

Appendix B2: Noise and Vibration Management Sub- Plan

CABRAMATTA LOOP PROJECT

ACKNOWLEDGEMENT TO COUNTRY

Fulton Hogan acknowledges the Cabrogal of the Darug Nation People as the Traditional Owners of the land we are working on, and pay our respect to their Elders past, present and emerging.

We recognise their deep connection to Country and value the contribution to caring for, and managing the land and water.

We are committed to pursuing genuine and lasting partnerships with Traditional Owners to understand their culture and connections to Country in the way we plan for and carry out the delivery of the Works.



Document control

This is an e-copy of the Plan and it interfaces with the other associated plans, which together describe the proposed overall project management system for the project.

The latest revision of this plan is available on the Fulton Hogan server. If any unsigned hard copies of this document are printed, they are valid only on the day of printing.

The revision number is included at the bottom of each page. When revisions occur, the entire document will be issued with the revision number updated accordingly for each owner of a controlled copy.

Attachments/Appendices to this plan are revised independently of this plan.

Revision History

REV	DATE	AUTHOR / REVISED BY	ENDORSED BY	BRIEF DESCRIPTION OF CHANGE
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Table of Contents

1. Introduction	1
1.1. Purpose	1
1.2. Background	1
1.3. Structure of NVMP	1
1.4. Consultation for Preparation of the NVMP	1
1.5. Operational Noise and Vibration	3
2. Objectives, Targets and Environmental Performance Outcomes	3
2.1. Objectives	3
2.2. Targets	3
2.3. Environmental Performance Outcomes	3
3. Legal and Other Requirements	4
3.1. Legislation	4
3.2. Guidelines and Standards	4
3.3. Conditions of Approval	5
3.4. Revised Mitigation Measures	15
4. Existing Environment	21
4.1. Sensitive Receivers	21
4.2. Noise Catchment Areas	24
4.3. Background Noise and Vibration Monitoring	26
4.3.1. Summary of Baseline Noise	26
4.3.2. Baseline Vibration Monitoring	28
5. Construction Noise and Vibration Criteria	28
5.1. Noise Criteria	28
5.1.1. Construction Working Hours	29
5.1.2. Construction Noise Management Levels (NMLs)	29
5.1.3. Modifying Factor Adjustments for Annoying Activities	31
5.1.4. Sleep Disturbance Criteria During Construction	31
5.1.5. Construction Traffic	32
5.1.6. Project Construction Noise Criteria	33
5.2. Vibration Criteria	34
5.2.1. Construction Vibration Goals	34
5.2.2. Heritage Structures	34
5.2.3. Other Buildings and Structures	34
5.2.4. Human Comfort and Amenity	36
6. Environmental Aspects and Impacts	37

7. Noise and Vibration Impact Assessment.....	37
7.1. Construction Hours.....	37
7.1.1. Standard Construction Hours.....	37
7.1.2. Highly Noise Intrusive Work.....	37
7.1.3. Out of Hours Work	37
7.2. Construction Activities	38
7.3. Construction Ancillary Facilities	39
7.3.1. Construction Ancillary Facilities Identified by Description and Location in the EIS	40
7.4. Construction Noise Impact Assessment	40
7.4.1. CNVS Noise Management Approach	40
7.4.2. General Construction During Standard Construction Hours.....	42
7.4.3. Out-of-Hours Work.....	44
7.4.4. Sleep Disturbance.....	48
7.4.5. Construction Traffic.....	50
7.5. Vibration Impact Assessment.....	51
7.5.1. Heritage Listed Structures	53
7.5.2. Condition Surveys.....	53
8. Environmental Mitigation Measures	55
9. Compliance Management	70
9.1. Roles and Responsibilities	70
9.2. Training.....	70
9.3. Complaints	70
9.4. Inspections and Monitoring	70
9.4.1. Noise Monitoring	71
9.4.2. Vibration monitoring.....	71
9.4.3. Monitoring Program Summary.....	72
9.5. Auditing.....	78
9.6. Reporting.....	78
9.7. Non-conformances.....	78
10. Review and Improvement of NVMP	78

List of Tables

Table 1: Environmental Performance Outcomes Relevant to Noise and Vibration Management	3
Table 2: Conditions of Approval Relevant to NVMP	5
Table 3: Revised Mitigation Measures Relevant to NVMP	15
Table 4: Medical, Educational and Places of Worship Sensitive Receivers	21
Table 5: Summary of Baseline Noise Monitoring	27
Table 6: Construction Working Hours	29
Table 7: Noise Management Levels (NMLs) for Residential Land Uses (ICNG)	30
Table 8: Noise Management Levels (NMLs) for Other Land Uses (ICNG)	31
Table 9: Construction Traffic Noise Criteria (NSW Road Noise Policy)	32
Table 10: Residential Construction NMLs, dB(A)	33
Table 11: Non-Residential Construction NMLs, dB(A)	33
Table 12: Structural Damage Criteria – Heritage Structures	34
Table 13: Transient Vibration Guide Values for Cosmetic Damage (BS 7385: Part 2:1993)	35
Table 14: Acceptable Vibration Dose Values (VDV) for Intermittent Vibration	36
Table 15: Indicative Schedule of Construction Scenarios/ Activities	38
Table 16: Construction Ancillary Facility Sites (EIS, p7.23)	40
Table 17: CNVS Noise Management Approach	41
Table 18: Predicted Construction Noise Levels at Residences from Standard Hours Works	43
Table 19: Predicted Construction Noise Levels at Non-Residential Sensitive Uses Residences from Standard Hours Works	44
Table 20: Predicted Construction Noise Levels at Residences from Potential Period 1 Day OOHW	45
Table 21: Predicted Construction Noise Levels at Residences from Potential Period 1 Evening OOHW	46
Table 22: Predicted Construction Noise Levels at Residences from Potential Period 2 Night OOHW	47
Table 23: Peak Number of Construction Vehicles Per Hour	50
Table 24: Existing Peak Traffic Volumes Per Hour	50
Table 25: Vibration Safe Working Distances	52
Table 26: Heritage Listed Structures	53
Table 27: Noise and Vibration Mitigation Measures	55
Table 28: Out of Hours Noise and Vibration Mitigation Measures	62
Table 29: Noise and Vibration Monitoring Summary	73
Table 30: Sound Power Levels	80

List of Figures

Figure 1: Noise Catchment Areas.....	25
Figure 2: Baseline Vibration Monitoring Data	28
Figure 3: Summary of Damage Thresholds for Transient Vibration on Domestic Structures	35
Figure 4: Sleep Disturbance Impacted Receivers	49
Figure 5: OOHW Approval Pathways Flowchart	87

Appendices

- Appendix A: Indicative Plant and Equipment Sound Power Levels
- Appendix B: Typical Worst-Case Construction Noise Contours
- Appendix C: Out-of-Hours Work Protocol (OOHW Protocol)
- Appendix D: Vibration Impact Map
- Appendix E: Monthly Attended Noise Monitoring Location

Glossary/ Abbreviations

Term/ abbreviation	Definition
ARTC	Australian Rail Track Corporation
CEMP	Construction Environmental Management Plan
CNVS	Construction Noise and Vibration Strategy
CoA	The Minister's conditions of approval for the CSSI.
Construction Boundary	Has the same meaning as the definition of the term in the Project approval: The area required for project construction as described in the documents listed in Condition A1 .
CSSI	Critical State Significant Infrastructure, as described in Schedule 1 of the project approval, the carrying out of which is approved under the terms of the project approval.
dB(A)	Decibels using the A-weighted scale measured according to the frequency of the human ear.
DPI	NSW Department of Primary Industries
DPIE	NSW Department of Planning, Industry and Environment
DPIE EES Group	Environment, Energy and Science Group of DPIE
DPIE Water Group	Water Group of DPIE and the National Resources Access Regulator
Ecologically sustainable development	Using, conserving and enhancing the community's resources so that the ecological processes on which life depends are maintained and the total quality of life now and in the future, can be increased (Council of Australian Governments, 1992).
EIS	Environmental Impact Statement
EPA	NSW Environment Protection Authority
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
EPL	Environment Protection Licence under the POEO Act
ER	Environmental Representative for the CSSI
ESCP	Primary Erosion and Sediment Control Plan
EWMS	Environmental Work Method Statement
HP	Hold Point: a point in the construction or verification process beyond which work may not proceed without receiving authorisation from the appropriate party.
Highly Noise Affected	Defined by the ICNG to be a sensitive receiver exposed to construction noise levels greater than 75 dB $L_{Aeq,15min}$
ICNG	<i>Interim Construction Noise Guidelines</i> (DECC 2009)
L_{eq}	Equivalent continuous sound level - the constant sound level which, when occurring over the same period of time, would result in the receiver experiencing the same amount of sound energy.
$L_{Aeq,15min}$	The A-weighted equivalent continuous (energy average) A-weighted sound pressure level of the construction works under consideration over a 15-minute period and excludes other noise sources such as from industry, road, rail and the community.
L_{AMax}	The A-weighted maximum noise level only from the construction works under consideration, measured using the fast time weighting on a sound level meter.

Term/ abbreviation	Definition
L ₉₀	The sound pressure level exceeded for 90% of the measurement period. For 90% of the measurement period it was louder than the L ₉₀ .
Minister, the	NSW Minister for Planning and Public Spaces
NA	Not applicable
NCA	Noise Catchment Area
NML	Noise Management Level
NPI	Noise Policy for Industry
Non-compliance	Failure to comply with the requirements of the Project Approval or any applicable license, permit or legal requirements.
Non-conformance	Failure to conform to the requirements of project system documentation including this PCEMP or supporting documentation.
NVMP	Noise and Vibration Management Sub-Plan
OEH	Office of Environment and Heritage
OEMS	Operational Environmental Management System
OOHW	Out-of-Hours Work
OOHW Protocol	Out-of-Hours Work Protocol
Planning Secretary, the	Has the same meaning as the definition of the term in the Project approval: Planning Secretary of DPIE (or nominee, whether nominated before or after the date on which the project approval was granted)
Planning Secretary's approval or agreement, the	Has the same meaning as the definition of the term in the Project approval: A written approval or agreement from the Planning Secretary (or nominee)
POEO Act	<i>Protection of the Environment Operations Act 1997 (NSW)</i>
Project, the	Cabramatta Loop
Project approval, the	The Minister's approval for the CSSI.
Publicly Available	Has the same meaning as the definition of the term in the Project approval: To be made available on the website required under Condition B10 of the project approval.
RBL	The Rating Background Level for each period is the medium value of the assessment background level for the period over all of the days measured. There is therefore an RBL value for each period (day, evening and night)
Relevant council(s)	Has the same meaning as the definition of the term in the Project approval: Any or all as relevant, Fairfield City Council or Liverpool City Council.
RMM	Revised Mitigation Measure
rms	Root mean square of vibration signal.
Sound Power Level	The total sound emitted by a source
Sound Pressure Level	The amount of sound at a specified point
SWL	Sound power level
TfNSW	Transport for NSW

Term/ abbreviation	Definition
Work	Has the same meaning as the definition of the term in the Project approval: Any physical work for the purpose of the CSSI including construction and low impact work.

1. Introduction

1.1. Purpose

This Noise and Vibration Management Sub-Plan (NVMP) describes how Fulton Hogan will manage construction of the Cabramatta Loop Project (the project) to ensure that impacts related to noise and vibration are minimised.

This NVMP has been prepared to detail how Fulton Hogan will comply with the project approval, and implement and achieve relevant performance outcomes, commitments and mitigation measures specified in the EIS as amended by the Submissions Report (also known as 'Revised Mitigation Measures' (RMM)) during construction of the project. Additionally, this NVMP has been prepared to address the requirements of ARTC Technical Specification and Works Description (TSWD) Appendix 04 Additional Environmental Requirements and Environment Protection Licence (EPL) Number 3142 (held by ARTC for railway activities – railway infrastructure operations) to the extent that it applies to Fulton Hogan's activities.

For the avoidance of doubt, the CEMP (including this NVMP) relates to the construction phase only. Detailed design environmental requirements will be addressed as part of the detailed design phase, separate to the CEMP approvals process. Detailed design is generally completed about six months after CEMP approval. In addition, operational environmental requirements will be met during the operational phase (upon the completion of construction) and addressed in the Operational Environmental Management System (OEMS) required under CoA D1.

1.2. Background

Chapter 9 of the EIS assessed the extent and magnitude of potential impacts of construction and operation of the project on noise and vibration. As part of this, a detailed assessment was undertaken and included in the EIS as:

- EIS Volume 2 – Technical Report 2 – Cabramatta Loop Project: Noise and Vibration Impact Assessment, prepared by GHD for ARTC, dated August 2019.

1.3. Structure of NVMP

This NVMP is part of Fulton Hogan's environmental management framework for the project and is supported by other documents, such as Environmental Work Method Statements. The review and document control processes for this NVMP are described in Chapters 11 and 12 respectively of the CEMP.

1.4. Consultation for Preparation of the NVMP

In accordance with CoA C4(b), consultation with the relevant council(s) has been undertaken during the preparation of this NVMP. In addition, consultation with the EPA has been undertaken in relation to the Construction Monitoring Program (refer to Section 9.4) and Out-of-Hours Work Protocol (OOHW Protocol) (refer to Appendix C) to satisfy the requirements of CoA C8(a) and CoA E16 respectively. A summary of the key issues raised is provided below and it is noted that there are no outstanding issues.

