R2	13	0.0	13	0.0	0.066	6.6	LOS A	0.2	2.3	0.19	0.54	36.8
Approach		45	28.9	45	28.9	0.066	5.9	LOS A	0.2	2.3	0.19	0.54	38.4
West: Eldon Street													
10	L2	13	0.0	13	0.0	0.048	5.7	LOS A	0.1	0.8	0.08	0.22	46.3
11	T1	48	4.2	48	4.2	0.048	0.1	LOS A	0.1	0.8	0.08	0.22	44.0
12	R2	16	0.0	16	0.0	0.048	5.7	LOS A	0.1	0.8	0.08	0.22	46.7
Approach		77	2.6	77	2.6	0.048	2.2	NA	0.1	0.8	0.08	0.22	45.7
All Vehicles		294	19.0	294	19.0	0.161	3.9	NA	0.6	5.9	0.15	0.34	46.9

2021 PM Peak (3-4PM) – (I-4) Eldon St / Chatham St

LANE SUMMARY

Site: 4 [Site 4 - Eldon St / Chatham St 3-4PM]

Network: N101 [2021 PM - bypass]

Site 4 - Eldon St / Chatham St
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Chatham Street															
Lane 1	50	0.0	50	0.0	1055	0.047	100	2.9	LOS A	0.2	1.3	Full	50	0.0	0.0
Approach	50	0.0	50	0.0		0.047		2.9	NA	0.2	1.3				
East: Eldon Street															
Lane 1	83	6.0	83	6.0	1207	0.069	100	3.1	LOS A	0.3	2.5	Full	100	0.0	0.0
Approach	83	6.0	83	6.0		0.069		3.1	NA	0.3	2.5				
North: Chatham Street															
Lane 1	31	0.0	31	0.0	869	0.036	100	4.3	LOS A	0.1	0.8	Full	180	0.0	0.0
Approach	31	0.0	31	0.0		0.036		4.3	LOS A	0.1	0.8				
West: Eldon Street															
Lane 1	89	3.4	89	3.4	910	0.098	100	4.0	LOS A	0.3	2.5	Full	100	0.0	0.0
Approach	89	3.4	89	3.4		0.098		4.0	LOS A	0.3	2.5				
Intersection	253	3.2	253	3.2		0.098		3.5	NA	0.3	2.5				

MOVEMENT SUMMARY

Site: 4 [Site 4 - Eldon St / Chatham St 3-4PM]

Network: N101 [2021 PM - bypass]

Site 4 - Eldon St / Chatham St
Giveway / Yield (Two-Way)

Movement Performance Vehicles													
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Chatham Street													
1	L2	23	0.0	23	0.0	0.047	4.2	LOS A	0.2	1.3	0.14	0.41	39.8
2	T1	19	0.0	19	0.0	0.047	0.9	LOS A	0.2	1.3	0.14	0.41	44.2
3	R2	8	0.0	8	0.0	0.047	4.1	LOS A	0.2	1.3	0.14	0.41	33.3
Approach		50	0.0	50	0.0	0.047	2.9	NA	0.2	1.3	0.14	0.41	41.5
East: Eldon Street													
4	L2	33	12.1	33	12.1	0.069	5.6	LOS A	0.3	2.5	0.05	0.36	41.0
5	T1	47	2.1	47	2.1	0.069	1.1	LOS A	0.3	2.5	0.05	0.36	44.8
6	R2	3	0.0	3	0.0	0.069	5.6	LOS A	0.3	2.5	0.05	0.36	43.2
Approach		83	6.0	83	6.0	0.069	3.1	NA	0.3	2.5	0.05	0.36	43.6
North: Chatham Street													
7	L2	6	0.0	6	0.0	0.036	5.0	LOS A	0.1	0.8	0.24	0.49	37.9
8	T1	24	0.0	24	0.0	0.036	4.1	LOS A	0.1	0.8	0.24	0.49	37.9
9	R2	1	0.0	1	0.0	0.036	5.8	LOS A	0.1	0.8	0.24	0.49	39.0
Approach		31	0.0	31	0.0	0.036	4.3	LOS A	0.1	0.8	0.24	0.49	38.0
West: Eldon Street													
10	L2	10	0.0	10	0.0	0.098	4.7	LOS A	0.3	2.5	0.12	0.48	40.7
11	T1	63	4.8	63	4.8	0.098	3.5	LOS A	0.3	2.5	0.12	0.48	33.2
12	R2	16	0.0	16	0.0	0.098	5.7	LOS A	0.3	2.5	0.12	0.48	33.2
Approach		89	3.4	89	3.4	0.098	4.0	LOS A	0.3	2.5	0.12	0.48	34.8
All Vehicles		253	3.2	253	3.2	0.098	3.5	NA	0.3	2.5	0.12	0.43	39.5

2021 PM Peak (3-4PM) – (I-5) Bathurst St / Chatham St

LANE SUMMARY

Site: 5 [Site 5 - Bathurst St / Chatham St 3-4PM]

Network: N101 [2021 PM - bypass]

Site 5 - Bathurst St / Chatham St
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
SouthEast: Bathurst															
Lane 1	282	1.4	282	1.4	1870	0.151	100	2.8	LOS A	0.0	0.0	Full	90	0.0	0.0
Approach	282	1.4	282	1.4		0.151		2.8	NA	0.0	0.0				
North: Chatham Street															
Lane 1	73	5.5	73	5.5	1439	0.051	100	3.5	LOS A	0.1	0.9	Full	50	0.0	0.0
Approach	73	5.5	73	5.5		0.051		3.5	NA	0.1	0.9				
West: Bathurst Street															
Lane 1	167	0.0	167	0.0	1078	0.155	100	4.6	LOS A	0.4	2.7	Full	160	0.0	0.0
Approach	167	0.0	167	0.0		0.155		4.6	LOS A	0.4	2.7				
Intersection	522	1.5	522	1.5		0.155		3.5	NA	0.4	2.7				

MOVEMENT SUMMARY

Network: N101 [2021 PM - bypass]

Site: 5 [Site 5 - Bathurst St / Chatham St 3-4PM]

Site 5 - Bathurst St / Chatham St
Giveway / Yield (Two-Way)

Movement Performance Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Bathurst													
21a	L1	244	1.6	244	1.6	0.151	2.8	LOS A	0.0	0.0	0.00	0.43	31.8
23a	R1	38	0.0	38	0.0	0.151	2.4	LOS A	0.0	0.0	0.00	0.43	27.6
Approach		282	1.4	282	1.4	0.151	2.8	NA	0.0	0.0	0.00	0.43	31.5
North: Chatham Street													
7a	L1	57	7.0	57	7.0	0.051	3.3	LOS A	0.1	0.9	0.16	0.40	22.5
9	R2	16	0.0	16	0.0	0.051	4.2	LOS A	0.1	0.9	0.16	0.40	35.0
Approach		73	5.5	73	5.5	0.051	3.5	NA	0.1	0.9	0.16	0.40	27.4
West: Bathurst Street													
10	L2	12	0.0	12	0.0	0.155	4.8	LOS A	0.4	2.7	0.17	0.55	36.0
12a	R1	155	0.0	155	0.0	0.155	4.6	LOS A	0.4	2.7	0.17	0.55	36.0
Approach		167	0.0	167	0.0	0.155	4.6	LOS A	0.4	2.7	0.17	0.55	36.0
All Vehicles		522	1.5	522	1.5	0.155	3.5	NA	0.4	2.7	0.08	0.46	32.3

2021 PM Peak (3-4PM) – (I-6) Bathurst St / Pitt Town Rd / Glebe Rd

LANE SUMMARY

Site: 9 [Upgraded Site 6 - Bathurst St / Pitt Town Rd / Glebe Rd 3-4PM]

Network: N101 [2021 PM - bypass]

Upgraded Site 6 - Bathurst St / Pitt Town Rd / Glebe Rd 8-9AM
Roundabout

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Pitt Town Rd															
Lane 1 d	425	3.8	425	3.8	1672	0.254	100	4.0	LOS A	1.9	13.7	Full	100	0.0	0.0
Approach	425	3.8	425	3.8		0.254		4.0	LOS A	1.9	13.7				
East: glebe															
Lane 1 d	16	0.0	16	0.0	1062	0.015	100	6.6	LOS A	0.1	0.6	Full	890	0.0	0.0
Approach	16	0.0	16	0.0		0.015		6.6	LOS A	0.1	0.6				
North: Bypass															
Lane 1 d	174	6.9	174	6.9	1119	0.155	100	6.1	LOS A	0.9	7.1	Full	450	0.0	0.0
Approach	174	6.9	174	6.9		0.155		6.1	LOS A	0.9	7.1				
West: Bathurst St															
Lane 1 d	216	1.9	216	1.9	1270	0.170	100	9.6	LOS A	1.0	7.0	Full	110	0.0	0.0
Approach	216	1.9	216	1.9		0.170		9.6	LOS A	1.0	7.0				
Intersection	831	3.9	831	3.9		0.254		6.0	LOS A	1.9	13.7				

MOVEMENT SUMMARY

Site: 9 [Upgraded Site 6 - Bathurst St / Pitt Town Rd / Glebe Rd 3-4PM]

Network: N101 [2021 PM - bypass]

Upgraded Site 6 - Bathurst St / Pitt Town Rd / Glebe Rd 8-9AM
Roundabout

Movement Performance Vehicles													
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Pitt Town Rd													
1	L2	279	1.4	279	1.4	0.254	3.7	LOS A	1.9	13.7	0.08	0.44	42.2
2	T1	136	8.8	136	8.8	0.254	4.1	LOS A	1.9	13.7	0.08	0.44	42.2
3	R2	10	0.0	10	0.0	0.254	9.9	LOS A	1.9	13.7	0.08	0.44	59.1
Approach		425	3.8	425	3.8	0.254	4.0	LOS A	1.9	13.7	0.08	0.44	44.3
East: glebe													
4	L2	9	0.0	9	0.0	0.015	5.2	LOS A	0.1	0.6	0.51	0.53	52.9
5	T1	3	0.0	3	0.0	0.015	5.2	LOS A	0.1	0.6	0.51	0.53	53.1
6	R2	4	0.0	4	0.0	0.015	10.9	LOS A	0.1	0.6	0.51	0.53	53.1
Approach		16	0.0	16	0.0	0.015	6.6	LOS A	0.1	0.6	0.51	0.53	53.0
North: Bypass													
7	L2	1	0.0	1	0.0	0.155	5.6	LOS A	0.9	7.1	0.45	0.51	57.5
8	T1	172	7.0	172	7.0	0.155	6.1	LOS A	0.9	7.1	0.45	0.51	53.8
9	R2	1	0.0	1	0.0	0.155	11.7	LOS A	0.9	7.1	0.45	0.51	53.8
Approach		174	6.9	174	6.9	0.155	6.1	LOS A	0.9	7.1	0.45	0.51	53.8
West: Bathurst St													
10	L2	4	0.0	4	0.0	0.170	4.2	LOS A	1.0	7.0	0.36	0.61	30.4
11	T1	10	10.0	10	10.0	0.170	4.4	LOS A	1.0	7.0	0.36	0.61	52.7
12	R2	202	1.5	202	1.5	0.170	10.0	LOS A	1.0	7.0	0.36	0.61	34.4
Approach		216	1.9	216	1.9	0.170	9.6	LOS A	1.0	7.0	0.36	0.61	36.3
All Vehicles		831	3.9	831	3.9	0.254	6.0	LOS A	1.9	13.7	0.24	0.50	45.4

2031 AM Peak (8-9AM) – (I-1) Cattai Rd / Buckingham St

LANE SUMMARY

Site: 1 [Upgraded Site 1 - Cattai Rd / Buckingham St 8-9AM]

Network: N101 [2031 AM - bypass]