Fairfield City Council provided comments, generally related to:

- the project approval
- ensuring that the NVMP is provided to the EPA for review and comment
- ensuring that all referenced information is current
- noting the importance of stringent implementation of acoustic/vibration control/mitigation measures ongoing noise/vibration monitoring throughout the project and strong community engagement/communication
- ensuring that information is translated in different languages
- ensuring vibration impacts on structures are assessed by a suitably qualified engineer or person qualified in assessing vibration impacts on structures; and

- updating the NVMP.

Fulton Hogan responded to Fairfield City Council and either noted the comment or outlined how each comment is addressed within the NVMP or other project documentation, such as the Communication Strategy. Fairfield City Council acknowledged Fulton Hogan's response. Fulton Hogan clarified that it considers Fairfield City Council's comments closed and Fairfield City Council raised no objections.

Liverpool City Council provided comments, generally related to:

- the project approval
- the Secretary's Environmental Assessment Requirements (SEARs)
- the EPA's review of the EIS
- information provided within the EIS and Submissions Report
- a request that the EPA is consulted in relation to the NVMP
- an overview of the overarching environmental management system
- application of the NVMP to all phases of construction work
- references to superseded legislation, guidelines and Australian Standards
- consideration of shoulder periods
- locations for measuring noise management levels (NMLs)
- whether background noise monitoring included sensitive receiver types other than residential receivers
- measurement of internal noise levels
- ground-borne noise
- a strong recommendation that, consistent with Council's lodgement requirements, acoustic assessments for the Project are prepared or reviewed and certified by a suitably qualified acoustic consultant who is a member of the Australian Acoustical Society or employed by an Association of Australasian Acoustical Consultants (AAAC) member firm
- audible movement alarms
- contingency planning when NMLs cannot be met; and
- the importance of community consultation.

Fulton Hogan responded to Liverpool City Council and either noted the comment, provided further clarification, or outlined how each comment is addressed within the updated NVMP (Revision 2). Liverpool City Council acknowledged Fulton Hogan's response and confirmed it is satisfied that the NVMP (Revision 2) satisfactorily addresses the representations made on behalf of Liverpool City Council on 27 August 2021. A further comment was made by Liverpool City Council about the Australian Standard reference in Section 9.4.1 of the NVMP and Fulton Hogan advised that the publication year of AS IEC 61672 would be amended from 2004 to 2019 as part of Revision 3 of the NVMP.

The EPA advised that its position on all post approval management plans is to encourage the development of such plans to ensure that proponents have determined how they will meet their statutory obligations and designated environmental objectives. However, the EPA notes that it does not approve or endorse these documents as its role is to set environmental objectives for environmental management and not to be directly involved in the development of strategies to achieve those objectives. Therefore, the EPA confirmed that it will not be providing comments on the NVMP prepared by Fulton Hogan in support of the Cabramatta Loop Project. Furthermore, the EPA notes it will manage any issues within its jurisdiction, during the construction phase of the project.

Copies of all consultation correspondence is included at Appendix A5 of the CEMP.

Ongoing consultation will be undertaken during detailed design and construction of the project as required by the environmental documents. This will be subject to a separate consultation process to that required for preparation of this NVMP.

1.5. Operational Noise and Vibration

The potential impacts relating to operational noise and vibration will be assessed and documented in a separate Operational Noise and Vibration Review (ONVR) report developed as part of the design process. A program of post construction operational noise and vibration measurements will be conducted in order to confirm the outcomes of the project and will be documented in a separate Operational Noise Compliance Report. The preliminary design indicates that no at-property acoustic treatments will be required. Should the situation change, this NVMP would be updated when detail on the specific mitigation measures is known and before the implementation of the mitigation measures in accordance with the requirements of CoA E23. Should operational noise mitigation requirements change and these could not be implemented within six months of commencement of construction, DPIE would be notified with justification relating to the delay of implementation in accordance with the requirements of CoA E24. The operational noise assessment will include the requirement to provide one continuous noise barrier.

2. Objectives, Targets and Environmental Performance Outcomes

2.1. Objectives

The key objective of the NVMP is to ensure that impacts to noise and vibration are minimised and within the scope permitted by the project approval. To achieve this objective, Fulton Hogan will undertake the following:

- Ensure appropriate controls and procedures are implemented during construction activities to avoid or minimise potential adverse impacts to sensitive receivers in relation to noise and vibration along the Project corridor
- Ensure appropriate measures are implemented to address the relevant CoA and RMM outlined in Table 2 and Table 3 respectively.
- Ensure appropriate measures are implemented to comply with all relevant legislation and other requirements as described in Chapter 3 of this NVMP.

2.2. Targets

The following targets have been established for the management of noise and vibration impacts during the project:

- Ensure full compliance with the relevant legislative requirements, CoA and RMM outlined in Table 2 and Table 3 respectively.
- Conduct noise and vibration monitoring as required to assess compliance with the relevant criteria.
- Ensure complaints from the community are minimised.

2.3. Environmental Performance Outcomes

The construction-related environmental performance outcomes relevant to this NVMP are listed in Table 1. A cross reference is also included to indicate where the environmental performance outcome is addressed in this NVMP in terms of how it will be implemented and achieved.

Table 1: Environmental Performance Outcomes Relevant to Noise and Vibration Management

Key Issue (as listed in Table 22.5 of the EIS)	Environmental Performance Outcome	Document Reference
2. Noise and Vibration -	The project minimises impacts to the local community	

Key Issue (as listed in Table 22.5 of the EIS)	Environmental Performance Outcome	Document Reference
Amenity	by: <ul style="list-style-type: none"> ▪ controlling noise and vibration at the source ▪ controlling noise and vibration on the source to receiver transmission path ▪ controlling noise and vibration at the receiver ▪ implementing practicable and reasonable measures to minimise the noise and vibration impacts of construction activities on local sensitive receivers 	Chapter 8 mitigation measure ID NVMM3, NVMM4, NVMM8, NVMM9, NVMM10, NVMM11, NVMM12, NVMM13, NVMM14, NVMM15, NVMM22, NVMM28, NVMM41. Chapter 8 mitigation measure ID NVMM5, NVMM6, NVMM24, NVMM25, NVMM30, NVMM31, NVMM33 Chapter 8 mitigation measure ID NVMM5, NVMM6, NVMM24, NVMM25. Chapter 8 mitigation measure ID NVMM23, NVMM27, NVMM34
3. Noise and Vibration – Structural	The project minimises impacts to structures by: <ul style="list-style-type: none"> ▪ controlling vibration at the source ▪ controlling vibration on the source to receiver transmission path ▪ implementing practicable and reasonable measures to minimise vibration impacts during construction and operation. 	Chapter 8 mitigation measure ID NVMM12, NVMM13, NVMM14, NVMM43, NVMM46, NVMM47, Chapter 8 mitigation measure ID NVMM5, NVMM6, NVMM24, NVMM25, NVMM31, NVMM33, NVMM40 Chapter 8 mitigation measure ID NVMM39, NVMM50, NVMM54.

3. Legal and Other Requirements

3.1. Legislation

Legislation relevant to noise and vibration management includes:

- *Protection of the Environment Operations Act 1997 (POEO Act)*
- *Protection of the Environment Operations (Noise Control) Regulation 2017.*

Relevant provisions of the above legislation are explained in the Register of Legal and Other Requirements included in Appendix A1 of the CEMP.

3.2. Guidelines and Standards

The main guidelines, standards and policy documents relevant to this NVMP include:

- Interim Construction Noise Guideline (ICNG) (DECC 2009)
- Noise Policy for Industry (NPI) (EPA 2017)
- Environmental Noise Management Assessing Vibration: A Technical Guideline (DEC, 2006)
- German Standard DIN 4150 - Part 3 - Structural Vibration in Buildings - Effects of Vibration on Structures
- AS 2107:2016 Acoustics - Recommended design sound levels and reverberation times for building interiors
- AS 2436:2010 Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites
- AS 1055:2018 Acoustics - Description and measurement of environmental noise
- AS IEC 61672-2019 Electroacoustics – Sound Level Meters
- AS ISO 6393:2019 Earth-moving machinery - Determination of sound power level - Stationary test conditions
- AS ISO 31000:2018 Risk management - Guidelines
- British Standard 7385: Part 2 – Evaluation and measurement of vibration in buildings
- NSW Road Noise Policy (DECCW, 2011)
- Construction Noise and Vibration Strategy (CNVS) (TfNSW, 2018).

3.3. Conditions of Approval

The CoA relevant to this NVMP are listed in Table 2 below. A cross reference is also included to indicate where the condition is addressed in this NVMP or other project management documents.

Table 2: Conditions of Approval Relevant to NVMP

CoA No.	Condition Requirements	Document Reference												
PART C - CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN														
C4	<p>CEMP Sub-Plans must be prepared in consultation with the relevant government agency(ies) and council(s) identified for each CEMP Sub-Plan in Table 3.</p> <p>Table 3: CEMP Sub-Plan and relevant public authorities</p> <table border="1"> <thead> <tr> <th></th> <th>Required CEMP Sub-Plan</th> <th>Relevant government agency(ies) and council(s) to be consulted for each CEMP Sub-Plan</th> </tr> </thead> <tbody> <tr> <td>(a)</td> <td>Traffic and Transport</td> <td>TfNSW and relevant council(s)</td> </tr> <tr> <td>(b)</td> <td>Noise and Vibration</td> <td>Relevant council(s)</td> </tr> <tr> <td>(c)</td> <td>Soil and Water</td> <td>DPIE Water Group, Sydney Water and relevant council(s)</td> </tr> </tbody> </table> <p><i>Note: This condition does not preclude the preparation of subplans the proponent has committed to preparing in documents referenced in Condition A1</i></p>		Required CEMP Sub-Plan	Relevant government agency(ies) and council(s) to be consulted for each CEMP Sub-Plan	(a)	Traffic and Transport	TfNSW and relevant council(s)	(b)	Noise and Vibration	Relevant council(s)	(c)	Soil and Water	DPIE Water Group, Sydney Water and relevant council(s)	Section 1.4
	Required CEMP Sub-Plan	Relevant government agency(ies) and council(s) to be consulted for each CEMP Sub-Plan												
(a)	Traffic and Transport	TfNSW and relevant council(s)												
(b)	Noise and Vibration	Relevant council(s)												
(c)	Soil and Water	DPIE Water Group, Sydney Water and relevant council(s)												
C5	The CEMP Sub-Plans must state how:													
(a)	the environmental performance outcomes identified in the documents listed in Condition A1 as modified by these conditions will be achieved;	Section 2.3												
(b)	the mitigation measures identified in the documents listed in Condition A1 as modified by these conditions will be implemented;	Through the implementation of this NVMP (in particular refer to Section 3.4).												
(c)	the relevant terms of this approval will be complied with; and	Through the implementation of												

CoA No.	Condition Requirements	Document Reference									
		this NVMP									
(d)	issues requiring management during construction (including cumulative impacts), as identified through ongoing environmental risk analysis, will be managed.	Chapter 6, second paragraph Chapter 8									
C6	Details of all information requested by an agency to be included in a CEMP Sub-plan as a result of consultation, including copies of all correspondence from those agencies, must be provided with the relevant CEMP Sub-Plan .	Section 1.4									
C7	Construction must not commence until the CEMP and all CEMP Sub-Plans have been approved by the ER and must be implemented for the duration of construction. Where construction of the CSSI is staged, construction of a stage must not commence until the CEMP and sub-plans for that stage have been approved by the ER.	CEMP (main section) Sections 1.4 and 2.2									
C8	<p>The Construction Monitoring Programs set out in Table 4 must be prepared and implemented to enable comparison of the actual construction performance against the predicted performance.</p> <p>The Construction Monitoring Programs must be prepared in consultation with the relevant government agencies as identified for each Construction Monitoring Program.</p> <p>Table 4: Construction Monitoring and relevant public authorities</p> <table border="1"> <thead> <tr> <th></th> <th>Required Construction Monitoring Programs</th> <th>Relevant government agencies to be consulted for each Construction Monitoring Program</th> </tr> </thead> <tbody> <tr> <td>(a)</td> <td>Noise and Vibration</td> <td>EPA</td> </tr> <tr> <td>(b)</td> <td>Water Quality</td> <td>DPIE Water Group</td> </tr> </tbody> </table>		Required Construction Monitoring Programs	Relevant government agencies to be consulted for each Construction Monitoring Program	(a)	Noise and Vibration	EPA	(b)	Water Quality	DPIE Water Group	Section 9.4 Section 1.4
	Required Construction Monitoring Programs	Relevant government agencies to be consulted for each Construction Monitoring Program									
(a)	Noise and Vibration	EPA									
(b)	Water Quality	DPIE Water Group									
C9	Each Construction Monitoring Program must provide:										
	(a) details of baseline data available;	Section 4.3.1 Section 4.3.2									
	(b) details of baseline data to be obtained and when;	Section 4.3.1 Section 4.3.2									
	(c) details of all monitoring of the project to be undertaken;	Section 9.4.3									
	(d) the parameters of the project to be monitored;	Section 9.4.3									
	(e) the frequency of monitoring to be undertaken;	Section 9.4.1									
	(f) the location of monitoring;	Section 9.4.3									
	(g) procedure for the timing and frequency reporting of monitoring and analysis against relevant criteria, including details of the timing and frequency for reporting results to the ER, the Planning Secretary and relevant government	Section 9.4 Section 9.4.3									