Site 1 - Cattai Rd / Buckingham St
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Cattai Road															
Lane 1	4	0.0	4	0.0	1854	0.002	100	6.4	LOS A	0.0	0.0	Short	85	0.0	NA
Lane 2	150	15.3	150	15.3	1561	0.096	100	0.0	LOS A	0.0	0.0	Full	200	0.0	0.0
Approach	154	14.9	154	14.9		0.096		0.2	NA	0.0	0.0				
North: Cattai Road															
Lane 1	296	9.1	296	9.1	1703	0.174	100	0.0	LOS A	0.0	0.0	Full	100	0.0	0.0
Approach	296	9.1	296	9.1		0.174		0.0	NA	0.0	0.0				
West: Buckingham Street															
Lane 1	29	0.0	29	0.0	1006	0.029	100	6.3	LOS A	0.1	0.7	Full	430	0.0	0.0
Approach	29	0.0	29	0.0		0.029		6.3	LOS A	0.1	0.7				
Intersection	479	10.4	479	10.4		0.174		0.4	NA	0.1	0.7				

MOVEMENT SUMMARY

Site: 1 [Upgraded Site 1 - Cattai Rd / Buckingham St 8-9AM]

Network: N101 [2031 AM - bypass]

Site 1 - Cattai Rd / Buckingham St
Giveway / Yield (Two-Way)

Movement Performance Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Cattai Road													
1	L2	4	0.0	4	0.0	0.002	6.4	LOS A	0.0	0.0	0.00	0.61	55.1
31	T1	150	15.3	150	15.3	0.096	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
Approach		154	14.9	154	14.9	0.096	0.2	NA	0.0	0.0	0.00	0.02	69.0
North: Cattai Road													
25	T1	296	9.1	296	9.1	0.174	0.0	LOS A	0.0	0.0	0.00	0.00	69.9
Approach		296	9.1	296	9.1	0.174	0.0	NA	0.0	0.0	0.00	0.00	69.9
West: Buckingham Street													
10	L2	29	0.0	29	0.0	0.029	6.3	LOS A	0.1	0.7	0.27	0.56	46.9
Approach		29	0.0	29	0.0	0.029	6.3	LOS A	0.1	0.7	0.27	0.56	46.9
All Vehicles		479	10.4	479	10.4	0.174	0.4	NA	0.1	0.7	0.02	0.04	64.4

2031 AM Peak (8-9AM) – (I-2) Cattai Rd / Eldon St / Old Pitt Town Rd

LANE SUMMARY

Site: 8 [Upgraded Site 2 - Cattai Rd / Eldon St / Old Pitt Town Rd 8-9AM]

Network: N101 [2031 AM - bypass]

Upgraded Site 2 - Cattai Rd / Eldon St / Old Pitt Town Rd
Roundabout

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Bypass															
Lane 1 d	141	12.1	141	12.1	1118	0.126	100	6.0	LOS A	0.7	5.9	Full	450	0.0	0.0
Approach	141	12.1	141	12.1		0.126		6.0	LOS A	0.7	5.9				
East: Old Pitt Town Road															
Lane 1 d	41	4.9	41	4.9	1032	0.040	100	6.2	LOS A	0.2	1.6	Full	370	0.0	0.0
Approach	41	4.9	41	4.9		0.040		6.2	LOS A	0.2	1.6				
North: Cattai Road															
Lane 1 d	337	8.0	337	8.0	1343	0.251	100	7.8	LOS A	1.7	13.2	Full	200	0.0	0.0
Approach	337	8.0	337	8.0		0.251		7.8	LOS A	1.7	13.2				
West: Eldon Street															
Lane 1 d	86	5.8	86	5.8	1191	0.072	100	5.0	LOS A	0.4	3.1	Full	490	0.0	0.0
Approach	86	5.8	86	5.8		0.072		5.0	LOS A	0.4	3.1				
Intersection	605	8.4	605	8.4		0.251		6.9	LOS A	1.7	13.2				

MOVEMENT SUMMARY

Site: 8 [Upgraded Site 2 - Cattai Rd / Eldon St / Old Pitt Town Rd 8-9AM]

Network: N101 [2031 AM - bypass]

Upgraded Site 2 - Cattai Rd / Eldon St / Old Pitt Town Rd
Roundabout

Movement Performance Vehicles													
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Bypass													
1	L2	1	0.0	1	0.0	0.126	5.3	LOS A	0.7	5.9	0.39	0.48	54.3
2	T1	139	12.2	139	12.2	0.126	5.9	LOS A	0.7	5.9	0.39	0.48	54.3
3	R2	1	0.0	1	0.0	0.126	11.3	LOS A	0.7	5.9	0.39	0.48	58.7
Approach		141	12.1	141	12.1	0.126	6.0	LOS A	0.7	5.9	0.39	0.48	54.4
East: Old Pitt Town Road													
4	L2	22	4.5	22	4.5	0.040	5.3	LOS A	0.2	1.6	0.51	0.54	46.9
5	T1	13	0.0	13	0.0	0.040	5.3	LOS A	0.2	1.6	0.51	0.54	46.9
6	R2	6	16.7	6	16.7	0.040	11.2	LOS A	0.2	1.6	0.51	0.54	46.9
Approach		41	4.9	41	4.9	0.040	6.2	LOS A	0.2	1.6	0.51	0.54	46.9
North: Cattai Road													
7	L2	9	0.0	9	0.0	0.251	4.9	LOS A	1.7	13.2	0.29	0.54	50.7
8	T1	183	10.9	183	10.9	0.251	5.4	LOS A	1.7	13.2	0.29	0.54	41.9
9	R2	145	4.8	145	4.8	0.251	11.0	LOS A	1.7	13.2	0.29	0.54	41.9
Approach		337	8.0	337	8.0	0.251	7.8	LOS A	1.7	13.2	0.29	0.54	42.4
West: Eldon Street													
10	L2	8	50.0	8	50.0	0.072	5.4	LOS A	0.4	3.1	0.36	0.44	50.2
11	T1	70	1.4	70	1.4	0.072	4.4	LOS A	0.4	3.1	0.36	0.44	55.2
12	R2	8	0.0	8	0.0	0.072	9.8	LOS A	0.4	3.1	0.36	0.44	50.2
Approach		86	5.8	86	5.8	0.072	5.0	LOS A	0.4	3.1	0.36	0.44	54.6
All Vehicles		605	8.4	605	8.4	0.251	6.9	LOS A	1.7	13.2	0.34	0.51	48.9

2031 AM Peak (8-9AM) – (I-3) Eldon St / Liverpool St / Wellesley St

LANE SUMMARY

Site: 3 [Upgraded Site 3 - Eldon St / Liverpool St / Wellesley St 8-9AM]

Network: N101 [2031 AM - bypass]

Site 3 - Eldon St / Liverpool St / Wellesley St
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Wellesley Street															
Lane 1	43	2.3	43	2.3	792	0.054	100	5.6	LOS A	0.2	1.4	Full	400	0.0	0.0
Approach	43	2.3	43	2.3		0.054		5.6	LOS A	0.2	1.4				
East: Eldon Street															
Lane 1	174	13.2	174	13.2	1259	0.138	100	2.5	LOS A	0.5	3.9	Full	490	0.0	0.0
Approach	174	13.2	174	13.2		0.138		2.5	NA	0.5	3.9				
North: Liverpool Street															
Lane 1	107	27.1	107	27.1	673	0.159	100	6.3	LOS A	0.6	5.9	Full	200	0.0	0.0
Approach	107	27.1	107	27.1		0.159		6.3	LOS A	0.6	5.9				
West: Eldon Street															
Lane 1	62	9.7	62	9.7	1490	0.042	100	1.5	LOS A	0.1	0.6	Full	100	0.0	0.0
Approach	62	9.7	62	9.7		0.042		1.5	NA	0.1	0.6				
Intersection	386	15.3	386	15.3		0.159		3.7	NA	0.6	5.9				

MOVEMENT SUMMARY

Site: 3 [Upgraded Site 3 - Eldon St / Liverpool St / Wellesley St 8-9AM]

Network: N101 [2031 AM - bypass]

Site 3 - Eldon St / Liverpool St / Wellesley St
Giveway / Yield (Two-Way)

Movement Performance Vehicles													
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Wellesley Street													
1	L2	28	3.6	28	3.6	0.054	5.4	LOS A	0.2	1.4	0.26	0.54	42.1
2	T1	8	0.0	8	0.0	0.054	4.8	LOS A	0.2	1.4	0.26	0.54	43.9
3	R2	7	0.0	7	0.0	0.054	7.3	LOS A	0.2	1.4	0.26	0.54	42.1
Approach		43	2.3	43	2.3	0.054	5.6	LOS A	0.2	1.4	0.26	0.54	42.6
East: Eldon Street													
4	L2	2	50.0	2	50.0	0.138	6.4	LOS A	0.5	3.9	0.11	0.22	51.1
5	T1	107	5.6	107	5.6	0.138	0.2	LOS A	0.5	3.9	0.11	0.22	55.8
6	R2	65	24.6	65	24.6	0.138	6.1	LOS A	0.5	3.9	0.11	0.22	48.9
Approach		174	13.2	174	13.2	0.138	2.5	NA	0.5	3.9	0.11	0.22	52.4
North: Liverpool Street													
7	L2	66	43.9	66	43.9	0.159	5.8	LOS A	0.6	5.9	0.20	0.56	36.1
8	T1	3	0.0	3	0.0	0.159	5.0	LOS A	0.6	5.9	0.20	0.56	43.6
9	R2	38	0.0	38	0.0	0.159	7.1	LOS A	0.6	5.9	0.20	0.56	36.1
Approach		107	27.1	107	27.1	0.159	6.3	LOS A	0.6	5.9	0.20	0.56	36.6
West: Eldon Street													
10	L2	3	0.0	3	0.0	0.042	5.9	LOS A	0.1	0.6	0.08	0.14	47.5
11	T1	47	12.8	47	12.8	0.042	0.1	LOS A	0.1	0.6	0.08	0.14	47.2
12	R2	12	0.0	12	0.0	0.042	5.9	LOS A	0.1	0.6	0.08	0.14	47.4
Approach		62	9.7	62	9.7	0.042	1.5	NA	0.1	0.6	0.08	0.14	47.3
All Vehicles		386	15.3	386	15.3	0.159	3.7	NA	0.6	5.9	0.15	0.34	47.5

2031 AM Peak (8-9AM) – (I-4) Eldon St / Chatham St

LANE SUMMARY

Site: 4 [Site 4 - Eldon St / Chatham St 8-9AM]

Network: N101 [2031 AM - bypass]

Site 4 - Eldon St / Chatham St
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Chatham Street															
Lane 1	74	5.4	74	5.4	997	0.074	100	2.1	LOS A	0.3	2.0	Full	50	0.0	0.0
Approach	74	5.4	74	5.4		0.074		2.1	NA	0.3	2.0				
East: Eldon Street															
Lane 1	173	4.0	173	4.0	1359	0.127	100	4.0	LOS A	0.6	4.3	Full	100	0.0	0.0
Approach	173	4.0	173	4.0		0.127		4.0	NA	0.6	4.3				
North: Chatham Street															
Lane 1	107	0.0	107	0.0	806	0.133	100	4.9	LOS A	0.5	3.3	Full	180	0.0	0.0
Approach	107	0.0	107	0.0		0.133		4.9	LOS A	0.5	3.3				
West: Eldon Street															
Lane 1	60	1.7	60	1.7	820	0.073	100	4.7	LOS A	0.2	1.7	Full	100	0.0	0.0
Approach	60	1.7	60	1.7		0.073		4.7	LOS A	0.2	1.7				
Intersection	414	2.9	414	2.9		0.133		4.0	NA	0.6	4.3				

MOVEMENT SUMMARY

Site: 4 [Site 4 - Eldon St / Chatham St 8-9AM]

Network: N101 [2031 AM - bypass]

Site 4 - Eldon St / Chatham St
Giveway / Yield (Two-Way)