CoA No.	Condition Requirements	Document Reference
	agencies;	Section 9.6
	(h) details of the methods that will be used to analyse the monitoring data;	Section 9.4.3 Section 9.4.1 Section 9.4.2
	(i) procedures to identify and implement additional mitigation measures where results of monitoring identify unexpected impact; and	Section 9.4.1 Section 9.4.2
	(j) any consultation to be undertaken in relation to the monitoring programs.	Section 1.4
C10	The Construction Monitoring Programs must be submitted to the ER for approval at least one (1) month before the commencement of construction.	CEMP (main section) Section 1.4
C11	Construction, which is required to be monitored under the Construction Monitoring Programs , must not commence until the Construction Monitoring Programs have been approved by the ER , and all relevant baseline data for the specific construction activity has been collected.	CEMP (main section) Section 1.4
C12	The Construction Monitoring Programs , as approved by the ER must be implemented for the duration of construction and for any longer period set out in the monitoring program or specific by the Planning Secretary, whichever is the greater.	CEMP (main section) Section 1.4
C13	The results of the Construction Monitoring Programs must be made publicly available in the form of a Construction Monitoring Report at the frequency identified in the relevant Construction Monitoring Program . <i>Note: Where a relevant CEMP Sub-Plan exists, the relevant Construction Monitoring Program may be incorporated into that CEMP Sub-Plan.</i>	Section 9.6
PART E – NOISE AND VIBRATION		
Work Hours		
E10	Work must only be undertaken during the following hours: (a) 7:00am to 6:00pm Mondays to Fridays, inclusive; (b) 8:00am to 1:00pm Saturdays; and (c) at no time on Sundays or public holidays.	Section 7.1.1
Variation to Works Hours		
E11	Notwithstanding Conditions E10 and E15 , work may be undertaken outside the hours specified in the following circumstances: (a) for the delivery of materials required by the NSW Police Force or other appropriate authority for safety reasons; or	Section 7.1.3

CoA No.	Condition Requirements	Document Reference
	(b) where it is required in an emergency to avoid injury or the loss of life, to avoid damage or loss of property or to prevent environmental harm; or	Section 7.1.3
	(c) where different construction hours are permitted or required under an EPL in force in respect of the CSSI; or	Section 7.1.3
	(d) work approved under an Out-of-Hours Work Protocol for work <u>not</u> subject to an EPL as required by Condition E16 ; or	Section 7.1.3
	(e) construction that causes $L_{Aeq(15\text{ minute})}$ noise levels: <ul style="list-style-type: none"> (i) no more than 5 dB(A) above the rating background level at any residence in accordance with the <i>Interim Construction Noise Guideline</i> (DECC, 2009), and 	Section 5.1.2
	(ii) no more than the ‘Noise affected’ noise management levels specified in Table 3 of the <i>Interim Construction Noise Guideline</i> (DECC, 2009) at other sensitive land uses, and	Section 5.1.2
	(iii) continuous or impulsive vibration values, measured at the most affected residence are no more than the maximum values for human exposure to vibration, specified in Table 2.2 of <i>Assessing Vibration: a technical guideline</i> (DEC, 2006), and	Section 5.2
	(iv) intermittent vibration values measured at the most affected residence are no more than the maximum values for human exposure to vibration, specified in Table 2.4 of <i>Assessing Vibration: a technical guideline</i> (DEC, 2006);or	Section 5.2
	(f) negotiated agreements with directly affected residents	Section 7.1.3
E12	On becoming aware of the need for emergency work in accordance with Condition E11(b) , the Proponent must notify the ER of the need for that work. The Proponent must use best endeavours to notify all noise and/or vibration affected sensitive land uses of the likely impact and duration of those works.	Appendix C OOHW Protocol Chapter 8
Out-of-Hours Work Scheduling and Respite		
E13	Except as permitted by an EPL, out-of-hours work that is regulated through the Out-of-Hours Work Protocol as per Condition E16 includes (but is not limited to):	Appendix C OOHW Protocol Section 7.1.3
	(a) work which could result in a high risk to construction personnel or public safety, based on a risk assessment carried out in accordance with AS/NZS ISO 31000:2009 “ <i>Risk Management – Principles and Guidelines</i> ”; or	Section 7.1.3
	(b) where the relevant utility service operator has advised the Proponent in writing that carrying out the work and activities could result in a high risk to the operation and integrity of the utility network; or	Section 7.1.3

CoA No.	Condition Requirements	Document Reference
	<p>(c) work undertaken in a Rail Possession for operational or safety reasons; and</p> <p>(d) where the relevant road authority has advised the Proponent in writing that carrying out the works and activities could result in a risk to road network operational performance or safety.</p> <p><i>Note: Other out-of-hours works can be undertaken with the approval of an EPL, or through the project's Out-of-Hours Work Protocol for works not subject to an EPL</i></p>	<p>Section 7.1.3</p> <p>Section 7.1.3</p>
E14	<p>In order to undertake out-of-hours work, the Proponent must identify appropriate respite for out of-hours work in consultation with the community at each affected location on a regular basis.</p> <p>This consultation must include (but not be limited to) providing the community with:</p> <p>(a) a schedule of likely out-of-hours work for a period no less than three (3) months;</p> <p>(b) the potential works, location and duration;</p> <p>(c) the noise characteristics and likely noise levels of the works; and</p> <p>(d) likely mitigation and management measures.</p> <p>The outcomes of the community consultation, the identified respite periods and the scheduling of the likely out-of-hour works must be provided to the EPA and the Planning Secretary.</p>	<p>Chapter 8 mitigation measures</p> <p>Chapter 8 mitigation measure ID OOHMM16</p> <p>Chapter 8 mitigation measure ID OOHMM16</p> <p>Chapter 8 mitigation measure ID OOHMM16</p> <p>Chapter 8 mitigation measure ID OOHMM16</p>
Highly Noise Intensive Works		
E15	<p>Except as permitted by an EPL, highly noise intensive work must only be undertaken:</p> <p>(a) between the hours of 8:00 am to 6:00 pm Monday to Friday;</p> <p>(b) between the hours of 8:00 am to 1:00 pm Saturday; and</p> <p>(c) in continuous blocks not exceeding three (3) hours, with a minimum respite from that work of not less than one (1) hour between each block where the works are likely to impact the same noise sensitive receivers.</p> <p>For the purposes of this condition, 'continuous' includes any period during which there is less than of one (1) hour respite between ceasing and recommencing any of the work that is the subject of this condition.</p>	Section 7.1.2
Out-of-Hours Work Protocol – Work not subject to an EPL		

CoA No.	Condition Requirements	Document Reference
E16	<p>An Out-of-Hours Work Protocol must be prepared to identify a process for the consideration, management and approval of work which is outside the hours defined in Condition E10, and that is not subject to an EPL. The Protocol must be approved by the Planning Secretary before commencement of the relevant out-of-hours work. The Protocol must be prepared in consultation with the EPA. The Protocol must:</p> <p>(a) provide a process for the consideration of out-of-hours work against the relevant noise and vibration criteria, including the determination of low and high-risk activities;</p> <p>(b) provide a process for the identification and implementation of mitigation measures for residual impacts, including respite periods in consultation with the community at each affected location, consistent with the requirements of Condition E14;</p> <p>(c) identify procedures to facilitate the coordination of out-of-hours work approved by an EPL to ensure appropriate respite is provided;</p> <p>(d) identify an approval process that considers the risk of activities, proposed mitigation, management, and coordination, including where:</p> <ul style="list-style-type: none"> (i) low risk activities can be approved by the ER, and (ii) high risk activities that are approved by the Planning Secretary; and <p>(e) identify DPIE, EPA and community notification arrangements for approved out-of-hours works, which maybe detailed in the Communication Strategy.</p>	<p>Appendix C OOHW Protocol</p> <p>Appendix C OOHW Protocol</p> <p>Appendix C OOHW Protocol</p> <p>Appendix C OOHW Protocol</p> <p>Appendix C OOHW Protocol</p> <p>Appendix C OOHW Protocol</p>
E17	<p>Noise generating work in the vicinity of potentially-affected community, religious, educational institutions and noise and vibration-sensitive businesses and critical working areas (such as theatres, laboratories and operating theatres) resulting in noise levels above the NMLs must not be timetabled within sensitive periods or during important events, unless other reasonable arrangements with the affected institutions are made at no cost to the affected institution or as otherwise approved by the Planning Secretary.</p>	<p>Section 7.1.3</p>
<p>Noise and Vibration Mitigation</p>		
E18	<p>Mitigation measures must be implemented with the aim of achieving the following construction noise management levels and vibration criteria:</p> <p>(a) construction ‘Noise affected’ noise management levels established using the <i>Interim Construction Noise Guideline</i> (DECC, 2009);</p> <p>(b) vibration criteria established using the <i>Assessing vibration: a technical guideline</i> (DEC, 2006) (for human exposure);</p> <p>(c) BS 7385 Part 2-1993 “<i>Evaluation and measurement for vibration in buildings Part 2</i>” as they are “applicable to Australian conditions”; and</p>	<p>Section 5.1.2</p> <p>Section 5.2</p> <p>Section 5.2.3</p>

CoA No.	Condition Requirements	Document Reference
	<p>(d) the vibration limits set out in the <i>German Standard DIN 4150-3: Structural Vibration- effects of vibration on structures</i> (for structural damage).</p> <p>Any work identified as exceeding the noise management levels and/or vibration criteria must be managed in accordance with the Noise and Vibration CEMP Sub-Plan.</p> <p><i>Note: The Interim Construction Noise Guideline identifies 'particularly annoying' activities that require the addition of 5 dB(A) to the predicted level before comparing to the construction Noise Management Level.</i></p>	<p>Section 5.2.1</p> <p>Section 5.1.3</p>
E19	To protect the heritage significant fabric of heritage items, the Proponent must seek the advice of a heritage specialist on methods and locations for installing equipment used for vibration and noise monitoring at heritage-listed structures before installation.	Chapter 8 mitigation measure ID NVMM46 and OHMM47
E20	The Proponent must sequence construction along Broomfield Street to minimise the duration of time any section of the existing Broomfield Street noise barrier is partially or fully removed.	Chapter 8 mitigation measure ID NVMM18
Noise Mitigation - Operational Noise Mitigation Measures		
E21	<p>The Broomfield Street noise barrier must be a single continuous barrier.</p> <p><i>Note: Continuous for the purposes of this condition allows for the inclusion of access points where there are overlapping sections of noise barrier. in accordance with the ARTC Noise Prediction and Mitigation Guideline.</i></p>	Section 1.5
E22	<p>The Proponent must prepare an Operational Noise and Vibration Review (ONVR) to confirm noise and vibration control measures that will be implemented for the operation of the CSSI. The ONVR must be prepared as an iterative design development and in consultation with relevant council(s) and other relevant stakeholders and must:</p> <p>(a) confirm the appropriate operational noise and vibration objectives and levels for surrounding development, including existing sensitive land uses;</p> <p>(b) confirm the operational noise predictions based on the final design. Confirmation must be based on an appropriately calibrated noise model (which has incorporated data obtained from noise monitoring);</p> <p>(c) confirm the operational noise and vibration impacts at sensitive receivers based on the final design of the CSSI, including operational daytime LAeq,15 hour and night-time LAeq, 9 hour noise contours;</p> <p>(d) examine all noise and vibration mitigation measures, with a focus on source control and design;</p> <p>(e) identify specific physical and other mitigation measures that will be installed for controlling noise and vibration impacts at the source and at the receiver (if relevant) including location, type and timing of mitigation measures;</p> <p>(f) where noise and vibration objectives cannot be achieved, the ONVR must present an analysis of all noise and vibration mitigation measures, the 'best practice' achievable noise and vibration outcome and justification for the</p>	Section 1.5

CoA No.	Condition Requirements	Document Reference
	<p>measure decided upon based upon the analysis;</p> <p>(g) fully describe the design, assumptions, calculation process, mitigation strategy, and other relevant factors;</p> <p>(h) include a consultation strategy to seek feedback from directly affected landowners on the noise and vibration mitigation measures; and</p> <p>(i) procedures for the management of operational noise and vibration complaints.</p> <p>Notwithstanding the above, the Proponent is responsible for the cumulative operational noise impacts of the CSSI and the Southern Sydney Freight Line (SSFL) project. That is, the ONVR must consider the pre-SSFL noise levels at sensitive receivers in meeting the objectives in Condition E22(a) for the cumulative operation of the CSSI and SSFL.</p> <p>The ONVR is to be verified by a suitably qualified and experienced noise and vibration expert. The ONVR is to be undertaken at the Proponent’s expense and submitted to the Planning Secretary for approval before the implementation of mitigation measures. The ONVR must be made publicly available consistent with the requirements of Condition B10.</p> <p>The Proponent must implement the identified noise and vibration control measures no later than 6 months after the commencement of construction, unless otherwise agreed with the Planning Secretary.</p> <p><i>Note: Nothing in this approval devolves the Proponent from meeting the requirements of approval MP05_0089 (as modified) in regard to operational noise outcomes.</i></p>	
E23	<p>Operational noise and vibration mitigation measures as identified in Condition E22 that will not be physically affected by works, must be implemented within six (6) months of the commencement of construction in the vicinity of the impacted receiver to minimise construction noise impacts, and detailed in the Noise and Vibration CEMP Sub-Plan for the CSSI.</p> <p>Note: For the purpose of Conditions E23 and E25, operational noise mitigation measures refer to at-property treatments, the detail of which would broadly be included in the Noise and Vibration CEMP Sub-Plan. When detail on the specific mitigation measures is known and before the implementation of the mitigation measures, the CEMP Sub-Plan must be updated.</p>	Section 1.5
E24	<p>Where implementation of operational noise mitigation measures cannot be implemented within six months of commencement of construction in accordance with Condition E23, the Proponent must submit to the Planning Secretary a report providing justification as to why. The report must include details of temporary measures that would be implemented to reduce construction noise impacts, until such time that the operational noise mitigation measures identified in Condition E21 are implemented. The report must be submitted to the ER for approval within six (6) months of the commencement of construction which would affect the identified sensitive land uses.</p>	Section 1.5
E25	<p>Within 12 months of the commencement of operation of the CSSI, the Proponent must undertake monitoring of operational noise to compare actual</p>	Section 1.5

CoA No.	Condition Requirements	Document Reference
	<p>noise performance of the CSSI against the noise performance predicted in the review of noise mitigation measures required by Condition E21.</p> <p>The Proponent must prepare an Operational Noise Compliance Report to document this monitoring. The Report must include, but not necessarily be limited to:</p> <ul style="list-style-type: none"> (a) noise monitoring to assess compliance with the operational noise levels predicted in the review of operational noise mitigation measures required under Condition E21; (b) a review of the operational noise levels in terms of criteria and noise goals established in the <i>NSW Rail Infrastructure Noise Guideline 2013</i>; (c) methodology, location and frequency of noise monitoring undertaken, including monitoring sites at which CSSI noise levels are ascertained, with specific reference to locations indicative of impacts on receivers; (d) details of any complaints and enquiries received in relation to operational noise generated by the CSSI between the date of commencement of operation and the date the report was prepared; (e) any required recalibrations of the noise model taking into consideration factors such as noise monitoring and actual traffic numbers and proportions; (f) an assessment of the performance and effectiveness of applied noise mitigation measures together with a review and if necessary, reassessment of mitigation measures; and (g) identification of additional measures to those identified in the review of noise mitigation measures required by Condition E18, that are to be implemented with the objective of meeting the criteria outlined in the <i>NSW Rail Infrastructure Noise Guideline 2013</i> and <i>Industrial Noise Policy (EPA, 2000)</i>, when these measures are to be implemented and how their effectiveness is to be measured and reported to the Planning Secretary and the EPA. <p>The Operational Noise Compliance Report must be submitted to the Planning Secretary and the EPA for information within 60 days of completing the operational noise monitoring and made publicly available.</p>	
E27	<p>Before commencement of any construction, a structural engineer must undertake condition surveys of all buildings, structures, utilities and the like that are identified in the Noise and Vibration CEMP Sub-Plan as being at risk of damage due to construction vibration. The results of the surveys must be documented in a Condition Survey Report for each item surveyed. Copies of Condition Survey Reports must be provided to owners of the items surveyed, and no later than one month before the commencement of construction, or as otherwise instructed or agreed to by the utility operator.</p>	Section 7.5.2
E28	<p>After completion of construction, condition surveys must be undertaken by a structural engineer of all items for which condition surveys were undertaken in accordance with Condition E27. The results of the surveys must be documented in a Condition Survey Report for each item surveyed. Copies of Condition Survey Reports must be provided to the landowners of the items</p>	Section 7.5.2

CoA No.	Condition Requirements	Document Reference
	surveyed no later than three (3) months following the completion of construction.	
E29	The Proponent, where liable, must rectify any property damage caused directly or indirectly (for example from vibration) by the construction of the CSSI at no cost to the owner unless otherwise agreed with the owner	Section 7.5.2

3.4. Revised Mitigation Measures

Relevant construction-related RMM from the Submissions Report are listed in Table 3. A cross reference is also included to indicate where the measure is addressed in this NVMP or other project management documents.

Table 3: Revised Mitigation Measures Relevant to NVMP

ID No.	Revised Mitigation Measure	Document Reference
C2 Noise and Vibration		
General impacts of construction activities on sensitive receivers		
C2.1	<p>A construction noise and vibration management plan will be prepared by the contractor and implemented as part of the CEMP. It will include measures to minimise the potential for noise and vibration impacts on the community, including those listed in this EIS. It will also consider relevant noise mitigation measures and notification procedures outlined in ARTC’s existing EPL (EPL #3142).</p> <p>The construction noise and vibration management plan will be developed in consultation with Liverpool City Council, Fairfield City Council, and the EPA.</p>	<p>This NVMP Chapter 8</p> <p>Section 1.4</p>
Noise impacts during out of hours work		
C2.2	<p>An out of hours protocol will be developed as part of the construction noise and vibration management plan. It will at a minimum:</p> <ul style="list-style-type: none"> ▪ provide a process for the consideration of out of hours work against the relevant noise and vibration criteria ▪ document procedures to manage potential impacts ▪ identify responsibilities for implementation and management including managing complaints. 	<p>Appendix C OOHW Protocol</p>
Vibration impacts on structures including heritage items		
C2.3	<p>Strategies to minimise the vibration of construction activities will be considered during construction planning. This will include a detailed review of work methods and equipment selection with the aim of avoiding the use of equipment within the relevant vibration safe working buffer distances.</p> <p>Where this is not possible, attended vibration measurements of vibration generating equipment (eg bored piling, vibratory rolling works) will be undertaken prior to works near the sensitive structures located within the vibration buffer distances identified in Figure 4-12 and Figure 4-13 provided in Technical Report 2 – Noise and vibration impact assessment. This will confirm the project specific minimum working distances for vibration intensive activities.</p>	<p>Section 7.5</p> <p>Chapter 8 mitigation measure ID NVMM40, NVMM46, NVMM47</p>

ID No.	Revised Mitigation Measure	Document Reference
C2.4	Building dilapidation surveys will be carried out on all structures located within the vibration buffer distance prior to major project construction activities with the potential to cause property damage.	Section 7.5.2 Chapter 8 mitigation measure ID NVMM48, NVMM49, OOHMM49, OOHMM50, OOHMM51
Vibration impacts from the increase number of trains passing by Cabramatta (Cabramatta Creek), Railway Parade and Sussex Street Underbridge (I19).		
C2.5	If following a dilapidation survey of the heritage items the structures are found to be unsound, then a structural engineer will advise if there is a risk from increasing operational train numbers and identify strategies to avoid risks.	Chapter 8 mitigation measure ID NVMM52
Noise impacts during sensitive periods		
C2.6	Where feasible and reasonable, construction will be carried out during the standard daytime working hours. The use of highly intensive noise and vibration generating equipment (such as jack and rock hammering, sheet and pile driving, rock breaking and vibratory rolling) less sensitive times (eg the middle of the day).	Chapter 8 mitigation measure ID NVMM1, NVMM38, NVMM53
Noise impacts from continuous activities		
C2.7	Highly intensive noise and vibration generating equipment (such as jack and rock hammering, sheet and pile driving, rock breaking and vibratory rolling) will only be used in continuous blocks not exceeding three hours each, with a minimum respite period of one hour between each block. 'Continuous' includes any period during which there is less than one hour respite between ceasing and recommencing any of the work. Additionally, this equipment will not be used for more than two consecutive nights over any seven day period adjacent to the same sensitive receivers.	Chapter 8 mitigation measure ID NVMM32, NVMM35, NVMM37, NVMM45, OOHMM9
Noise impacts from worker activities		

ID No.	Revised Mitigation Measure	Document Reference
C2.8	<p>All employees, contractors and subcontractors are to receive an environmental induction. The induction will include at least:</p> <ul style="list-style-type: none"> ▪ all relevant project specific and standard noise and vibration mitigation measures ▪ relevant licence and approval conditions ▪ permissible hours of work ▪ any limitations on noise generating activities with special audible characteristics ▪ location of nearest sensitive receivers ▪ construction employee parking areas ▪ designated loading/unloading areas and procedures ▪ site opening/closing times (including deliveries) ▪ environmental incident procedures. 	Section 9.2
Noise impacts from worker activities		
C2.9	<p>While on site, construction workers will refrain from:</p> <ul style="list-style-type: none"> ▪ swearing or unnecessary shouting or loud stereos/radios on site ▪ dropping of materials from height, throwing of metal items and slamming of doors ▪ excessive revving of plant and vehicle engines ▪ uncontrolled release of compressed air. 	Chapter 8 mitigation measure ID NVMM8, NVMM29, OOHMM28
Construction traffic noise		
C2.10	Traffic flow, parking and loading/unloading areas will be planned to minimise reversing movements within the site.	Chapter 8 mitigation measure ID NVMM4, OOHMM4
C2.11	To reduce the impact of noise from construction traffic the following mitigation measures will be implemented:	Chapter 8 mitigation measure ID
	<ul style="list-style-type: none"> ▪ Loading and unloading of materials/deliveries will occur as far as possible from sensitive receivers. 	Chapter 8 mitigation measure ID NVMM33
	<ul style="list-style-type: none"> ▪ Site access points and roads will be selected as far as possible away from sensitive receivers. 	Chapter 8 mitigation measure ID NVMM6, NVMM24
	<ul style="list-style-type: none"> ▪ Dedicated loading/unloading areas will be shielded if close to sensitive receivers, where reasonable and feasible. 	Chapter 8 mitigation measure ID NVMM25, NVMM31
	<ul style="list-style-type: none"> ▪ Delivery vehicles will be fitted with straps rather than chains for unloading, wherever possible. 	Chapter 8 mitigation measure ID NVMM33

ID No.	Revised Mitigation Measure	Document Reference
	<ul style="list-style-type: none"> ▪ Vehicle movements will be scheduled away from sensitive receivers and during less sensitive times, where possible. 	Chapter 8 mitigation measure ID NVMM33, NVMM34
	<ul style="list-style-type: none"> ▪ The speed of vehicles within and approaching construction compounds will be reduced 	Chapter 8 mitigation measure ID NVMM41
	<ul style="list-style-type: none"> ▪ The use of engine compression brakes during night time periods will be avoided, where possible 	Chapter 8 mitigation measure ID NVMM15
	<ul style="list-style-type: none"> ▪ On-site storage capacity will be maximised to reduce the need for truck movements during sensitive times. 	Chapter 8 mitigation measure ID NVMM19
	<ul style="list-style-type: none"> ▪ Vehicles will be fitted with a maintained original equipment manufacturer exhaust silencer that complies with the National Transport Commissions <i>National Stationary Exhaust Noise Test Procedures for In-service Motor Vehicles</i> (2006). 	Chapter 8 mitigation measure ID NVMM9, OOHMM9
Construction noise and vibration		
C2.12	<p>Quieter and less vibration emitting construction methods and equipment will be used where feasible and reasonable.</p> <p>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.</p>	Chapter 8 mitigation measure ID NVMM14
C2.13	<p>Where practicable, materials will be pre-fabricated and/or prepared off-site to reduce noise with special audible characteristics occurring on site. Materials can then be delivered to site for installation.</p>	Chapter 8 mitigation measure ID NVMM20
Noise from construction equipment		
C2.14	<p>The noise of plant and equipment must have operating Sound Power or Sound Pressure Levels compliant with the allowable noise levels.</p>	Chapter 8 mitigation measure ID NVMM10, OOHMM10
Noise from construction equipment		
C2.15	<p>To reduce the impact of noise from construction equipment the following mitigation measures will be implemented:</p> <ul style="list-style-type: none"> ▪ The offset distance between noisy plant and adjacent sensitive receivers will be maximised. 	Chapter 8 mitigation measure ID NVMM24

ID No.	Revised Mitigation Measure	Document Reference
	<ul style="list-style-type: none"> ▪ Plant used intermittently will be throttled or shut down. 	Chapter 8 mitigation measure ID NVMM13
	<ul style="list-style-type: none"> ▪ Noise-emitting plant will be directed away from sensitive receivers. 	Chapter 8 mitigation measure ID NVMM26, OOHMM24
C2.16	Non-tonal reversing beepers (or an equivalent mechanism) will be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out of hours work, including delivery vehicles.	Chapter 8 mitigation measure ID NVMM3, OOHMM3
C2.17	<p>Noise from mobile plant will be reduced where possible, through additional fittings including:</p> <ul style="list-style-type: none"> ▪ residential grade mufflers ▪ damped hammers such as 'City' Model Rammer Hammers ▪ air parking brake engagement silenced. 	Chapter 8 mitigation measure ID NVMM9, NVMM15 OOHMM9, OOHMM15, NVMM20
Noise impact from compound (C1)		
C2.18	Use of the construction compound (C1) near Warwick Farm Station will where practicable, be limited to standard hours only with the exception of plant storage and material delivery.	Chapter 8 mitigation measure ID NVMM21
Noise from construction compounds		
C2.19	Stationary noise sources on construction compounds will be enclosed or shielded where practicable, to ensure that the occupational health and safety of workers is maintained. Appendix F of AS 2436:1981 lists materials suitable for shielding.	Chapter 8 mitigation measure ID NVMM31
C2.20	Structures will be used to shield residential receivers from noise where practicable such as site shed placement; earth bunds; fencing; erection of operational stage noise barriers (where practicable) and consideration of site topography when situating plant.	Chapter 8 mitigation measure ID NVMM6, NVMM30
Construction noise resulting in highly intrusive levels		
C2.21	A noise monitoring program will be carried out for the duration of works at sensitive receivers identified as experiencing highly intrusive noise levels and as a result of complaints received, in accordance with the CEMP.	Section 9.4 Section 9.4.3
Vibration impacts on heritage sites: Cabramatta (Cabramatta Creek), Railway Parade and Sussex Street Underbridge		

ID No.	Revised Mitigation Measure	Document Reference
C2.22	Where building dilapidation surveys indicate that the heritage listed bridges are unsound, then the conservative criteria of 3.0 mm/s provided by DIN 4150-3 will be used for construction equipment used within the vibration buffer distances, where practicable.	Section 7.5.1 Appendix D

4. Existing Environment

This Chapter provides a brief summary of what is known about noise and vibration within and adjacent to the project based on information provided in the EIS Technical Report 2 – Noise and Vibration Impact Assessment.