Movement Performance Vehicles													
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Chatham Street													
1	L2	19	0.0	19	0.0	0.074	4.3	LOS A	0.3	2.0	0.16	0.34	42.7
2	T1	49	0.0	49	0.0	0.074	0.9	LOS A	0.3	2.0	0.16	0.34	46.6
3	R2	6	66.7	6	66.7	0.074	4.1	LOS A	0.3	2.0	0.16	0.34	38.9
Approach		74	5.4	74	5.4	0.074	2.1	NA	0.3	2.0	0.16	0.34	45.5
East: Eldon Street													
4	L2	108	5.6	108	5.6	0.127	5.6	LOS A	0.6	4.3	0.05	0.43	37.4
5	T1	61	1.6	61	1.6	0.127	1.1	LOS A	0.6	4.3	0.05	0.43	42.4
6	R2	4	0.0	4	0.0	0.127	5.7	LOS A	0.6	4.3	0.05	0.43	41.5
Approach		173	4.0	173	4.0	0.127	4.0	NA	0.6	4.3	0.05	0.43	39.9
North: Chatham Street													
7	L2	15	0.0	15	0.0	0.133	4.9	LOS A	0.5	3.3	0.26	0.54	36.9
8	T1	80	0.0	80	0.0	0.133	4.7	LOS A	0.5	3.3	0.26	0.54	36.9
9	R2	12	0.0	12	0.0	0.133	6.1	LOS A	0.5	3.3	0.26	0.54	38.2
Approach		107	0.0	107	0.0	0.133	4.9	LOS A	0.5	3.3	0.26	0.54	37.1
West: Eldon Street													
10	L2	5	0.0	5	0.0	0.073	4.9	LOS A	0.2	1.7	0.18	0.51	39.7
11	T1	39	2.6	39	2.6	0.073	3.6	LOS A	0.2	1.7	0.18	0.51	31.5
12	R2	16	0.0	16	0.0	0.073	7.3	LOS A	0.2	1.7	0.18	0.51	31.5
Approach		60	1.7	60	1.7	0.073	4.7	LOS A	0.2	1.7	0.18	0.51	32.8
All Vehicles		414	2.9	414	2.9	0.133	4.0	NA	0.6	4.3	0.14	0.45	39.1

2031 AM Peak (8-9AM) – (I-5) Bathurst St / Chatham St

LANE SUMMARY

Site: 5 [Site 5 - Bathurst St / Chatham St 8-9AM]

Network: N101 [2031 AM - bypass]

Site 5 - Bathurst St / Chatham St
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
SouthEast: Bathurst															
Lane 1	260	1.9	260	1.9	1859	0.140	100	2.7	LOS A	0.0	0.0	Full	90	0.0	0.0
Approach	260	1.9	260	1.9		0.140		2.7	NA	0.0	0.0				
North: Chatham Street															
Lane 1	204	2.9	204	2.9	1668	0.122	100	3.1	LOS A	0.1	0.9	Full	50	0.0	0.0
Approach	204	2.9	204	2.9		0.122		3.1	NA	0.1	0.9				
West: Bathurst Street															
Lane 1	377	0.3	377	0.3	994	0.379	100	5.5	LOS A	1.3	9.1	Full	160	0.0	0.0
Approach	377	0.3	377	0.3		0.379		5.5	LOS A	1.3	9.1				
Intersection	841	1.4	841	1.4		0.379		4.0	NA	1.3	9.1				

MOVEMENT SUMMARY

Network: N101 [2031 AM - bypass]

Site: 5 [Site 5 - Bathurst St / Chatham St 8-9AM]

Site 5 - Bathurst St / Chatham St
Giveway / Yield (Two-Way)

Movement Performance Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Bathurst													
21a	L1	198	0.5	198	0.5	0.140	2.8	LOS A	0.0	0.0	0.00	0.43	31.8
23a	R1	62	6.5	62	6.5	0.140	2.4	LOS A	0.0	0.0	0.00	0.43	27.7
Approach		260	1.9	260	1.9	0.140	2.7	NA	0.0	0.0	0.00	0.43	31.3
North: Chatham Street													
7a	L1	189	3.2	189	3.2	0.122	3.0	LOS A	0.1	0.9	0.06	0.41	23.4
9	R2	15	0.0	15	0.0	0.122	4.2	LOS A	0.1	0.9	0.06	0.41	35.6
Approach		204	2.9	204	2.9	0.122	3.1	NA	0.1	0.9	0.06	0.41	25.4
West: Bathurst Street													
10	L2	12	0.0	12	0.0	0.379	5.3	LOS A	1.3	9.1	0.31	0.66	34.6
12a	R1	365	0.3	365	0.3	0.379	5.5	LOS A	1.3	9.1	0.31	0.66	34.6
Approach		377	0.3	377	0.3	0.379	5.5	LOS A	1.3	9.1	0.31	0.66	34.6
All Vehicles		841	1.4	841	1.4	0.379	4.0	NA	1.3	9.1	0.15	0.53	31.9

2031 AM Peak (8-9AM) – (I-6) Bathurst St / Pitt Town Rd / Glebe Rd

LANE SUMMARY

Site: 9 [Upgraded Site 6 - Bathurst St / Pitt Town Rd / Glebe Rd 8-9AM]

Network: N101 [2031 AM - bypass]

Upgraded Site 6 - Bathurst St / Pitt Town Rd / Glebe Rd 8-9AM
Roundabout

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Pitt Town Rd															
Lane 1 d	400	5.8	400	5.8	1635	0.245	100	4.0	LOS A	1.9	14.2	Full	100	0.0	0.0
Approach	400	5.8	400	5.8		0.245		4.0	LOS A	1.9	14.2				
East: glebe															
Lane 1 d	25	0.0	25	0.0	747	0.033	100	9.2	LOS A	0.2	1.5	Full	890	0.0	0.0
Approach	25	0.0	25	0.0		0.033		9.2	LOS A	0.2	1.5				
North: Bypass															
Lane 1 d	214	9.3	214	9.3	800	0.267	100	8.8	LOS A	1.8	14.0	Full	450	0.0	0.0
Approach	214	9.3	214	9.3		0.267		8.8	LOS A	1.8	14.0				
West: Bathurst St															
Lane 1 d	558	1.3	558	1.3	1331	0.419	100	10.1	LOS A	3.1	22.2	Full	110	0.0	0.0
Approach	558	1.3	558	1.3		0.419		10.1	LOS A	3.1	22.2				
Intersection	1197	4.2	1197	4.2		0.419		7.8	LOS A	3.1	22.2				

MOVEMENT SUMMARY

Site: 9 [Upgraded Site 6 - Bathurst St / Pitt Town Rd / Glebe Rd 8-9AM]

Network: N101 [2031 AM - bypass]

Upgraded Site 6 - Bathurst St / Pitt Town Rd / Glebe Rd 8-9AM
Roundabout

Movement Performance Vehicles													
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Pitt Town Rd													
1	L2	258	2.3	258	2.3	0.245	3.7	LOS A	1.9	14.2	0.09	0.44	41.9
2	T1	130	13.1	130	13.1	0.245	4.1	LOS A	1.9	14.2	0.09	0.44	41.9
3	R2	12	0.0	12	0.0	0.245	9.9	LOS A	1.9	14.2	0.09	0.44	59.0
Approach		400	5.8	400	5.8	0.245	4.0	LOS A	1.9	14.2	0.09	0.44	44.5
East: glebe													
4	L2	17	0.0	17	0.0	0.033	8.0	LOS A	0.2	1.5	0.74	0.66	51.3
5	T1	3	0.0	3	0.0	0.033	8.1	LOS A	0.2	1.5	0.74	0.66	51.4
6	R2	5	0.0	5	0.0	0.033	13.8	LOS A	0.2	1.5	0.74	0.66	51.4
Approach		25	0.0	25	0.0	0.033	9.2	LOS A	0.2	1.5	0.74	0.66	51.4
North: Bypass													
7	L2	1	0.0	1	0.0	0.267	7.9	LOS A	1.8	14.0	0.73	0.74	56.3
8	T1	212	9.4	212	9.4	0.267	8.8	LOS A	1.8	14.0	0.73	0.74	51.3
9	R2	1	0.0	1	0.0	0.267	14.1	LOS A	1.8	14.0	0.73	0.74	50.9
Approach		214	9.3	214	9.3	0.267	8.8	LOS A	1.8	14.0	0.73	0.74	51.4
West: Bathurst St													
10	L2	4	0.0	4	0.0	0.419	4.5	LOS A	3.1	22.2	0.45	0.63	29.6
11	T1	8	0.0	8	0.0	0.419	4.5	LOS A	3.1	22.2	0.45	0.63	52.4
12	R2	546	1.3	546	1.3	0.419	10.3	LOS A	3.1	22.2	0.45	0.63	33.7
Approach		558	1.3	558	1.3	0.419	10.1	LOS A	3.1	22.2	0.45	0.63	34.3
All Vehicles		1197	4.2	1197	4.2	0.419	7.8	LOS A	3.1	22.2	0.38	0.59	41.4

2031 PM Peak (3-4PM) – (I-1) Cattai Rd / Buckingham St

LANE SUMMARY

Site: 1 [Upgraded Site 1 - Cattai Rd / Buckingham St 3-4PM]

Network: N101 [2031 PM - bypass]

Site 1 - Cattai Rd / Buckingham St
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Cattai Road															
Lane 1	8	0.0	8	0.0	1854	0.004	100	6.4	LOS A	0.0	0.0	Short	85	0.0	NA
Lane 2	217	7.8	217	7.8	1731	0.125	100	0.0	LOS A	0.0	0.0	Full	200	0.0	0.0
Approach	225	7.6	225	7.6		0.125		0.2	NA	0.0	0.0				
North: Cattai Road															
Lane 1	232	7.3	232	7.3	1747	0.133	100	0.0	LOS A	0.0	0.0	Full	100	0.0	0.0
Approach	232	7.3	232	7.3		0.133		0.0	NA	0.0	0.0				
West: Buckingham Street															
Lane 1	15	0.0	15	0.0	937	0.016	100	6.6	LOS A	0.1	0.4	Full	430	0.0	0.0
Approach	15	0.0	15	0.0		0.016		6.6	LOS A	0.1	0.4				
Intersection	472	7.2	472	7.2		0.133		0.3	NA	0.1	0.4				

MOVEMENT SUMMARY

Network: N101 [2031 PM - bypass]

Site: 1 [Upgraded Site 1 - Cattai Rd / Buckingham St 3-4PM]

Site 1 - Cattai Rd / Buckingham St
Giveway / Yield (Two-Way)

Movement Performance Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Cattai Road													
1	L2	8	0.0	8	0.0	0.004	6.4	LOS A	0.0	0.0	0.00	0.61	55.1
31	T1	217	7.8	217	7.8	0.125	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
Approach		225	7.6	225	7.6	0.125	0.2	NA	0.0	0.0	0.00	0.02	68.6
North: Cattai Road													
25	T1	232	7.3	232	7.3	0.133	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
Approach		232	7.3	232	7.3	0.133	0.0	NA	0.0	0.0	0.00	0.00	70.0
West: Buckingham Street													
10	L2	15	0.0	15	0.0	0.016	6.6	LOS A	0.1	0.4	0.32	0.57	46.6
Approach		15	0.0	15	0.0	0.016	6.6	LOS A	0.1	0.4	0.32	0.57	46.6
All Vehicles		472	7.2	472	7.2	0.133	0.3	NA	0.1	0.4	0.01	0.03	66.5

2031 PM Peak (3-4PM) – (I-2) Cattai Rd / Eldon St / Old Pitt Town Rd

LANE SUMMARY

Site: 8 [Upgraded Site 2 - Cattai Rd / Eldon St / Old Pitt Town Rd 3-4PM]

Network: N101 [2031 PM - bypass]

Upgraded Site 2 - Cattai Rd / Eldon St / Old Pitt Town Rd
Roundabout

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Bypass															
Lane 1 d	180	8.9	180	8.9	1154	0.156	100	5.9	LOS A	0.9	7.0	Full	450	0.0	0.0
Approach	180	8.9	180	8.9		0.156		5.9	LOS A	0.9	7.0				
East: Old Pitt Town Road															
Lane 1 d	119	1.7	119	1.7	1137	0.105	100	5.5	LOS A	0.6	4.2	Full	370	0.0	0.0
Approach	119	1.7	119	1.7		0.105		5.5	LOS A	0.6	4.2				
North: Cattai Road															
Lane 1 d	259	6.6	259	6.6	1446	0.179	100	7.5	LOS A	1.2	8.8	Full	200	0.0	0.0
Approach	259	6.6	259	6.6		0.179		7.5	LOS A	1.2	8.8				
West: Eldon Street															
Lane 1 d	74	2.7	74	2.7	1165	0.064	100	4.7	LOS A	0.4	2.6	Full	490	0.0	0.0
Approach	74	2.7	74	2.7		0.064		4.7	LOS A	0.4	2.6				
Intersection	632	5.9	632	5.9		0.179		6.4	LOS A	1.2	8.8				

MOVEMENT SUMMARY

Site: 8 [Upgraded Site 2 - Cattai Rd / Eldon St / Old Pitt Town Rd 3-4PM]

Network: N101 [2031 PM - bypass]

Upgraded Site 2 - Cattai Rd / Eldon St / Old Pitt Town Rd
Roundabout

Movement Performance Vehicles													
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Bypass													
1	L2	1	0.0	1	0.0	0.156	5.4	LOS A	0.9	7.0	0.38	0.49	54.4
2	T1	178	9.0	178	9.0	0.156	5.9	LOS A	0.9	7.0	0.38	0.49	54.4
3	R2	1	0.0	1	0.0	0.156	11.3	LOS A	0.9	7.0	0.38	0.49	58.7
Approach		180	8.9	180	8.9	0.156	5.9	LOS A	0.9	7.0	0.38	0.49	54.4
East: Old Pitt Town Road													
4	L2	65	1.5	65	1.5	0.105	4.9	LOS A	0.6	4.2	0.45	0.53	47.5
5	T1	42	2.4	42	2.4	0.105	5.0	LOS A	0.6	4.2	0.45	0.53	47.5
6	R2	12	0.0	12	0.0	0.105	10.5	LOS A	0.6	4.2	0.45	0.53	47.5
Approach		119	1.7	119	1.7	0.105	5.5	LOS A	0.6	4.2	0.45	0.53	47.5
North: Cattai Road													
7	L2	1	0.0	1	0.0	0.179	4.6	LOS A	1.2	8.8	0.18	0.53	51.3
8	T1	145	9.0	145	9.0	0.179	5.1	LOS A	1.2	8.8	0.18	0.53	42.9
9	R2	113	3.5	113	3.5	0.179	10.7	LOS A	1.2	8.8	0.18	0.53	42.9
Approach		259	6.6	259	6.6	0.179	7.5	LOS A	1.2	8.8	0.18	0.53	43.0
West: Eldon Street													
10	L2	36	5.6	36	5.6	0.064	4.6	LOS A	0.4	2.6	0.40	0.46	50.6
11	T1	37	0.0	37	0.0	0.064	4.5	LOS A	0.4	2.6	0.40	0.46	55.7
12	R2	1	0.0	1	0.0	0.064	10.0	LOS A	0.4	2.6	0.40	0.46	50.6
Approach		74	2.7	74	2.7	0.064	4.7	LOS A	0.4	2.6	0.40	0.46	53.7
All Vehicles		632	5.9	632	5.9	0.179	6.4	LOS A	1.2	8.8	0.32	0.51	49.5

2031 PM Peak (3-4PM) – (I-3) Eldon St / Liverpool St / Wellesley St

LANE SUMMARY

Site: 3 [Upgraded Site 3 - Eldon St / Liverpool St / Wellesley St 3-4PM]

Network: N101 [2031 PM - bypass]

Site 3 - Eldon St / Liverpool St / Wellesley St
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Wellesley Street															
Lane 1	13	7.7	13	7.7	732	0.018	100	5.9	LOS A	0.1	0.4	Full	400	0.0	0.0
Approach	13	7.7	13	7.7		0.018		5.9	LOS A	0.1	0.4				
East: Eldon Street															
Lane 1	201	24.9	201	24.9	1002	0.201	100	4.1	LOS A	0.8	7.7	Full	490	0.0	0.0
Approach	201	24.9	201	24.9		0.201		4.1	NA	0.8	7.7				
North: Liverpool Street															
Lane 1	56	28.6	56	28.6	647	0.087	100	6.3	LOS A	0.3	3.1	Full	200	0.0	0.0
Approach	56	28.6	56	28.6		0.087		6.3	LOS A	0.3	3.1				
West: Eldon Street															
Lane 1	95	3.2	95	3.2	1585	0.060	100	2.3	LOS A	0.1	1.0	Full	100	0.0	0.0
Approach	95	3.2	95	3.2		0.060		2.3	NA	0.1	1.0				
Intersection	365	19.2	365	19.2		0.201		4.0	NA	0.8	7.7				

MOVEMENT SUMMARY

Site: 3 [Upgraded Site 3 - Eldon St / Liverpool St / Wellesley St 3-4PM]

Network: N101 [2031 PM - bypass]

Site 3 - Eldon St / Liverpool St / Wellesley St
Giveway / Yield (Two-Way)

Movement Performance Vehicles													
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Wellesley Street													
1	L2	8	12.5	8	12.5	0.018	5.3	LOS A	0.1	0.4	0.23	0.53	41.8
2	T1	1	0.0	1	0.0	0.018	5.3	LOS A	0.1	0.4	0.23	0.53	43.6
3	R2	4	0.0	4	0.0	0.018	7.4	LOS A	0.1	0.4	0.23	0.53	41.8
Approach		13	7.7	13	7.7	0.018	5.9	LOS A	0.1	0.4	0.23	0.53	42.0
East: Eldon Street													
4	L2	7	0.0	7	0.0	0.201	6.1	LOS A	0.8	7.7	0.19	0.33	51.4
5	T1	81	7.4	81	7.4	0.201	0.5	LOS A	0.8	7.7	0.19	0.33	53.7
6	R2	113	38.9	113	38.9	0.201	6.5	LOS A	0.8	7.7	0.19	0.33	45.9
Approach		201	24.9	201	24.9	0.201	4.1	NA	0.8	7.7	0.19	0.33	48.4
North: Liverpool Street													
7	L2	33	48.5	33	48.5	0.087	6.0	LOS A	0.3	3.1	0.22	0.56	36.1
8	T1	7	0.0	7	0.0	0.087	5.5	LOS A	0.3	3.1	0.22	0.56	43.6
9	R2	16	0.0	16	0.0	0.087	7.3	LOS A	0.3	3.1	0.22	0.56	36.1
Approach		56	28.6	56	28.6	0.087	6.3	LOS A	0.3	3.1	0.22	0.56	38.0
West: Eldon Street													
10	L2	16	0.0	16	0.0	0.060	5.8	LOS A	0.1	1.0	0.09	0.22	46.1
11	T1	59	5.1	59	5.1	0.060	0.1	LOS A	0.1	1.0	0.09	0.22	43.6
12	R2	20	0.0	20	0.0	0.060	5.8	LOS A	0.1	1.0	0.09	0.22	46.6
Approach		95	3.2	95	3.2	0.060	2.3	NA	0.1	1.0	0.09	0.22	45.5
All Vehicles		365	19.2	365	19.2	0.201	4.0	NA	0.8	7.7	0.17	0.35	46.7

2031 PM Peak (3-4PM) – (I-4) Eldon St / Chatham St

LANE SUMMARY

Site: 4 [Site 4 - Eldon St / Chatham St 3-4PM]

Network: N101 [2031 PM - bypass]

Site 4 - Eldon St / Chatham St
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Chatham Street															
Lane 1	62	0.0	62	0.0	1043	0.059	100	3.0	LOS A	0.2	1.6	Full	50	0.0	0.0
Approach	62	0.0	62	0.0		0.059		3.0	NA	0.2	1.6				
East: Eldon Street															
Lane 1	104	6.7	104	6.7	1202	0.086	100	3.1	LOS A	0.4	3.2	Full	100	0.0	0.0
Approach	104	6.7	104	6.7		0.086		3.1	NA	0.4	3.2				
North: Chatham Street															
Lane 1	38	0.0	38	0.0	836	0.045	100	4.6	LOS A	0.2	1.1	Full	180	0.0	0.0
Approach	38	0.0	38	0.0		0.045		4.6	LOS A	0.2	1.1				
West: Eldon Street															
Lane 1	109	2.8	109	2.8	897	0.122	100	4.1	LOS A	0.4	3.2	Full	100	0.0	0.0
Approach	109	2.8	109	2.8		0.122		4.1	LOS A	0.4	3.2				
Intersection	313	3.2	313	3.2		0.122		3.6	NA	0.4	3.2				

MOVEMENT SUMMARY

Site: 4 [Site 4 - Eldon St / Chatham St 3-4PM]

Network: N101 [2031 PM - bypass]

Site 4 - Eldon St / Chatham St
Giveway / Yield (Two-Way)

Movement Performance Vehicles													
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Chatham Street													
1	L2	28	0.0	28	0.0	0.059	4.3	LOS A	0.2	1.6	0.16	0.41	39.7
2	T1	24	0.0	24	0.0	0.059	0.9	LOS A	0.2	1.6	0.16	0.41	44.2
3	R2	10	0.0	10	0.0	0.059	4.2	LOS A	0.2	1.6	0.16	0.41	33.1
Approach		62	0.0	62	0.0	0.059	3.0	NA	0.2	1.6	0.16	0.41	41.5
East: Eldon Street													
4	L2	42	14.3	42	14.3	0.086	5.6	LOS A	0.4	3.2	0.06	0.36	40.8
5	T1	58	1.7	58	1.7	0.086	1.2	LOS A	0.4	3.2	0.06	0.36	44.7
6	R2	4	0.0	4	0.0	0.086	5.6	LOS A	0.4	3.2	0.06	0.36	43.1
Approach		104	6.7	104	6.7	0.086	3.1	NA	0.4	3.2	0.06	0.36	43.5
North: Chatham Street													
7	L2	8	0.0	8	0.0	0.045	5.1	LOS A	0.2	1.1	0.27	0.51	37.5
8	T1	29	0.0	29	0.0	0.045	4.4	LOS A	0.2	1.1	0.27	0.51	37.5
9	R2	1	0.0	1	0.0	0.045	6.2	LOS A	0.2	1.1	0.27	0.51	38.7
Approach		38	0.0	38	0.0	0.045	4.6	LOS A	0.2	1.1	0.27	0.51	37.6
West: Eldon Street													
10	L2	12	0.0	12	0.0	0.122	4.8	LOS A	0.4	3.2	0.14	0.49	40.6
11	T1	77	3.9	77	3.9	0.122	3.5	LOS A	0.4	3.2	0.14	0.49	32.9
12	R2	20	0.0	20	0.0	0.122	6.1	LOS A	0.4	3.2	0.14	0.49	32.9
Approach		109	2.8	109	2.8	0.122	4.1	LOS A	0.4	3.2	0.14	0.49	34.5
All Vehicles		313	3.2	313	3.2	0.122	3.6	NA	0.4	3.2	0.13	0.43	39.3

2031 PM Peak (3-4PM) – (I-5) Bathurst St / Chatham St

LANE SUMMARY

Site: 5 [Site 5 - Bathurst St / Chatham St 3-4PM]

Network: N101 [2031 PM - bypass]

Site 5 - Bathurst St / Chatham St
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
SouthEast: Bathurst															
Lane 1	348	1.7	348	1.7	1856	0.188	100	2.8	LOS A	0.0	0.0	Full	90	0.0	0.0
Approach	348	1.7	348	1.7		0.188		2.8	NA	0.0	0.0				
North: Chatham Street															
Lane 1	91	6.6	91	6.6	1378	0.066	100	3.7	LOS A	0.2	1.2	Full	50	0.0	0.0
Approach	91	6.6	91	6.6		0.066		3.7	NA	0.2	1.2				
West: Bathurst Street															
Lane 1	206	0.0	206	0.0	1041	0.198	100	4.8	LOS A	0.5	3.5	Full	160	0.0	0.0
Approach	206	0.0	206	0.0		0.198		4.8	LOS A	0.5	3.5				
Intersection	645	1.9	645	1.9		0.198		3.6	NA	0.5	3.5				