4.1. Sensitive Receivers

Noise and vibration sensitive receivers (NVSRs) are defined by the type of occupancy within the structure and the activities performed within the property boundary. NVSRs could include the following:

- residences (including multi-floor dwellings): Each floor of a multi-floor dwelling is considered to be a separate sensitive receiver as each floor could have separate property owners and/or land uses (e.g. commercial ground floor and residential first floor)
- educational institutes (such as schools and universities e.g. Lawrence Hargrave School)
- hospitals and medical facilities
- places of worship
- commercial or industrial premises e.g. Peter Warren Automotive
- passive recreational areas
- active recreational areas such as sporting fields, golf courses. Note that recreational areas are only considered sensitive when they are in use or occupied.

3604 residential receivers and 283 non-residential receivers have been identified within the construction assessment study area shown in Figure 1.

All medical, educational and places of worship sensitive receivers are also summarised in Table 4. In addition to the existing sensitive receivers, a search of the NSW Government major projects online database and the Fairfield and Liverpool council online planning databases was undertaken to identify if any determined projects within 100 metres of the project site would alter the type or sensitivity of existing receivers (i.e. change from a commercial premises into residential). No projects were identified that would require additional consideration.

Table 4: Medical, Educational and Places of Worship Sensitive Receivers

Receiver ID	Address	Receiver Type	NCA
R0218	42 BIGGE STREET LIVERPOOL	Medical facility	NCA03
R0232	26 BIGGE STREET LIVERPOOL	Medical facility	NCA03
R0253	20 BIGGE STREET LIVERPOOL	Medical facility	NCA03
R0257	16 BIGGE STREET LIVERPOOL	Medical facility	NCA03
R0277	95 LAWRENCE HARGRAVE ROAD WARWICK FARM	Educational institute	NCA03
R0281	45 GOULBURN STREET LIVERPOOL	Medical facility	NCA03
R0287	41 GOULBURN STREET LIVERPOOL	Medical facility	NCA03
R0291	95 LAWRENCE HARGRAVE ROAD WARWICK FARM	Educational institute	NCA03
R0302	95 LAWRENCE HARGRAVE ROAD WARWICK FARM	Educational institute	NCA03
R0312	95 LAWRENCE HARGRAVE ROAD WARWICK FARM	Educational institute	NCA03
R0322	17 GOULBURN STREET LIVERPOOL	Medical facility	NCA03
R0329	95 LAWRENCE HARGRAVE ROAD WARWICK FARM	Educational institute	NCA03
R0340	95 LAWRENCE HARGRAVE ROAD WARWICK FARM	Educational institute	NCA03
R0351	LIVERPOOL HOSPITAL CANCER THERAPY CENTRE	Medical facility	NCA03

Receiver ID	Address	Receiver Type	NCA
R0357	17 GOULBURN STREET LIVERPOOL	Medical facility	NCA03
R0363	95 LAWRENCE HARGRAVE ROAD WARWICK FARM	Educational institute	NCA03
R0439	95 LAWRENCE HARGRAVE ROAD WARWICK FARM	Educational institute	NCA03
R0454	95 LAWRENCE HARGRAVE ROAD WARWICK FARM	Educational institute	NCA03
R0469	95 LAWRENCE HARGRAVE ROAD WARWICK FARM	Educational institute	NCA03
R0494	27 FORBES STREET LIVERPOOL	Place of worship	NCA03
R0516	95 LAWRENCE HARGRAVE ROAD WARWICK FARM	Educational institute	NCA03
R0607	136 JOHN STREET CABRAMATTA	Place of worship	NCA01
R0618	18 FORBES STREET LIVERPOOL	Educational institute	NCA03
R0619	13 LACHLAN STREET WARWICK FARM	Medical facility	NCA03
R0621	LIVERPOOL HOSPITAL CANCER THERAPY CENTRE	Medical facility	NCA03
R0623	LIVERPOOL HOSPITAL CANCER THERAPY CENTRE	Medical facility	NCA03
R0639	18 FORBES STREET LIVERPOOL	Educational institute	NCA03
R0641	LIVERPOOL HOSPITAL CANCER THERAPY CENTRE	Medical facility	NCA03
R0679	18 FORBES STREET LIVERPOOL	Educational institute	NCA03
R0692	18 FORBES STREET LIVERPOOL	Educational institute	NCA03
R0736	18 FORBES STREET LIVERPOOL	Educational institute	NCA03
R0744	LIVERPOOL HOSPITAL CANCER THERAPY CENTRE	Medical facility	NCA03
R0767	18 FORBES STREET LIVERPOOL	Educational institute	NCA03
R0776	18 FORBES STREET LIVERPOOL	Educational institute	NCA03
R0785	18 FORBES STREET LIVERPOOL	Educational institute	NCA03
R0806	18 FORBES STREET LIVERPOOL	Educational institute	NCA03
R0810	18 FORBES STREET LIVERPOOL	Educational institute	NCA03
R0818	18 FORBES STREET LIVERPOOL	Educational institute	NCA03
R0842	18 FORBES STREET LIVERPOOL	Educational institute	NCA03
R0852	LIVERPOOL HOSPITAL CANCER THERAPY CENTRE	Medical facility	NCA03
R0866	18 FORBES STREET LIVERPOOL	Educational institute	NCA03
R0888	18 FORBES STREET LIVERPOOL	Educational institute	NCA03
R0892	18 FORBES STREET LIVERPOOL	Educational institute	NCA03
R0913	18 FORBES STREET LIVERPOOL	Educational institute	NCA03
R0970	LIVERPOOL HOSPITAL CANCER THERAPY CENTRE	Medical facility	NCA03
R0975	54 HUGHES STREET CABRAMATTA	Medical facility	NCA01
R0989	LIVERPOOL HOSPITAL CANCER THERAPY CENTRE	Medical facility	NCA03
R1025	120 JOHN STREET CABRAMATTA	Medical facility	NCA01
R1037	18 FORBES STREET LIVERPOOL	Medical facility	NCA03
R1086	18 FORBES STREET LIVERPOOL	Educational institute	NCA03
R1087	18 FORBES STREET LIVERPOOL	Medical facility	NCA03

Receiver ID	Address	Receiver Type	NCA
R1099	18 FORBES STREET LIVERPOOL	Medical facility	NCA03
R1245	119A JOHN STREET CABRAMATTA	Medical facility	NCA01
R1348	117 JOHN STREET CABRAMATTA	Medical facility	NCA01
R1476	42 HILL STREET CABRAMATTA	Medical facility	NCA01
R1641	1 LAWRENCE HARGRAVE ROAD WARWICK FARM	Educational institute	NCA03
R1649	1 LAWRENCE HARGRAVE ROAD WARWICK FARM	Educational institute	NCA03
R1673	1 LAWRENCE HARGRAVE ROAD WARWICK FARM	Educational institute	NCA03
R1683	1 LAWRENCE HARGRAVE ROAD WARWICK FARM	Educational institute	NCA03
R1705	1 LAWRENCE HARGRAVE ROAD WARWICK FARM	Educational institute	NCA03
R1739	1 LAWRENCE HARGRAVE ROAD WARWICK FARM	Educational institute	NCA03
R1919	PARK ROAD CABRAMATTA	Educational institute	NCA01
R1952	39 PARK ROAD CABRAMATTA	Place of worship	NCA01
R2030	7 MCBURNEY ROAD CABRAMATTA	Place of worship	NCA01
R2035	PARK ROAD CABRAMATTA	Place of worship	NCA01
R2250	1 BARTLEY STREET CANLEY VALE	Place of worship	NCA01
R2368	70 BROOMFIELD STREET CABRAMATTA	Place of worship	NCA02
R2696	60 CUMBERLAND STREET CABRAMATTA	Educational institute	NCA02
R2706	72 CABRAMATTA ROAD CABRAMATTA	Educational institute	NCA02
R2724	60 CUMBERLAND STREET CABRAMATTA	Educational institute	NCA02
R2751	72 CABRAMATTA ROAD CABRAMATTA	Educational institute	NCA02
R2753	42 CUMBERLAND STREET CABRAMATTA	Place of worship	NCA02
R2789	65 CURTIN STREET CABRAMATTA	Place of worship	NCA02
R2791	72 CABRAMATTA ROAD CABRAMATTA	Educational institute	NCA02
R2800	72 CABRAMATTA ROAD CABRAMATTA	Educational institute	NCA02
R2810	72 CABRAMATTA ROAD CABRAMATTA	Educational institute	NCA02
R2814	72 CABRAMATTA ROAD CABRAMATTA	Educational institute	NCA02
R2822	72 CABRAMATTA ROAD CABRAMATTA	Educational institute	NCA02
R2824	72 CABRAMATTA ROAD CABRAMATTA	Educational institute	NCA02
R2831	72 CABRAMATTA ROAD CABRAMATTA	Educational institute	NCA02
R2832	9 NIANGALA STREET COOMA	Educational institute	NCA02
R2862	72 CABRAMATTA ROAD CABRAMATTA	Educational institute	NCA02
R2895	79 CABRAMATTA ROAD CABRAMATTA	Place of worship	NCA02

4.2. Noise Catchment Areas

The study has been sub-divided into four noise catchment areas (NCAs). These NCAs have been created based on the ambient noise characteristics with respect to the major roads and rail corridors in the study area. The following NCAs were created:

- NCA 1: The area to the north of Jacquie Osmond Reserve and west of the rail corridor. The area comprises of commercial and residential land uses. Rail noise, road traffic noise from Railway Parade and noise from commercial premises along Railway Parade dominate the noise environment in NCA01.
- NCA 2: The area to the north of Jacquie Osmond Reserve and east of the rail corridor. The area comprises of residential land uses. Road traffic noise from Broomfield Street and local roads in the area dominate the noise environment. An existing noise wall along Broomfield Street shields the catchment from rail noise.
- NCA 3: The area to the south of Jacquie Osmond Reserve and west of the rail corridor. The area comprises of primarily residential land uses. Rail noise and traffic along local roads dominate the noise environment in NCA03.
- NCA 4: The area to the south of Jacquie Osmond Reserve and east of the rail corridor. The area comprises of primarily commercial land uses. Rail noise and noise from commercial premises dominate the noise environment in NCA04.

Figure 1 shows the noise catchment areas.

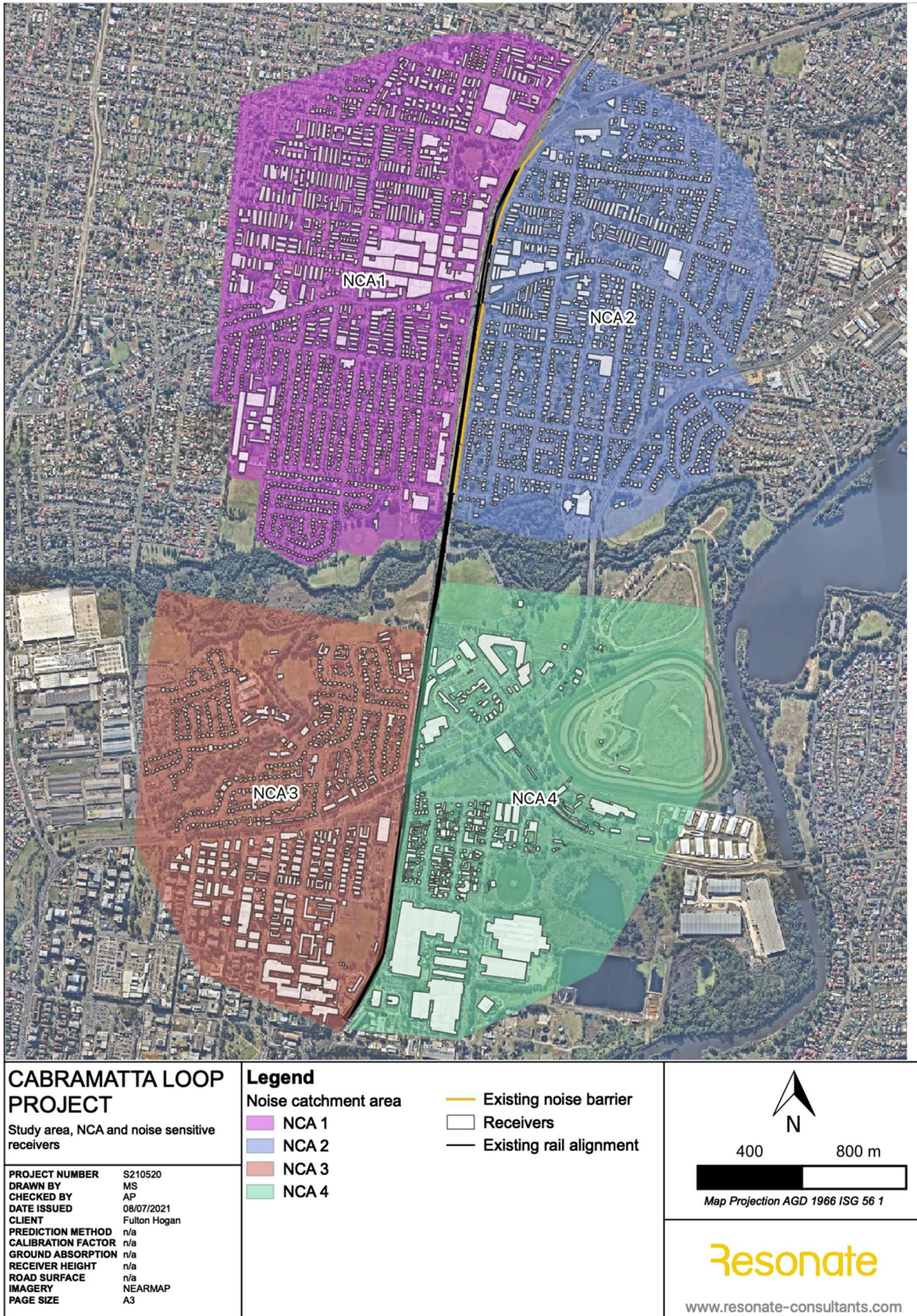


Figure 1: Noise Catchment Areas

4.3. Background Noise and Vibration Monitoring

Existing ambient and background noise monitoring was undertaken at seven locations in the study area between 12 October 2018 and 1 November 2018. A minimum of two weeks of monitoring was carried out at each location. The objectives of the monitoring were to quantify:

- The existing railway and background noise levels at five locations (two within the rail corridor and three at residential receivers). These locations were used for noise model validation.
- The existing background noise levels (only) at an additional two locations set back from the rail corridor.

Baseline logger location considerations included land topography, distance from rail activities and contribution from other noise activities, such as road noise. The logger locations were considered representative of the existing background and ambient noise environment in the study area.

The noise loggers accumulated L_{AN} , L_{Aeq} and L_{Amax} noise descriptors continuously over sampling periods of 15 minutes for the entire monitoring period.

Prior to deployment, a calibration check was performed on the noise monitoring equipment using a SV 30 sound level calibrator (serial number 29030). At completion of the measurements, the equipment was re-checked to ensure the sensitivity of the noise monitoring equipment had not varied. The noise loggers were found to be within the acceptable tolerance of 0.5 dB(A).

The data collected by the loggers was downloaded and analysed, and any invalid data removed. Invalid data generally refers to periods where average wind speeds were greater than five metres per second, or when rainfall occurred in accordance with the Noise Policy for Industry (NPI) (EPA, 2017). Concurrent half-hourly weather data was sourced from the Bureau of Meteorology's Bankstown Airport automatic weather station (AWS) to identify any periods of weather, which may have affected the monitoring results. The Bankstown Airport AWS is located about five kilometres east of the project area.

All sampling activities were carried out with consideration to the specifications outlined in AS 1055 (1997) *Acoustics—Description and Measurement of Environmental Noise* and the NPI.

4.3.1. Summary of Baseline Noise

A summary of the baseline noise monitoring, including a description of the ambient noise environment at each location is provided in Table 5. Detailed noise monitoring tables and charts are provided in the EIS.

This baseline data is deemed sufficient and therefore, no further baseline data is required.

Background noise levels at residential locations L04 to L07 are consistent and within 2 dB across the day (37 to 39 dB(A)), evening (37 to 39 dB(A)) and night (30 to 32 dB(A)) time periods. As per Australian Standard AS 1055, these background noise levels are typical of a suburban environment with negligible transportation. Intermittent noise events such as rail passbys do not contribute significantly to the background noise levels.

Background noise levels at L03 (225 Railway Parade) are slightly higher during the day and evening time periods due to higher road traffic noise levels. The noise levels are typical of a suburban area with low density transportation.

No additional baseline noise data collection is proposed further to what has been provided in the EIS. Monitoring to confirm predicted construction noise levels will be conducted.

Table 5: Summary of Baseline Noise Monitoring

Location	NCA	Address	Free-field or façade	Rating background level (RBL)			Ambient noise levels, $L_{Aeq}(\text{period})$					Ambient noise observations
				Day	Evening	Night	Day	Evening	Night	Day (15 hour)	Night (9 hour)	
L01 ²	-	In rail corridor (North of Warwick Farm Station)	Free field	-	-	-	65	64	63	65	63	Rail noise dominant
L02 ²	-	In rail corridor (South of Cabramatta Station)	Free field	43	41	33	68	68	66	68	66	Rail noise dominant
L03	01	225 Railway Parade, Cabramatta	Free field	45	44	33	61	61	59	61	59	Rail noise dominant, road traffic noise along Railway Parade
L04	02	150 Broomfield Street, Cabramatta	Façade	39	38	31	56	56	52	56	52	Rail noise dominant, road traffic noise along Broomfield Street, construction works at residence along Broomfield Street
L05	02	46a National Street, Cabramatta	Free field	38	37	31	53	48	46	51	46	Rail noise faintly audible, road traffic noise along National Street
L06	01	41 Church Street, Cabramatta	Free field	38	39	30	55	53	50	54	50	Road traffic noise along Church Street, rail passbys in background
L07	03	25 Lawrence Hargrave Road, Warwick Farm	Free field	37	38	32	52	50	47	50	47	Rail noise dominant, car passbys and bird noise

Note 1: For the rating background and ambient noise levels, the periods are defined as per the NPI (EPA, 2017):

- Day: the period from 7.00 am to 6.00 pm Monday to Saturday or 8.00 am to 6.00 pm on Sundays and public holidays
- Evening: the period from 6.00 pm to 10.00 pm
- Night: the remaining periods.

For the 15 hour and nine hour noise levels, as per the Rail Infrastructure Noise Guideline (EPA, 2013), day refers to the 7.00 am to 10.00 pm time period while night refers to 10.00 pm to 7.00 am.

Note 2: The absolute rail noise contributions at L01 were calculated to be 64 dB(A) $L_{Aeq(15 \text{ hour})}$ and 63 dB(A) $L_{Aeq(9 \text{ hour})}$. The absolute rail noise contributions at L02 were calculated to be 68 dB(A) $L_{Aeq(15 \text{ hour})}$ and 66 dB(A) $L_{Aeq(9 \text{ hour})}$. The absolute rail noise contributions were calculated from a detailed analysis of passby data and do not include non-rail noise sources.

4.3.2. Baseline Vibration Monitoring

Attended and unattended vibration monitoring was also undertaken within and outside the rail corridor. The results of the monitoring indicated 4-5 mm/s peak vibration levels 6 metres from the railway tracks and levels between 0.1 mm/s and 0.3 mm/s at the residence (150 Broomfield Street, 31 metres from the SSFL). The vibration environment was dominated by road traffic noise and intermittent rail passbys. The measured vibration levels from train passbys as presented in the EIS is shown in Figure 2. No additional baseline vibration data collection is proposed further to what has been provided in the EIS. However, monitoring to confirm that works occur outside of the minimum working distances will be conducted.

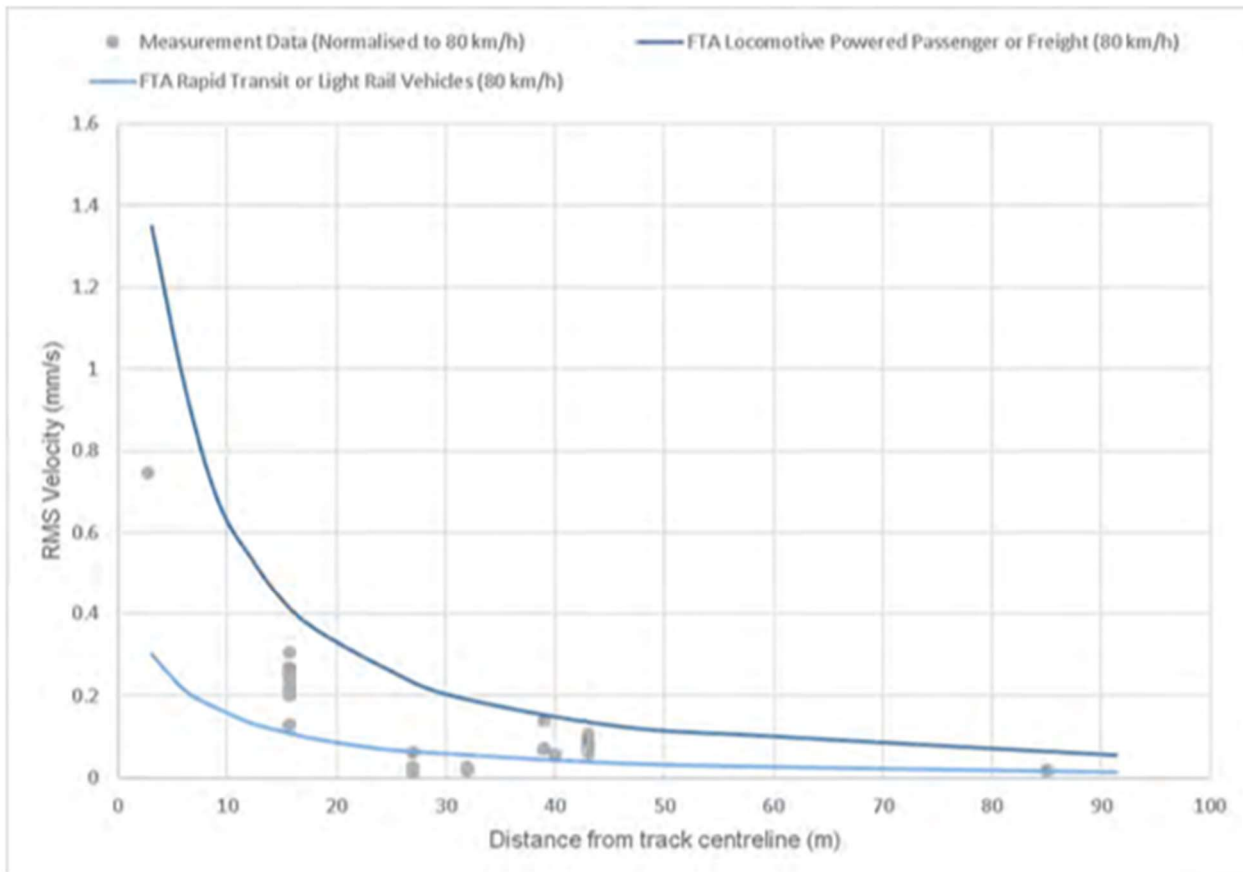


Figure 2: Baseline Vibration Monitoring Data

5. Construction Noise and Vibration Criteria

The construction noise and vibration criteria for the project are outlined in this section. The criteria are referenced to the relevant noise and vibration guidelines. The predicted noise and vibration levels (refer to Section 7.4 and 7.5) are compared with the criteria outlined in this section. If the predicted construction noise and vibration levels exceed the criteria, potential noise and vibration mitigation measures need to be considered.

5.1. Noise Criteria

The *Interim Construction Noise Guideline* (ICNG) (DECC 2009) applies to the management of construction noise in NSW. The guideline provides recommendations on construction noise management levels (NMLs) and standard construction periods.

5.1.1. Construction Working Hours

Construction NMLs for the project are based on the ICNG and the *Construction Noise and Vibration Strategy* (CNVS) (TfNSW, 2018).

The construction periods defined in the CNVS are provided in Table 6.