MOVEMENT SUMMARY

Network: N101 [2031 PM - bypass]

Site: 5 [Site 5 - Bathurst St / Chatham St 3-4PM]

Site 5 - Bathurst St / Chatham St
Giveway / Yield (Two-Way)

Movement Performance Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Bathurst													
21a	L1	301	2.0	301	2.0	0.188	2.8	LOS A	0.0	0.0	0.00	0.43	31.8
23a	R1	47	0.0	47	0.0	0.188	2.4	LOS A	0.0	0.0	0.00	0.43	27.6
Approach		348	1.7	348	1.7	0.188	2.8	NA	0.0	0.0	0.00	0.43	31.5
North: Chatham Street													
7a	L1	71	8.5	71	8.5	0.066	3.4	LOS A	0.2	1.2	0.18	0.39	22.0
9	R2	20	0.0	20	0.0	0.066	4.6	LOS A	0.2	1.2	0.18	0.39	34.7
Approach		91	6.6	91	6.6	0.066	3.7	NA	0.2	1.2	0.18	0.39	27.0
West: Bathurst Street													
10	L2	15	0.0	15	0.0	0.198	4.9	LOS A	0.5	3.5	0.21	0.57	35.8
12a	R1	191	0.0	191	0.0	0.198	4.8	LOS A	0.5	3.5	0.21	0.57	35.8
Approach		206	0.0	206	0.0	0.198	4.8	LOS A	0.5	3.5	0.21	0.57	35.8
All Vehicles		645	1.9	645	1.9	0.198	3.6	NA	0.5	3.5	0.09	0.47	32.2

2031 PM Peak (3-4PM) – (I-6) Bathurst St / Pitt Town Rd / Glebe Rd

LANE SUMMARY

Site: 9 [Upgraded Site 6 - Bathurst St / Pitt Town Rd / Glebe Rd 3-4PM]

Network: N101 [2031 PM - bypass]

Upgraded Site 6 - Bathurst St / Pitt Town Rd / Glebe Rd 8-9AM
Roundabout

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Pitt Town Rd															
Lane 1 d	521	3.5	521	3.5	1679	0.310	100	4.0	LOS A	2.5	18.0	Full	100	0.0	0.0
Approach	521	3.5	521	3.5		0.310		4.0	LOS A	2.5	18.0				
East: glebe															
Lane 1 d	19	0.0	19	0.0	988	0.019	100	7.2	LOS A	0.1	0.8	Full	890	0.0	0.0
Approach	19	0.0	19	0.0		0.019		7.2	LOS A	0.1	0.8				
North: Bypass															
Lane 1 d	213	6.6	213	6.6	1073	0.199	100	6.5	LOS A	1.2	9.4	Full	450	0.0	0.0
Approach	213	6.6	213	6.6		0.199		6.5	LOS A	1.2	9.4				
West: Bathurst St															
Lane 1 d	267	1.9	267	1.9	1236	0.216	100	9.9	LOS A	1.3	9.3	Full	110	0.0	0.0
Approach	267	1.9	267	1.9		0.216		9.9	LOS A	1.3	9.3				
Intersection	1020	3.6	1020	3.6		0.310		6.1	LOS A	2.5	18.0				

MOVEMENT SUMMARY

Site: 9 [Upgraded Site 6 - Bathurst St / Pitt Town Rd / Glebe Rd 3-4PM]

Network: N101 [2031 PM - bypass]

Upgraded Site 6 - Bathurst St / Pitt Town Rd / Glebe Rd 8-9AM
Roundabout

Movement Performance Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Pitt Town Rd													
1	L2	343	1.2	343	1.2	0.310	3.7	LOS A	2.5	18.0	0.09	0.44	42.0
2	T1	166	8.4	166	8.4	0.310	4.1	LOS A	2.5	18.0	0.09	0.44	42.0
3	R2	12	0.0	12	0.0	0.310	9.9	LOS A	2.5	18.0	0.09	0.44	59.0
Approach		521	3.5	521	3.5	0.310	4.0	LOS A	2.5	18.0	0.09	0.44	44.1
East: glebe													
4	L2	11	0.0	11	0.0	0.019	5.7	LOS A	0.1	0.8	0.57	0.56	52.6
5	T1	3	0.0	3	0.0	0.019	5.7	LOS A	0.1	0.8	0.57	0.56	52.8
6	R2	5	0.0	5	0.0	0.019	11.4	LOS A	0.1	0.8	0.57	0.56	52.8
Approach		19	0.0	19	0.0	0.019	7.2	LOS A	0.1	0.8	0.57	0.56	52.7
North: Bypass													
7	L2	1	0.0	1	0.0	0.199	5.9	LOS A	1.2	9.4	0.51	0.55	57.2
8	T1	211	6.6	211	6.6	0.199	6.4	LOS A	1.2	9.4	0.51	0.55	53.2
9	R2	1	0.0	1	0.0	0.199	12.1	LOS A	1.2	9.4	0.51	0.55	53.1
Approach		213	6.6	213	6.6	0.199	6.5	LOS A	1.2	9.4	0.51	0.55	53.3
West: Bathurst St													
10	L2	5	0.0	5	0.0	0.216	4.5	LOS A	1.3	9.3	0.41	0.63	30.1
11	T1	12	8.3	12	8.3	0.216	4.6	LOS A	1.3	9.3	0.41	0.63	52.5
12	R2	250	1.6	250	1.6	0.216	10.3	LOS A	1.3	9.3	0.41	0.63	34.1
Approach		267	1.9	267	1.9	0.216	9.9	LOS A	1.3	9.3	0.41	0.63	36.0
All Vehicles		1020	3.6	1020	3.6	0.310	6.1	LOS A	2.5	18.0	0.27	0.52	45.0

2041 – Future with Bypass

2041 AM Peak (8-9AM) – (I-1) Cattai Rd / Buckingham St

LANE SUMMARY

Site: 1 [Upgraded Site 1 - Cattai Rd / Buckingham St 8-9AM]

Network: N101 [2041 AM - bypass]

Site 1 - Cattai Rd / Buckingham St
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	Total veh/h	HV %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
South: Cattai Road															
Lane 1	5	0.0	5	0.0	1854	0.003	100	6.4	LOS A	0.0	0.0	Short	85	0.0	NA
Lane 2	178	15.2	178	15.2	1568	0.114	100	0.0	LOS A	0.0	0.0	Full	200	0.0	0.0
Approach	183	14.8	183	14.8		0.114		0.2	NA	0.0	0.0				
North: Cattai Road															
Lane 1	351	8.8	351	8.8	1712	0.205	100	0.0	LOS A	0.0	0.0	Full	100	0.0	0.0
Approach	351	8.8	351	8.8		0.205		0.0	NA	0.0	0.0				
West: Buckingham Street															
Lane 1	35	0.0	35	0.0	971	0.036	100	6.5	LOS A	0.1	0.9	Full	430	0.0	0.0
Approach	35	0.0	35	0.0		0.036		6.5	LOS A	0.1	0.9				
Intersection	569	10.2	569	10.2		0.205		0.5	NA	0.1	0.9				

MOVEMENT SUMMARY

Network: N101 [2041 AM - bypass]

Site: 1 [Upgraded Site 1 - Cattai Rd / Buckingham St 8-9AM]

Site 1 - Cattai Rd / Buckingham St
Giveway / Yield (Two-Way)

Movement Performance Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Cattai Road													
1	L2	5	0.0	5	0.0	0.003	6.4	LOS A	0.0	0.0	0.00	0.61	55.1
31	T1	178	15.2	178	15.2	0.114	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
Approach		183	14.8	183	14.8	0.114	0.2	NA	0.0	0.0	0.00	0.02	68.9
North: Cattai Road													
25	T1	351	8.8	351	8.8	0.205	0.0	LOS A	0.0	0.0	0.00	0.00	69.9
Approach		351	8.8	351	8.8	0.205	0.0	NA	0.0	0.0	0.00	0.00	69.9
West: Buckingham Street													
10	L2	35	0.0	35	0.0	0.036	6.5	LOS A	0.1	0.9	0.30	0.58	46.7
Approach		35	0.0	35	0.0	0.036	6.5	LOS A	0.1	0.9	0.30	0.58	46.7
All Vehicles		569	10.2	569	10.2	0.205	0.5	NA	0.1	0.9	0.02	0.04	64.2

2041 AM Peak (8-9AM) – (I-2) Cattai Rd / Eldon St / Old Pitt Town Rd

LANE SUMMARY

Site: 8 [Upgraded Site 2 - Cattai Rd / Eldon St / Old Pitt Town Rd 8-9AM]

Network: N101 [2041 AM - bypass]

Upgraded Site 2 - Cattai Rd / Eldon St / Old Pitt Town Rd
Roundabout

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Bypass															
Lane 1 d	167	12.0	167	12.0	1082	0.154	100	6.2	LOS A	0.9	7.4	Full	450	0.0	0.0
Approach	167	12.0	167	12.0		0.154		6.2	LOS A	0.9	7.4				
East: Old Pitt Town Road															
Lane 1 d	52	3.8	52	3.8	981	0.053	100	6.8	LOS A	0.3	2.2	Full	370	0.0	0.0
Approach	52	3.8	52	3.8		0.053		6.8	LOS A	0.3	2.2				
North: Cattai Road															
Lane 1 d	400	8.0	400	8.0	1324	0.302	100	7.9	LOS A	2.2	16.8	Full	200	0.0	0.0
Approach	400	8.0	400	8.0		0.302		7.9	LOS A	2.2	16.8				
West: Eldon Street															
Lane 1 d	101	5.0	101	5.0	1162	0.087	100	5.1	LOS A	0.5	3.7	Full	490	0.0	0.0
Approach	101	5.0	101	5.0		0.087		5.1	LOS A	0.5	3.7				
Intersection	720	8.2	720	8.2		0.302		7.1	LOS A	2.2	16.8				

MOVEMENT SUMMARY

Site: 8 [Upgraded Site 2 - Cattai Rd / Eldon St / Old Pitt Town Rd 8-9AM]

Network: N101 [2041 AM - bypass]

Upgraded Site 2 - Cattai Rd / Eldon St / Old Pitt Town Rd
Roundabout

Movement Performance Vehicles													
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Bypass													
1	L2	1	0.0	1	0.0	0.154	5.5	LOS A	0.9	7.4	0.43	0.51	53.8
2	T1	165	12.1	165	12.1	0.154	6.2	LOS A	0.9	7.4	0.43	0.51	53.8
3	R2	1	0.0	1	0.0	0.154	11.5	LOS A	0.9	7.4	0.43	0.51	58.4
Approach		167	12.0	167	12.0	0.154	6.2	LOS A	0.9	7.4	0.43	0.51	53.9
East: Old Pitt Town Road													
4	L2	26	3.8	26	3.8	0.053	5.7	LOS A	0.3	2.2	0.56	0.58	46.1
5	T1	16	0.0	16	0.0	0.053	5.7	LOS A	0.3	2.2	0.56	0.58	46.1
6	R2	10	10.0	10	10.0	0.053	11.5	LOS A	0.3	2.2	0.56	0.58	46.1
Approach		52	3.8	52	3.8	0.053	6.8	LOS A	0.3	2.2	0.56	0.58	46.1
North: Cattai Road													
7	L2	11	0.0	11	0.0	0.302	5.0	LOS A	2.2	16.8	0.33	0.54	50.5
8	T1	218	11.0	218	11.0	0.302	5.6	LOS A	2.2	16.8	0.33	0.54	41.5
9	R2	171	4.7	171	4.7	0.302	11.1	LOS A	2.2	16.8	0.33	0.54	41.5
Approach		400	8.0	400	8.0	0.302	7.9	LOS A	2.2	16.8	0.33	0.54	42.0
West: Eldon Street													
10	L2	9	44.4	9	44.4	0.087	5.6	LOS A	0.5	3.7	0.40	0.46	49.9
11	T1	83	1.2	83	1.2	0.087	4.5	LOS A	0.5	3.7	0.40	0.46	55.0
12	R2	9	0.0	9	0.0	0.087	10.0	LOS A	0.5	3.7	0.40	0.46	49.9
Approach		101	5.0	101	5.0	0.087	5.1	LOS A	0.5	3.7	0.40	0.46	54.4
All Vehicles		720	8.2	720	8.2	0.302	7.1	LOS A	2.2	16.8	0.38	0.53	48.5