Table 6: Construction Working Hours

Construction hours	Monday to Friday	Saturday	Sunday/Public holiday
Standard hours	7.00 am to 6.00 pm	8.00 am to 1.00 pm	No work
OOHW Period 1 (Day)	-	7.00 am to 8.00 am 1.00 pm to 6.00 pm	8.00 am to 6.00 pm
OOHW Period 1 (Evening)	6.00 pm to 10.00 pm	6.00 pm to 10.00 pm	-
OOHW Period 2	10.00 pm to 7.00 am	10.00 pm to 7.00 am	6.00 pm to 8.00 am

The standard hours for construction periods are not mandatory and the ICNG acknowledges that some activities can be carried out outside standard construction hours, assuming that all reasonable and feasible mitigation measures are implemented to minimise impacts on the surrounding sensitive land uses. These activities may include the following:

- the delivery of oversized plant or structures that police or other authorities determine are required for special arrangements to transport along public roads
- emergency work to avoid the loss of life or damage to property, or to prevent environmental harm
- works where a proponent demonstrates and justifies a need to operate outside the recommended standard construction hours
- works that maintain noise levels at sensitive receivers to below the NMLs outside of the recommended standard construction hours.
- work undertaken in a Rail Possession for operational or safety reasons

5.1.2. Construction Noise Management Levels (NMLs)

Construction NMLs at sensitive residential receivers are provided in Table 7. Construction NMLs at non-residential receivers are provided in Table 8.

The construction NMLs during recommended standard hours represent a noise level that, if exceeded, would require management measures including the following:

- reasonable and feasible work practices
- contact with residences to inform them of the nature of works to be carried out, the expected noise levels and durations and contact details.

The management measures aim to reduce noise impacts on the residential receivers; however, it may not be reasonable and feasible to reduce noise levels to below the noise affected management level. The construction NMLs during recommended standard hours are not intended as a noise limit but rather a level where noise management is required. The construction NMLs outside of recommended standard hours would be considered as noise limits unless it falls under ARTC EPL 3142 Operating Condition O9.8, O9.10 and O9.11.

Table 7: Noise Management Levels (NMLs) for Residential Land Uses (ICNG)

Time of day	Noise Management Level, $L_{Aeq(15\text{-minute})}$ *	How to apply
Recommended 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 the highly noise affected 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.
Outside recommended standard hours (OOHW)	Noise affected RBL + 5 dB(A)	Actions: Strong justification typically required for these works. All feasible and reasonable work practices should be adopted to meet the noise affected level. Where all feasible and reasonable work practices have been adopted and noise level is more than 5 dB(A) above the noise affected NML, negotiation should be undertaken with the community.

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

Table 8: Noise Management Levels (NMLs) for Other Land Uses (ICNG)

Land use	Noise Management Level, $L_{Aeq(15-minute)}$ ¹
Industrial	External noise level – 75 dB(A)
Commercial	External noise level – 70 dB(A)
Classrooms at schools and other educational institutions	Internal noise level – 45 dB(A)
Hospital wards and operating theatres	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.

5.1.3. Modifying Factor Adjustments for Annoying Activities

The ICNG lists a number of activities that have proven to be particularly annoying to sensitive receptors, including the following:

- use of ‘beeper’ style reversing or movement alarms, particularly at night-time
- use of power saws, such as used for cutting timber, rail lines, masonry, road pavement or steel work
- grinding metal, concrete or masonry
- rock drilling
- line drilling
- vibratory rolling
- rail tamping and regulating
- bitumen milling or profiling
- jackhammering, rock hammering or rock breaking
- impact piling.

These activities, if required, would be factored into the assessment by adding 5 dB to the predicted noise levels.

5.1.4. Sleep Disturbance Criteria During Construction

The sleep disturbance criteria is only relevant to night time construction works. The ICNG recommends that where construction works are planned to extend over two or more consecutive nights, the project should consider maximum noise levels and the extent and frequency of maximum noise level events exceeding the RBL. The potential for both sleep disturbance and awakenings should be considered in the assessment.

The NPI provides the latest Environmental Protection Authority (EPA) guidance for the assessment of sleep disturbance.

As stated in the NPI the potential for sleep disturbance from maximum noise level events (such as material drop noise) generated by construction works during the night-time period needs to be considered. The term “sleep disturbance” is considered to be both awakenings and disturbance to sleep stages.

To evaluate potential sleep disturbance or awakening issues associated with the operation the NPI screening method has been adapted as follows. There is limited potential for sleep disturbance or awakening issues to occur, where:

- The predicted project night-time noise level ($L_{eq, 15 \text{ minute}}$ in dB(A)) at any residential receptor remains below 40 dB(A) (or the prevailing night-time background noise level plus 5 dB(A)), whichever is the greater.
- The predicted project night-time noise level (L_{Amax} in dB(A)) at any residential receptor remains below 52 dB(A) (or the prevailing night-time background noise level plus 15 dB(A)), whichever is the greater.

A detailed maximum noise level assessment should be carried out if the screening test indicates there is a potential for sleep disturbance. The detailed assessment should cover the maximum noise level, the extent to which the maximum noise level exceeds the RBL, and the number of times this happens during the night-time period. The detailed assessment should consider all feasible and reasonable noise mitigation measures with a goal of achieving the maximum noise screening levels.

5.1.5. Construction Traffic

Construction traffic relates to light and heavy vehicle movements associated with travel to-and-from construction compounds, transporting construction materials and spoil along defined haulage routes as well as personnel travelling to and from construction sites.

Construction related traffic noise objectives are based on the Road Noise Policy (RNP) (DECCW, 2011). The RNP states that an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person.

The RNP states that any increase in the total traffic noise level should be limited to 2 dB above the existing road traffic noise levels. This applies for existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments.

The RNP has been used to identify potential impacts as a result of noise produced by construction traffic. If road traffic noise increases due to construction works within 2 dBA of current levels, then the RNP objectives would be met and no specific mitigation measures required.

Where construction traffic increases the existing road traffic noise levels by more than 2 dBA, then further assessment against the road traffic noise criteria in Table 9 is required.

Table 9: Construction Traffic Noise Criteria (NSW Road Noise Policy)

Type of development	Day 7.00 am to 10.00 pm	Night 10.00 pm to 7.00 am
Existing residence affected by additional traffic on arterial roads generated by land use developments	60 $L_{Aeq}(15 \text{ hour})$	55 $L_{Aeq}(9 \text{ hour})$
Existing residence affected by additional traffic on local roads generated by land use developments	55 $L_{Aeq}(1 \text{ hour})$	50 $L_{Aeq}(1 \text{ hour})$

5.1.6. Project Construction Noise Criteria

A summary of the project construction NMLs for each identified sensitive receiver type is provided in Table 10 for residential receivers and Table 11 for non-residential receivers (within the study area). The NMLs have been calculated based on the rating background levels provided in Table 5 and the calculation procedure outlined in Table 7. Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence.

Table 10: Residential Construction NMLs, dB(A)

NCA	Standard hours, L _{Aeq,15min}	OOHW Period 1, L _{Aeq,15min}		OOHW Period 2, L _{Aeq,15min}	Sleep disturbance, L _{AFmax}
		Day	Evening	Night	Night
NCA01	48	43	42	36	52
NCA02	48	43	43	35	52
NCA03	47	42	42	37	52
NCA04	47	42	42	37	52

Notes: The time periods for Standard hours, OOHW Period 1 (Day), OOHW Period 1 (Evening) and OOHW Period 2 (night) are defined in Table 6.

Table 11: Non-Residential Construction NMLs, dB(A)

Land use	Noise Management Level, L _{Aeq(15-minute)} 1
Commercial	External noise level – 70 dB(A)
Classrooms at schools and other educational institutions	Internal noise level – 45 dB(A)
Hospital wards and operating theatres	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.

5.2. Vibration Criteria

Construction vibration criteria have been adopted from the following sources, consistent with the EIS:

- Cosmetic and structural damage to buildings: German Standard DIN 4150-31
- Human comfort: British Standard BS 6472-12 and BS 6472-23
- Human comfort: Assessing Vibration – a technical guideline (the Guideline).
- Ground-borne noise, that is ground vibration re-radiated as noise internally within a building, has also been assessed against the requirements of the ICNG.

5.2.1. Construction Vibration Goals

The project will be constructed with the aim of achieving the following construction vibration goals:

- for structural damage to heritage structures, the vibration limits set out in the German Standard DIN 4150-3: Structural Vibration - effects of vibration on structures
- for damage to other buildings and/or structures, the vibration limits set out in the British Standard BS 7385-2:1993 - Evaluation and measurement for vibration in buildings - Guide for measurement of vibration and evaluation of their effects on buildings (and referenced in Australian Standard 2187.2 – 2006 Explosives – Storage and use – Use of explosives), and
- for human exposure, the acceptable vibration values set out in Environmental Noise Management Assessing Vibration: A Technical Guideline (Department of Environment and Conservation, 2006).

Further details of each of these references are provided below and specific vibration criteria for the project identified.

5.2.2. Heritage Structures

The German standard DIN 4150: Part 3 – 1999 Effects of Vibration on Structure (DIN 1999) guideline values for peak particle velocity (mm/s) criteria at heritage structures are summarised in Table 12.

Table 12: Structural Damage Criteria – Heritage Structures

Type of Structure	Peak Particle Velocity (PPV) mm/s			
	Vibration at the foundation at a frequency of:			Vibration of horizontal plane of highest floor at all frequencies
	1 to 10 Hz	10 to 50 Hz	50 to 100 Hz ¹	
Structures that are particularly sensitive to vibration, e.g. heritage-listed structures.	3	3 to 8	8 to 10	8

(1) For frequencies above 100 Hz, the maximum values specified in this column shall be applied.

Values referred to are at the base of the building

5.2.3. Other Buildings and Structures

British Standard BS 7385: Part 2: 1993 ‘*Evaluation and measurement for vibration in buildings Part 2. Guide to damage levels from ground borne vibration*’ gives guidance on the levels of vibration above which building structures could be damaged. These values apply to buildings other than heritage buildings, including residential, industrial and commercial buildings, for the project.

For the purposes of BS 7385 damage is classified as cosmetic (formation of hairline cracks), minor (formation of large cracks) or major (damage to structural elements). Guideline values give in the Standard are associated with

¹ German Standard DIN 4150-3, 1999, *Structural vibration – Part 3: Effects of vibration on structures*.

² British Standard BS 6472-1, 2008, *Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting*.

³ British Standard BS 6472-1, 2008, *Guide to evaluation of human exposure to vibration in buildings. Blast induced vibration*.

the threshold of cosmetic damage only, usually in wall and/or ceiling lining materials. The BS 7385 values for vibration limits above which cosmetic damage could occur are provided in Table 13 and Figure 3.

Table 13: Transient Vibration Guide Values for Cosmetic Damage (BS 7385: Part 2:1993)

Line (see Figure 3)	Type of Building	Peak component particle velocity in frequency range of predominant pulse	
		4 to 15 Hz	15 Hz and above
1	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
2	Reinforced or framed structures. Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	

- Notes
1. Values referred to are at the base of the building
 2. For line 1, at frequencies below 4 Hz, a maximum displacement of 0.6 mm (zero to peak) should not be exceeded.

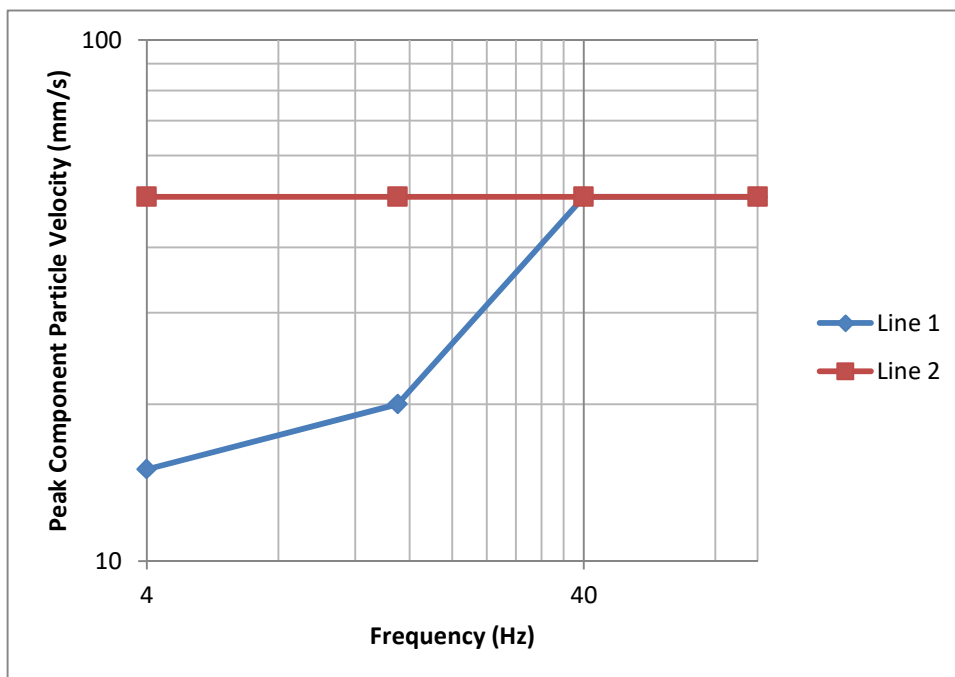


Figure 3: Summary of Damage Thresholds for Transient Vibration on Domestic Structures

The guide values relate mainly to transient vibration which does not give rise to resonant responses in structures and low-rise buildings. In the event that continuous vibration gives rise to magnification of vibration by resonance (specific conditions where the structure can readily store and transfer vibration energy), then the guide values may need to be reduced by up to 50%.