2041 AM Peak (8-9AM) – (I-3) Eldon St / Liverpool St / Wellesley St

LANE SUMMARY

Site: 3 [Upgraded Site 3 - Eldon St / Liverpool St / Wellesley St 8-9AM]

Network: N101 [2041 AM - bypass]

Site 3 - Eldon St / Liverpool St / Wellesley St
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Wellesley Street															
Lane 1	50	2.0	50	2.0	759	0.066	100	5.9	LOS A	0.2	1.7	Full	400	0.0	0.0
Approach	50	2.0	50	2.0		0.066		5.9	LOS A	0.2	1.7				
East: Eldon Street															
Lane 1	207	13.0	207	13.0	1256	0.165	100	2.5	LOS A	0.6	4.8	Full	490	0.0	0.0
Approach	207	13.0	207	13.0		0.165		2.5	NA	0.6	4.8				
North: Liverpool Street															
Lane 1	127	26.8	127	26.8	651	0.195	100	6.6	LOS A	0.8	7.4	Full	200	0.0	0.0
Approach	127	26.8	127	26.8		0.195		6.6	LOS A	0.8	7.4				
West: Eldon Street															
Lane 1	72	9.7	72	9.7	1489	0.048	100	1.5	LOS A	0.1	0.7	Full	100	0.0	0.0
Approach	72	9.7	72	9.7		0.048		1.5	NA	0.1	0.7				
Intersection	456	15.1	456	15.1		0.195		3.9	NA	0.8	7.4				

MOVEMENT SUMMARY

Site: 3 [Upgraded Site 3 - Eldon St / Liverpool St / Wellesley St 8-9AM]

Network: N101 [2041 AM - bypass]

Site 3 - Eldon St / Liverpool St / Wellesley St
Giveway / Yield (Two-Way)

Movement Performance Vehicles													
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Wellesley Street													
1	L2	33	3.0	33	3.0	0.066	5.5	LOS A	0.2	1.7	0.29	0.56	41.8
2	T1	9	0.0	9	0.0	0.066	5.2	LOS A	0.2	1.7	0.29	0.56	43.6
3	R2	8	0.0	8	0.0	0.066	8.0	LOS A	0.2	1.7	0.29	0.56	41.8
Approach		50	2.0	50	2.0	0.066	5.9	LOS A	0.2	1.7	0.29	0.56	42.2
East: Eldon Street													
4	L2	3	33.3	3	33.3	0.165	6.3	LOS A	0.6	4.8	0.12	0.22	51.5
5	T1	127	5.5	127	5.5	0.165	0.2	LOS A	0.6	4.8	0.12	0.22	55.7
6	R2	77	24.7	77	24.7	0.165	6.1	LOS A	0.6	4.8	0.12	0.22	48.8
Approach		207	13.0	207	13.0	0.165	2.5	NA	0.6	4.8	0.12	0.22	52.3
North: Liverpool Street													
7	L2	78	43.6	78	43.6	0.195	6.0	LOS A	0.8	7.4	0.23	0.57	35.5
8	T1	3	0.0	3	0.0	0.195	5.5	LOS A	0.8	7.4	0.23	0.57	43.3
9	R2	46	0.0	46	0.0	0.195	7.8	LOS A	0.8	7.4	0.23	0.57	35.5
Approach		127	26.8	127	26.8	0.195	6.6	LOS A	0.8	7.4	0.23	0.57	35.9
West: Eldon Street													
10	L2	3	0.0	3	0.0	0.048	6.0	LOS A	0.1	0.7	0.09	0.14	47.4
11	T1	55	12.7	55	12.7	0.048	0.1	LOS A	0.1	0.7	0.09	0.14	47.1
12	R2	14	0.0	14	0.0	0.048	6.0	LOS A	0.1	0.7	0.09	0.14	47.4
Approach		72	9.7	72	9.7	0.048	1.5	NA	0.1	0.7	0.09	0.14	47.3
All Vehicles		456	15.1	456	15.1	0.195	3.9	NA	0.8	7.4	0.17	0.34	47.3

2041 AM Peak (8-9AM) – (I-4) Eldon St / Chatham St

LANE SUMMARY

Site: 4 [Site 4 - Eldon St / Chatham St 8-9AM]

Network: N101 [2041 AM - bypass]

Site 4 - Eldon St / Chatham St
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Chatham Street															
Lane 1	89	6.7	89	6.7	992	0.090	100	2.2	LOS A	0.3	2.6	Full	50	0.0	0.0
Approach	89	6.7	89	6.7		0.090		2.2	NA	0.3	2.6				
East: Eldon Street															
Lane 1	205	3.9	205	3.9	1358	0.151	100	4.1	LOS A	0.7	5.2	Full	100	0.0	0.0
Approach	205	3.9	205	3.9		0.151		4.1	NA	0.7	5.2				
North: Chatham Street															
Lane 1	126	0.0	126	0.0	766	0.165	100	5.3	LOS A	0.6	4.2	Full	180	0.0	0.0
Approach	126	0.0	126	0.0		0.165		5.3	LOS A	0.6	4.2				
West: Eldon Street															
Lane 1	72	1.4	72	1.4	788	0.091	100	5.0	LOS A	0.3	2.2	Full	100	0.0	0.0
Approach	72	1.4	72	1.4		0.091		5.0	LOS A	0.3	2.2				
Intersection	492	3.0	492	3.0		0.165		4.2	NA	0.7	5.2				

MOVEMENT SUMMARY

Site: 4 [Site 4 - Eldon St / Chatham St 8-9AM]

Network: N101 [2041 AM - bypass]

Site 4 - Eldon St / Chatham St
Giveway / Yield (Two-Way)

Movement Performance Vehicles													
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Chatham Street													
1	L2	22	0.0	22	0.0	0.090	4.4	LOS A	0.3	2.6	0.18	0.35	42.5
2	T1	58	0.0	58	0.0	0.090	1.0	LOS A	0.3	2.6	0.18	0.35	46.5
3	R2	9	66.7	9	66.7	0.090	4.2	LOS A	0.3	2.6	0.18	0.35	38.5
Approach		89	6.7	89	6.7	0.090	2.2	NA	0.3	2.6	0.18	0.35	45.4
East: Eldon Street													
4	L2	128	5.5	128	5.5	0.151	5.6	LOS A	0.7	5.2	0.06	0.43	37.2
5	T1	72	1.4	72	1.4	0.151	1.2	LOS A	0.7	5.2	0.06	0.43	42.2
6	R2	5	0.0	5	0.0	0.151	5.8	LOS A	0.7	5.2	0.06	0.43	41.4
Approach		205	3.9	205	3.9	0.151	4.1	NA	0.7	5.2	0.06	0.43	39.7
North: Chatham Street													
7	L2	17	0.0	17	0.0	0.165	5.0	LOS A	0.6	4.2	0.31	0.56	36.1
8	T1	95	0.0	95	0.0	0.165	5.1	LOS A	0.6	4.2	0.31	0.56	36.1
9	R2	14	0.0	14	0.0	0.165	6.5	LOS A	0.6	4.2	0.31	0.56	37.7
Approach		126	0.0	126	0.0	0.165	5.3	LOS A	0.6	4.2	0.31	0.56	36.4
West: Eldon Street													
10	L2	6	0.0	6	0.0	0.091	5.0	LOS A	0.3	2.2	0.21	0.52	39.4
11	T1	47	2.1	47	2.1	0.091	3.7	LOS A	0.3	2.2	0.21	0.52	30.8
12	R2	19	0.0	19	0.0	0.091	8.0	LOS A	0.3	2.2	0.21	0.52	30.8
Approach		72	1.4	72	1.4	0.091	5.0	LOS A	0.3	2.2	0.21	0.52	32.2
All Vehicles		492	3.0	492	3.0	0.165	4.2	NA	0.7	5.2	0.17	0.46	38.7

2041 AM Peak (8-9AM) – (I-5) Bathurst St / Chatham St

LANE SUMMARY

Site: 5 [Site 5 - Bathurst St / Chatham St 8-9AM]

Network: N101 [2041 AM - bypass]

Site 5 - Bathurst St / Chatham St
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
SouthEast: Bathurst															
Lane 1	311	2.3	311	2.3	1843	0.169	100	2.7	LOS A	0.0	0.0	Full	90	0.0	0.0
Approach	311	2.3	311	2.3		0.169		2.7	NA	0.0	0.0				
North: Chatham Street															
Lane 1	241	2.9	241	2.9	1665	0.145	100	3.1	LOS A	0.2	1.1	Full	50	0.0	0.0
Approach	241	2.9	241	2.9		0.145		3.1	NA	0.2	1.1				
West: Bathurst Street															
Lane 1	448	0.2	448	0.2	949	0.472	100	6.1	LOS A	2.0	13.7	Full	160	0.0	0.0
Approach	448	0.2	448	0.2		0.472		6.1	LOS A	2.0	13.7				
Intersection	1000	1.5	1000	1.5		0.472		4.3	NA	2.0	13.7				

MOVEMENT SUMMARY

Site: 5 [Site 5 - Bathurst St / Chatham St 8-9AM]

Network: N101 [2041 AM - bypass]

Site 5 - Bathurst St / Chatham St
Giveway / Yield (Two-Way)

Movement Performance Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Bathurst													
21a	L1	236	0.4	236	0.4	0.169	2.8	LOS A	0.0	0.0	0.00	0.43	31.8
23a	R1	75	8.0	75	8.0	0.169	2.5	LOS A	0.0	0.0	0.00	0.43	27.7
Approach		311	2.3	311	2.3	0.169	2.7	NA	0.0	0.0	0.00	0.43	31.3
North: Chatham Street													
7a	L1	224	3.1	224	3.1	0.145	3.0	LOS A	0.2	1.1	0.06	0.41	23.3
9	R2	17	0.0	17	0.0	0.145	4.6	LOS A	0.2	1.1	0.06	0.41	35.5
Approach		241	2.9	241	2.9	0.145	3.1	NA	0.2	1.1	0.06	0.41	25.2
West: Bathurst Street													
10	L2	14	0.0	14	0.0	0.472	5.8	LOS A	2.0	13.7	0.38	0.74	33.3
12a	R1	434	0.2	434	0.2	0.472	6.1	LOS A	2.0	13.7	0.38	0.74	33.3
Approach		448	0.2	448	0.2	0.472	6.1	LOS A	2.0	13.7	0.38	0.74	33.3
All Vehicles		1000	1.5	1000	1.5	0.472	4.3	NA	2.0	13.7	0.19	0.56	31.4

2041 AM Peak (8-9AM) – (I-6) Bathurst St / Pitt Town Rd / Glebe Rd

LANE SUMMARY

Site: 9 [Upgraded Site 6 - Bathurst St / Pitt Town Rd / Glebe Rd 8-9AM]

Network: N101 [2041 AM - bypass]

Upgraded Site 6 - Bathurst St / Pitt Town Rd / Glebe Rd 8-9AM
Roundabout

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Pitt Town Road															
Lane 1 d	476	5.7	476	5.7	1631	0.292	100	4.0	LOS A	2.4	18.4	Full	100	0.0	0.0
Approach	476	5.7	476	5.7		0.292		4.0	LOS A	2.4	18.4				
East: Glebe Road															
Lane 1 d	30	0.0	30	0.0	624	0.048	100	11.0	LOS A	0.3	2.3	Full	890	0.0	0.0
Approach	30	0.0	30	0.0		0.048		11.0	LOS A	0.3	2.3				
North: Bypass															
Lane 1 d	255	9.4	255	9.4	705	0.362	100	10.1	LOS A	2.6	20.4	Full	450	0.0	0.0
Approach	255	9.4	255	9.4		0.362		10.1	LOS A	2.6	20.4				
West: Bathurst Street															
Lane 1 d	663	1.4	663	1.4	1294	0.512	100	10.5	LOS A	4.2	30.0	Full	110	0.0	0.0
Approach	663	1.4	663	1.4		0.512		10.5	LOS A	4.2	30.0				
Intersection	1424	4.2	1424	4.2		0.512		8.3	LOS A	4.2	30.0				

MOVEMENT SUMMARY

Site: 9 [Upgraded Site 6 - Bathurst St / Pitt Town Rd / Glebe Rd 8-9AM]

Network: N101 [2041 AM - bypass]

Upgraded Site 6 - Bathurst St / Pitt Town Rd / Glebe Rd 8-9AM
Roundabout

Movement Performance Vehicles													
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Pitt Town Road													
1	L2	307	2.3	307	2.3	0.292	3.8	LOS A	2.4	18.4	0.11	0.44	41.6
2	T1	155	12.9	155	12.9	0.292	4.1	LOS A	2.4	18.4	0.11	0.44	41.6
3	R2	14	0.0	14	0.0	0.292	9.9	LOS A	2.4	18.4	0.11	0.44	58.9
Approach		476	5.7	476	5.7	0.292	4.0	LOS A	2.4	18.4	0.11	0.44	44.1
East: Glebe Road													
4	L2	20	0.0	20	0.0	0.048	9.9	LOS A	0.3	2.3	0.83	0.72	50.1
5	T1	4	0.0	4	0.0	0.048	9.9	LOS A	0.3	2.3	0.83	0.72	50.0
6	R2	6	0.0	6	0.0	0.048	15.6	LOS B	0.3	2.3	0.83	0.72	50.0
Approach		30	0.0	30	0.0	0.048	11.0	LOS A	0.3	2.3	0.83	0.72	50.1
North: Bypass													
7	L2	1	0.0	1	0.0	0.362	9.1	LOS A	2.6	20.4	0.84	0.83	55.9
8	T1	253	9.5	253	9.5	0.362	10.1	LOS A	2.6	20.4	0.84	0.83	50.5
9	R2	1	0.0	1	0.0	0.362	15.3	LOS B	2.6	20.4	0.84	0.83	50.0
Approach		255	9.4	255	9.4	0.362	10.1	LOS A	2.6	20.4	0.84	0.83	50.6
West: Bathurst Street													
10	L2	4	0.0	4	0.0	0.512	4.8	LOS A	4.2	30.0	0.54	0.65	29.0
11	T1	9	0.0	9	0.0	0.512	4.9	LOS A	4.2	30.0	0.54	0.65	52.1
12	R2	650	1.4	650	1.4	0.512	10.6	LOS A	4.2	30.0	0.54	0.65	33.2
Approach		663	1.4	663	1.4	0.512	10.5	LOS A	4.2	30.0	0.54	0.65	33.8
All Vehicles		1424	4.2	1424	4.2	0.512	8.3	LOS A	4.2	30.0	0.45	0.61	40.8

2041 PM Peak (3-4PM) – (I-1) Cattai Rd / Buckingham St

LANE SUMMARY

Site: 1 [Upgraded Site 1 - Cattai Rd / Buckingham St 3-4PM]

Network: N101 [2041 PM - bypass]

Site 1 - Cattai Rd / Buckingham St
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	Total veh/h	HV %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
South: Cattai Road															
Lane 1	9	0.0	9	0.0	1854	0.005	100	6.4	LOS A	0.0	0.0	Short	85	0.0	NA
Lane 2	258	7.8	258	7.8	1732	0.149	100	0.0	LOS A	0.0	0.0	Full	200	0.0	0.0
Approach	267	7.5	267	7.5		0.149		0.2	NA	0.0	0.0				
North: Cattai Road															
Lane 1	275	7.3	275	7.3	1747	0.157	100	0.0	LOS A	0.0	0.0	Full	100	0.0	0.0
Approach	275	7.3	275	7.3		0.157		0.0	NA	0.0	0.0				
West: Buckingham Street															
Lane 1	17	0.0	17	0.0	889	0.019	100	6.9	LOS A	0.1	0.5	Full	430	0.0	0.0
Approach	17	0.0	17	0.0		0.019		6.9	LOS A	0.1	0.5				
Intersection	559	7.2	559	7.2		0.157		0.3	NA	0.1	0.5				

MOVEMENT SUMMARY

Network: N101 [2041 PM - bypass]

Site: 1 [Upgraded Site 1 - Cattai Rd / Buckingham St 3-4PM]

Site 1 - Cattai Rd / Buckingham St
Giveway / Yield (Two-Way)

Movement Performance Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Cattai Road													
1	L2	9	0.0	9	0.0	0.005	6.4	LOS A	0.0	0.0	0.00	0.61	55.1
31	T1	258	7.8	258	7.8	0.149	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
Approach		267	7.5	267	7.5	0.149	0.2	NA	0.0	0.0	0.00	0.02	68.7
North: Cattai Road													
25	T1	275	7.3	275	7.3	0.157	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
Approach		275	7.3	275	7.3	0.157	0.0	NA	0.0	0.0	0.00	0.00	70.0
West: Buckingham Street													
10	L2	17	0.0	17	0.0	0.019	6.9	LOS A	0.1	0.5	0.36	0.59	46.5
Approach		17	0.0	17	0.0	0.019	6.9	LOS A	0.1	0.5	0.36	0.59	46.5
All Vehicles		559	7.2	559	7.2	0.157	0.3	NA	0.1	0.5	0.01	0.03	66.6

2041 PM Peak (3-4PM) – (I-2) Cattai Rd / Eldon St / Old Pitt Town Rd

LANE SUMMARY

Site: 8 [Upgraded Site 2 - Cattai Rd / Eldon St / Old Pitt Town Rd 3-4PM]

Network: N101 [2041 PM - bypass]

Upgraded Site 2 - Cattai Rd / Eldon St / Old Pitt Town Rd
Roundabout

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Bypass															
Lane 1 d	213	8.5	213	8.5	1125	0.189	100	6.2	LOS A	1.1	8.7	Full	450	0.0	0.0
Approach	213	8.5	213	8.5		0.189		6.2	LOS A	1.1	8.7				
East: Old Pitt Town Road															
Lane 1 d	142	2.1	142	2.1	1072	0.132	100	5.9	LOS A	0.8	5.5	Full	370	0.0	0.0
Approach	142	2.1	142	2.1		0.132		5.9	LOS A	0.8	5.5				
North: Cattai Road															
Lane 1 d	310	7.1	310	7.1	1424	0.218	100	7.6	LOS A	1.5	11.3	Full	200	0.0	0.0
Approach	310	7.1	310	7.1		0.218		7.6	LOS A	1.5	11.3				
West: Eldon Street															
Lane 1 d	89	3.4	89	3.4	1124	0.079	100	4.9	LOS A	0.5	3.3	Full	490	0.0	0.0
Approach	89	3.4	89	3.4		0.079		4.9	LOS A	0.5	3.3				
Intersection	754	6.1	754	6.1		0.218		6.6	LOS A	1.5	11.3				

MOVEMENT SUMMARY

Site: 8 [Upgraded Site 2 - Cattai Rd / Eldon St / Old Pitt Town Rd 3-4PM]

Network: N101 [2041 PM - bypass]

Upgraded Site 2 - Cattai Rd / Eldon St / Old Pitt Town Rd
Roundabout

Movement Performance Vehicles													
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Bypass													
1	L2	1	0.0	1	0.0	0.189	5.6	LOS A	1.1	8.7	0.43	0.51	53.9
2	T1	211	8.5	211	8.5	0.189	6.2	LOS A	1.1	8.7	0.43	0.51	53.9
3	R2	1	0.0	1	0.0	0.189	11.6	LOS A	1.1	8.7	0.43	0.51	58.4
Approach		213	8.5	213	8.5	0.189	6.2	LOS A	1.1	8.7	0.43	0.51	53.9
East: Old Pitt Town Road													
4	L2	78	2.6	78	2.6	0.132	5.3	LOS A	0.8	5.5	0.51	0.56	47.0
5	T1	50	2.0	50	2.0	0.132	5.4	LOS A	0.8	5.5	0.51	0.56	47.0
6	R2	14	0.0	14	0.0	0.132	10.8	LOS A	0.8	5.5	0.51	0.56	47.0
Approach		142	2.1	142	2.1	0.132	5.9	LOS A	0.8	5.5	0.51	0.56	47.0
North: Cattai Road													
7	L2	1	0.0	1	0.0	0.218	4.7	LOS A	1.5	11.3	0.21	0.53	51.1
8	T1	173	9.2	173	9.2	0.218	5.2	LOS A	1.5	11.3	0.21	0.53	42.6
9	R2	136	4.4	136	4.4	0.218	10.8	LOS A	1.5	11.3	0.21	0.53	42.6
Approach		310	7.1	310	7.1	0.218	7.6	LOS A	1.5	11.3	0.21	0.53	42.7
West: Eldon Street													
10	L2	43	7.0	43	7.0	0.079	4.9	LOS A	0.5	3.3	0.44	0.49	50.3
11	T1	44	0.0	44	0.0	0.079	4.7	LOS A	0.5	3.3	0.44	0.49	55.4
12	R2	2	0.0	2	0.0	0.079	10.2	LOS A	0.5	3.3	0.44	0.49	50.3
Approach		89	3.4	89	3.4	0.079	4.9	LOS A	0.5	3.3	0.44	0.49	53.4
All Vehicles		754	6.1	754	6.1	0.218	6.6	LOS A	1.5	11.3	0.36	0.53	49.1

2041 PM Peak (3-4PM) – (I-3) Eldon St / Liverpool St / Wellesley St

LANE SUMMARY

Site: 3 [Upgraded Site 3 - Eldon St / Liverpool St / Wellesley St 3-4PM]

Network: N101 [2041 PM - bypass]

Site 3 - Eldon St / Liverpool St / Wellesley St
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Wellesley Street															
Lane 1	15	6.7	15	6.7	688	0.022	100	6.3	LOS A	0.1	0.5	Full	400	0.0	0.0
Approach	15	6.7	15	6.7		0.022		6.3	LOS A	0.1	0.5				
East: Eldon Street															
Lane 1	237	24.5	237	24.5	988	0.240	100	4.2	LOS A	1.0	9.6	Full	490	0.0	0.0
Approach	237	24.5	237	24.5		0.240		4.2	NA	1.0	9.6				
North: Liverpool Street															
Lane 1	66	28.8	66	28.8	616	0.107	100	6.7	LOS A	0.4	3.8	Full	200	0.0	0.0
Approach	66	28.8	66	28.8		0.107		6.7	LOS A	0.4	3.8				
West: Eldon Street															
Lane 1	113	2.7	113	2.7	1585	0.071	100	2.3	LOS A	0.2	1.3	Full	100	0.0	0.0
Approach	113	2.7	113	2.7		0.071		2.3	NA	0.2	1.3				
Intersection	431	18.8	431	18.8		0.240		4.2	NA	1.0	9.6				

MOVEMENT SUMMARY

Site: 3 [Upgraded Site 3 - Eldon St / Liverpool St / Wellesley St 3-4PM]

Network: N101 [2041 PM - bypass]

Site 3 - Eldon St / Liverpool St / Wellesley St
Giveway / Yield (Two-Way)

Movement Performance Vehicles													
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Wellesley Street													
1	L2	9	11.1	9	11.1	0.022	5.4	LOS A	0.1	0.5	0.26	0.55	41.3
2	T1	1	0.0	1	0.0	0.022	5.8	LOS A	0.1	0.5	0.26	0.55	43.3
3	R2	5	0.0	5	0.0	0.022	8.2	LOS A	0.1	0.5	0.26	0.55	41.3
Approach		15	6.7	15	6.7	0.022	6.3	LOS A	0.1	0.5	0.26	0.55	41.5
East: Eldon Street													
4	L2	8	0.0	8	0.0	0.240	6.3	LOS A	1.0	9.6	0.22	0.34	51.3
5	T1	95	6.3	95	6.3	0.240	0.7	LOS A	1.0	9.6	0.22	0.34	53.5
6	R2	134	38.8	134	38.8	0.240	6.7	LOS A	1.0	9.6	0.22	0.34	45.8
Approach		237	24.5	237	24.5	0.240	4.2	NA	1.0	9.6	0.22	0.34	48.3
North: Liverpool Street													
7	L2	39	48.7	39	48.7	0.107	6.2	LOS A	0.4	3.8	0.25	0.58	35.5
8	T1	8	0.0	8	0.0	0.107	6.1	LOS A	0.4	3.8	0.25	0.58	43.3
9	R2	19	0.0	19	0.0	0.107	8.1	LOS A	0.4	3.8	0.25	0.58	35.5
Approach		66	28.8	66	28.8	0.107	6.7	LOS A	0.4	3.8	0.25	0.58	37.4
West: Eldon Street													
10	L2	19	0.0	19	0.0	0.071	5.8	LOS A	0.2	1.3	0.10	0.22	46.0
11	T1	70	4.3	70	4.3	0.071	0.1	LOS A	0.2	1.3	0.10	0.22	43.4
12	R2	24	0.0	24	0.0	0.071	5.9	LOS A	0.2	1.3	0.10	0.22	46.5
Approach		113	2.7	113	2.7	0.071	2.3	NA	0.2	1.3	0.10	0.22	45.4
All Vehicles		431	18.8	431	18.8	0.240	4.2	NA	1.0	9.6	0.20	0.35	46.5

2041 PM Peak (3-4PM) – (I-4) Eldon St / Chatham St

LANE SUMMARY

Site: 4 [Site 4 - Eldon St / Chatham St 3-4PM]

Network: N101 [2041 PM - bypass]

Site 4 - Eldon St / Chatham St
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Chatham Street															
Lane 1	73	0.0	73	0.0	1033	0.071	100	3.1	LOS A	0.3	2.0	Full	50	0.0	0.0
Approach	73	0.0	73	0.0		0.071		3.1	NA	0.3	2.0				
East: Eldon Street															
Lane 1	123	5.7	123	5.7	1204	0.102	100	3.1	LOS A	0.5	3.8	Full	100	0.0	0.0
Approach	123	5.7	123	5.7		0.102		3.1	NA	0.5	3.8				
North: Chatham Street															
Lane 1	45	0.0	45	0.0	804	0.056	100	4.8	LOS A	0.2	1.3	Full	180	0.0	0.0
Approach	45	0.0	45	0.0		0.056		4.8	LOS A	0.2	1.3				
West: Eldon Street															
Lane 1	129	2.3	129	2.3	883	0.146	100	4.3	LOS A	0.5	3.9	Full	100	0.0	0.0
Approach	129	2.3	129	2.3		0.146		4.3	LOS A	0.5	3.9				
Intersection	370	2.7	370	2.7		0.146		3.7	NA	0.5	3.9				

MOVEMENT SUMMARY

Site: 4 [Site 4 - Eldon St / Chatham St 3-4PM]

Network: N101 [2041 PM - bypass]

Site 4 - Eldon St / Chatham St
Giveway / Yield (Two-Way)

Movement Performance Vehicles													
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Chatham Street													
1	L2	33	0.0	33	0.0	0.071	4.4	LOS A	0.3	2.0	0.18	0.42	39.6
2	T1	28	0.0	28	0.0	0.071	1.0	LOS A	0.3	2.0	0.18	0.42	44.0
3	R2	12	0.0	12	0.0	0.071	4.2	LOS A	0.3	2.0	0.18	0.42	32.8
Approach		73	0.0	73	0.0	0.071	3.1	NA	0.3	2.0	0.18	0.42	41.3
East: Eldon Street													
4	L2	49	12.2	49	12.2	0.102	5.7	LOS A	0.5	3.8	0.07	0.36	40.6
5	T1	69	1.4	69	1.4	0.102	1.2	LOS A	0.5	3.8	0.07	0.36	44.6
6	R2	5	0.0	5	0.0	0.102	5.7	LOS A	0.5	3.8	0.07	0.36	43.0
Approach		123	5.7	123	5.7	0.102	3.1	NA	0.5	3.8	0.07	0.36	43.4
North: Chatham Street													
7	L2	9	0.0	9	0.0	0.056	5.3	LOS A	0.2	1.3	0.30	0.53	37.1
8	T1	35	0.0	35	0.0	0.056	4.6	LOS A	0.2	1.3	0.30	0.53	37.1
9	R2	1	0.0	1	0.0	0.056	6.6	LOS A	0.2	1.3	0.30	0.53	38.4
Approach		45	0.0	45	0.0	0.056	4.8	LOS A	0.2	1.3	0.30	0.53	37.1
West: Eldon Street													
10	L2	14	0.0	14	0.0	0.146	4.8	LOS A	0.5	3.9	0.16	0.49	40.4
11	T1	91	3.3	91	3.3	0.146	3.6	LOS A	0.5	3.9	0.16	0.49	32.6
12	R2	24	0.0	24	0.0	0.146	6.4	LOS A	0.5	3.9	0.16	0.49	32.6
Approach		129	2.3	129	2.3	0.146	4.3	LOS A	0.5	3.9	0.16	0.49	34.2
All Vehicles		370	2.7	370	2.7	0.146	3.7	NA	0.5	3.9	0.15	0.44	39.1

2041 PM Peak (3-4PM) – (I-5) Bathurst St / Chatham St

LANE SUMMARY

Site: 5 [Site 5 - Bathurst St / Chatham St 3-4PM]

Network: N101 [2041 PM - bypass]

Site 5 - Bathurst St / Chatham St
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
SouthEast: Bathurst															
Lane 1	413	1.5	413	1.5	1864	0.222	100	2.8	LOS A	0.0	0.0	Full	90	0.0	0.0
Approach	413	1.5	413	1.5		0.222		2.8	NA	0.0	0.0				
North: Chatham Street															
Lane 1	108	5.6	108	5.6	1350	0.080	100	3.9	LOS A	0.2	1.6	Full	50	0.0	0.0
Approach	108	5.6	108	5.6		0.080		3.9	NA	0.2	1.6				
West: Bathurst Street															
Lane 1	244	0.0	244	0.0	1008	0.242	100	5.0	LOS A	0.6	4.5	Full	160	0.0	0.0
Approach	244	0.0	244	0.0		0.242		5.0	LOS A	0.6	4.5				
Intersection	765	1.6	765	1.6		0.242		3.7	NA	0.6	4.5				

MOVEMENT SUMMARY

Network: N101 [2041 PM - bypass]

Site: 5 [Site 5 - Bathurst St / Chatham St 3-4PM]

Site 5 - Bathurst St / Chatham St
Giveway / Yield (Two-Way)

Movement Performance Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Bathurst													
21a	L1	357	1.7	357	1.7	0.222	2.8	LOS A	0.0	0.0	0.00	0.43	31.8
23a	R1	56	0.0	56	0.0	0.222	2.4	LOS A	0.0	0.0	0.00	0.43	27.6
Approach		413	1.5	413	1.5	0.222	2.8	NA	0.0	0.0	0.00	0.43	31.5
North: Chatham Street													
7a	L1	84	7.1	84	7.1	0.080	3.6	LOS A	0.2	1.6	0.21	0.39	21.4
9	R2	24	0.0	24	0.0	0.080	5.1	LOS A	0.2	1.6	0.21	0.39	34.3
Approach		108	5.6	108	5.6	0.080	3.9	NA	0.2	1.6	0.21	0.39	26.5
West: Bathurst Street													
10	L2	17	0.0	17	0.0	0.242	5.0	LOS A	0.6	4.5	0.24	0.59	35.4
12a	R1	227	0.0	227	0.0	0.242	5.0	LOS A	0.6	4.5	0.24	0.59	35.4
Approach		244	0.0	244	0.0	0.242	5.0	LOS A	0.6	4.5	0.24	0.59	35.4
All Vehicles		765	1.6	765	1.6	0.242	3.7	NA	0.6	4.5	0.11	0.48	32.1

2041 PM Peak (3-4PM) – (I-6) Bathurst St / Pitt Town Rd / Glebe Rd

LANE SUMMARY

Site: 9 [Upgraded Site 6 - Bathurst St / Pitt Town Rd / Glebe Rd 3-4PM]

Network: N101 [2041 PM - bypass]

Upgraded Site 6 - Bathurst St / Pitt Town Rd / Glebe Rd 8-9AM
Roundabout

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Pitt Town Road															
Lane 1 d	621	3.7	621	3.7	1669	0.372	100	4.0	LOS A	3.2	23.9	Full	100	0.0	0.0
Approach	621	3.7	621	3.7		0.372		4.0	LOS A	3.2	23.9				
East: Glebe Road															
Lane 1 d	23	0.0	23	0.0	916	0.025	100	7.8	LOS A	0.1	1.0	Full	890	0.0	0.0
Approach	23	0.0	23	0.0		0.025		7.8	LOS A	0.1	1.0				
North: Bypass															
Lane 1 d	253	6.7	253	6.7	1021	0.248	100	6.9	LOS A	1.6	12.3	Full	450	0.0	0.0
Approach	253	6.7	253	6.7		0.248		6.9	LOS A	1.6	12.3				
West: Bathurst Street															
Lane 1 d	316	1.6	316	1.6	1200	0.263	100	10.2	LOS A	1.7	11.8	Full	110	0.0	0.0
Approach	316	1.6	316	1.6		0.263		10.2	LOS A	1.7	11.8				
Intersection	1213	3.7	1213	3.7		0.372		6.3	LOS A	3.2	23.9				

MOVEMENT SUMMARY

Site: 9 [Upgraded Site 6 - Bathurst St / Pitt Town Rd / Glebe Rd 3-4PM]

Network: N101 [2041 PM - bypass]

Upgraded Site 6 - Bathurst St / Pitt Town Rd / Glebe Rd 8-9AM
Roundabout

Movement Performance Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Pitt Town Road													
1	L2	409	1.5	409	1.5	0.372	3.8	LOS A	3.2	23.9	0.11	0.44	41.7
2	T1	198	8.6	198	8.6	0.372	4.1	LOS A	3.2	23.9	0.11	0.44	41.7
3	R2	14	0.0	14	0.0	0.372	9.9	LOS A	3.2	23.9	0.11	0.44	58.9
Approach		621	3.7	621	3.7	0.372	4.0	LOS A	3.2	23.9	0.11	0.44	43.7
East: Glebe Road													
4	L2	13	0.0	13	0.0	0.025	6.3	LOS A	0.1	1.0	0.62	0.59	52.3
5	T1	4	0.0	4	0.0	0.025	6.3	LOS A	0.1	1.0	0.62	0.59	52.5
6	R2	6	0.0	6	0.0	0.025	12.0	LOS A	0.1	1.0	0.62	0.59	52.5
Approach		23	0.0	23	0.0	0.025	7.8	LOS A	0.1	1.0	0.62	0.59	52.4
North: Bypass													
7	L2	1	0.0	1	0.0	0.248	6.3	LOS A	1.6	12.3	0.58	0.60	57.0
8	T1	251	6.8	251	6.8	0.248	6.9	LOS A	1.6	12.3	0.58	0.60	52.7
9	R2	1	0.0	1	0.0	0.248	12.4	LOS A	1.6	12.3	0.58	0.60	52.5
Approach		253	6.7	253	6.7	0.248	6.9	LOS A	1.6	12.3	0.58	0.60	52.7
West: Bathurst Street													
10	L2	6	0.0	6	0.0	0.263	4.7	LOS A	1.7	11.8	0.46	0.65	29.7
11	T1	14	7.1	14	7.1	0.263	4.9	LOS A	1.7	11.8	0.46	0.65	52.4
12	R2	296	1.4	296	1.4	0.263	10.5	LOS A	1.7	11.8	0.46	0.65	33.8
Approach		316	1.6	316	1.6	0.263	10.2	LOS A	1.7	11.8	0.46	0.65	35.7
All Vehicles		1213	3.7	1213	3.7	0.372	6.3	LOS A	3.2	23.9	0.31	0.53	44.6



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Customer feedback
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November 2018
RMS 18.1083
ISBN: 978-1-925093-92-6