Rock breaking, rock hammering and sheet piling are considered to have the potential to cause dynamic loading in some structures and it may therefore be appropriate to reduce the transient values by 50% for these construction activities.

For most sources of intermittent vibration during construction, such as rock breakers, piling rigs, vibratory rollers and excavators, the predominant vibration energy occurs at frequencies usually in the 10 to 100 Hz range. On this

basis a vibration damage screening level of 7.5 mm/s has been adopted for the purpose of assessing potential impacts from these sources.

In the lower frequency region below 4 Hz the guide values for building types are reduced as a high displacement is associated with relatively low peak component particle velocity. To minimise risk of structural damage a guide value of 3.7 mm/s has been adopted for other sources.

BS 7385 indicates, for example, that for a residential building (line 1) a peak particle velocity (PPV) of greater than 15 mm/s at 4 Hz or greater than 50 mm/s at 40 Hz or above, measured at the base of the building, may be expected to result in cosmetic damage.

The standard states in Annexure A that *‘the age and existing condition of a building are factors to consider in assessing the tolerance to vibration. If a building is in a very unstable state, then it will tend to be more vulnerable to the possibility of damage arising from vibration or any other ground-borne disturbance.’*

5.2.4. Human Comfort and Amenity

For most construction activities that generate perceptible vibration in nearby buildings, the character of the vibration emissions is intermittent. Assessing Vibration: a technical guideline (DEC 2006) nominates preferred and maximum vibration goals for residences and other sensitive receptors as shown in Table 14.

The applicable human comfort vibration goal for intermittent vibration source is defined in terms of Vibration Dose Values (VDVs) where the permissible vibration level corresponding to the VDV varies according to the duration of exposure. The Guideline advises a low probability of adverse comment or disturbance to building occupants would be expected at or below the preferred values.

Table 14: Acceptable Vibration Dose Values (VDV) for Intermittent Vibration

Building type	Preferred VDV (m/s ^{1.75})	Maximum VDV (m/s ^{1.75})
Residential daytime (7am-10pm)	0.20	0.40
Residential night-time (10pm-7am)	0.13	0.26
Offices, schools, educational institutions and places of worship (day and night-time)	0.40	0.80

In applying the preferred and maximum VDV, the Guideline states that situations exist where vibration above the preferred values can be acceptable, particularly for temporary disturbances and infrequent events of short term duration. An example is a construction or excavation project.

The Guideline also advises that where all feasible and reasonable measures have been applied to control potential ground vibration levels the maximum values may be used. For values above the maximum value the Contractor should negotiate directly with the affected community.

6. Environmental Aspects and Impacts

The key construction activities and the associated potential sources of noise and vibration impact are identified through a risk management approach. The consequence and likelihood of each activity's impact on the environment has been assessed to prioritise its significance. The results of this risk assessment are included in Appendix A3 of the CEMP.

Ongoing environmental risk analysis will be undertaken during construction through regular inspections, monitoring and auditing as described in Chapter 9. This will ensure that issues requiring management (including cumulative impacts) are appropriately managed.

7. Noise and Vibration Impact Assessment

7.1. Construction Hours

The following construction hours apply to the Project:

7.1.1. Standard Construction Hours

Standard construction hours are as per those defined in the ICNG:

- 7 am to 6 pm Mondays to Fridays
- 8 am to 1 pm Saturdays.

7.1.2. Highly Noise Intrusive Work

Except as permitted by an EPL, highly noise intensive work must only be undertaken:

- between the hours of 8:00 am to 6:00 pm Monday to Friday;
- between the hours of 8:00 am to 1:00 pm Saturday; and
- in continuous blocks not exceeding three (3) hours, with a minimum respite from that work of not less than one (1) hour between each block where the works are likely to impact the same noise sensitive receivers.

For the purposes of CoA E15, 'continuous' includes any period during which there is less than of one (1) hour respite between ceasing and recommencing any of the work that is the subject of this condition.

7.1.3. Out of Hours Work

Work outside of the standard construction hours would also be required at times – this is called Out of Hours Work (OOHW). All OOHW will be assessed and approved in accordance with the OOHW Protocol in Appendix C of this NVMP. The OOHW Protocol must be approved by the Planning Secretary before commencement of OOHW that is not subject to EPL 3142.

OOHW that may be required could include:

- delivery of materials required to occur outside of standard hours by the NSW Police Force or another authority for safety reasons;
- emergency work to avoid injury or the loss of life, to avoid damage or loss of property to prevent environmental harm;
- where different construction hours are permitted or required under an EPL in force in respect of the CSSI;
- where it is low noise and vibration work that complies with the relevant noise and vibration level requirements for OOHW;
- work approved under an OOHW Protocol for work not subject to an EPL as required by CoA E16;
- beforehand negotiated agreements with directly affected residents;
- work which could result in a high risk to construction personnel or public safety, based on a risk assessment carried out in accordance with AS ISO 31000:2018 "*Risk Management – Guidelines*";

- where the relevant utility service operator has advised Fulton Hogan/ ARTC in writing that carrying out the work and activities could result in a high risk to the operation and integrity of the utility network;
- work undertaken in a Rail Possession for operational or safety reasons; and
- where the relevant road authority has advised Fulton Hogan/ ARTC in writing that carrying out the works and activities could result in a risk to road network operational performance or safety.

Where possible, OOHW would be undertaken at less sensitive times where reasonable and feasible, e.g. in the morning period between 6 am and 7 am prior to the commencement of main works.

CoA E17 requires that noise generating work in the vicinity of potentially-affected community, religious, educational institutions and noise and vibration-sensitive businesses and critical working areas (such as theatres, laboratories and operating theatres) resulting in noise levels above the NMLs must not be timetabled within sensitive periods or during important events, unless other reasonable arrangements with the affected institutions are made at no cost to the affected institution or as otherwise approved by the Planning Secretary. Consultation will be undertaken throughout the construction phase of the Project with affected noise sensitive receivers in accordance with the Communication Strategy (CS).

7.2. Construction Activities

Table 15 provides a summary of construction scenarios. Appendix A provides a list of equipment and a correlating sound power level (SWL). A typical overall sound power level for each scenario is also provided which is a typical upper estimate of the sound power level for the noisier activities that may occur during each phase over a 15-minute period. This could be considered a worst-case as generally not all activities occur at the same time and location.

Table 15: Indicative Schedule of Construction Scenarios/ Activities

Construction Scenario	Typical activities and overall worst-case SWL
CS01 - Site establishment	<ul style="list-style-type: none"> ■ Installation of initial environmental controls ■ Establishment of construction site facilities and access ■ Potholing and identification of services ■ Surveys and geotechnical investigations ■ Pre-condition surveys <p>Overall SWL: 112 LAeq(15-minute)</p>
CS02 - Enabling Works	<ul style="list-style-type: none"> ■ Minor vegetation clearing and grubbing ■ Installation of site sediment and erosion controls and pollution management measures ■ Temporary works for signaling ■ Demolition of grease trap <p>Overall SWL: 115 LAeq(15-minute)</p>
CS03 - Adjustment of existing services / Road earthworks	<ul style="list-style-type: none"> ■ Installation of environmental controls ■ Demolition / removal of existing kerb and gutters ■ Box out existing side path to widen road ■ Excavation and protection of existing drainage pipes ■ The construction and modifications to pipe drainage systems, such as the extension of drainage lines, the replacement of pipe drainage systems and the modification of stormwater drainage pits ■ Temporary diversion of water ■ Adjustment / installation of utilities ■ Excavation and protection of utilities <p>Overall SWL: 121 LAeq(15-minute)</p>
CS04 - Pavements	<ul style="list-style-type: none"> ■ Construction of pavement layers including, sub-surface drainage, sub-base and base layers, and surfacing ■ Installation of kerb and gutter and planter boxes

Construction Scenario	Typical activities and overall worst-case SWL
	<ul style="list-style-type: none"> ▪ The reconstruction of concrete pavements, including the localised demolition of concrete pavements, cross stitching of pavement slabs and joint works ▪ Shared User Path ▪ Milling and re-sheeting of pavement <p style="margin-left: 40px;">Overall SWL: 117 L_{Aeq(15-minute)}</p>
CS06 - Noise barrier construction	<ul style="list-style-type: none"> ▪ Demolition of stormwater ▪ The construction of piling, concrete footings and walls ▪ Relocate noise walls and paint the panels <p style="margin-left: 40px;">Overall SWL: 121 L_{Aeq(15-minute)}</p>
CS05 - Signals, testing and Commissioning	<ul style="list-style-type: none"> ▪ The temporary diversion of the Combined Services Route (CSR) ▪ The construction of signaling foundations ▪ Installing signaling equipment and furniture ▪ Upgrade of electrical system ▪ Installation of cables ▪ The testing and commissioning of new signal system <p style="margin-left: 40px;">Overall SWL: 107 L_{Aeq(15-minute)}</p>
CS10 – Retaining walls CS11 – Track construction CS12 – Track installation	<ul style="list-style-type: none"> ▪ Demolish existing retaining wall ▪ Foundation works and earthworks ▪ Installation of CSR conduits and track drainage ▪ The lower track formation of engineering fill ▪ The rail pavement layers including structural fill and capping ▪ Installation of track ▪ The construction of turnouts, slew track and resurfacing works <p style="margin-left: 40px;">CS10 Overall SWL: 121 L_{Aeq(15-minute)} CS11 Overall SWL: 115 L_{Aeq(15-minute)} CS12 Overall SWL: 120 L_{Aeq(15-minute)}</p>
CS07 – Bridge construction pre-work CS08 – Bridge construction work CS09 – Bridge rail installation	<ul style="list-style-type: none"> ▪ The construction of piling, substructure and superstructure ▪ The installation of walkways, ballast mat and waterproofing <p style="margin-left: 40px;">CS07 Overall SWL: 115 L_{Aeq(15-minute)} CS08 Overall SWL: 118 L_{Aeq(15-minute)} CS09 Overall SWL: 110 L_{Aeq(15-minute)}</p>
CS13 – Finishing works	<ul style="list-style-type: none"> ▪ Vegetation and landscaping ▪ Installation of lighting and roadside furniture ▪ Line marking and raised pavement markers ▪ Restoration and landscaping of temporary sites ▪ Site clean-up and disposal of all surplus waste materials ▪ Decommission construction facilities. ▪ Reinstate Jacquie Osmond Reserve. <p style="margin-left: 40px;">Overall SWL: 112 L_{Aeq(15-minute)}</p>

7.3. Construction Ancillary Facilities

Temporary ancillary facility sites are required to support construction of the project. A construction ancillary facility is defined in the project approval as:

‘A temporary facility for construction of the CSSI including an office and amenities compound, construction compound, material crushing and screening plant, materials storage compound, maintenance workshop, testing laboratory and material stockpiles area.’

7.3.1. Construction Ancillary Facilities Identified by Description and Location in the EIS

Section 7.4.1 of the EIS (p7.23) identified three potential construction ancillary facilities by description and location as outlined in Table 16.

Table 16: Construction Ancillary Facility Sites (EIS, p7.23)

Construction ancillary facility site	Location
C1	<ul style="list-style-type: none"> ▪ Within rail corridor
C2	<ul style="list-style-type: none"> ▪ Warwick Farm Recreation Reserve
C3	<ul style="list-style-type: none"> ▪ Jacquie Osmond Reserve

The abovementioned three construction ancillary facilities have been previously identified and assessed in the EIS as amended by the Submissions Report. The use/operation of each ancillary facility will be undertaken in accordance with the CEMP and relevant Sub-Plan(s).

Indicative noise levels have been predicted for each site. Noise level contours are provided in Appendix B Figure A1 – A13. A summary of potential NML exceedances is provided in Section 7.4.2 and Section 7.4.3 relating to Construction Scenario CS01.

Noise and vibration management will be in accordance with the Chapter 8 which includes the requirements of the REMMs relating to ancillary sites.

7.4. Construction Noise Impact Assessment

Based on the sound power levels for each construction scenario presented in Table 15 above, construction noise levels at noise-sensitive land uses have been predicted using a three-dimensional model of the site and surrounds developed in SoundPlan version 8.2 environmental noise prediction software. The noise model was based on:

- predictions conducted using the ISO 9613-2 prediction algorithm, which predicts noise levels typical of light downwind conditions or a moderate ground-based temperature inversion
- construction noise sources being in the worst-case position for each sensitive land use (i.e. the position at which the highest construction noise levels were predicted)
- typical source heights for construction noise sources
- topography, considering both the existing and/or altered topography of the road corridor dependent on the construction scenario
- sensitive receiver locations based on information in the EIS
- ground absorption factor of 50%.
- construction scenarios assume that the noise wall along Broomfield Street will be completely demolished in the immediate work area. However, in reality, the existing noise wall will be progressively removed and the new noise wall constructed (in sections) as works progress along Broomfield Street. Partial shielding from construction of a new noise wall (during demolition of the existing noise wall) has not been taken into consideration and therefore the predicted modelling results are conservative.

Typical construction noise contours for the various phases of work are included in Appendix B. A discussion is provided in the following sections regarding the typical construction noise impact that may occur for each time period and each NCA.

Construction noise mitigation and management measures are provided in Chapter 8 that will be implemented to assist in reducing construction noise impacts to receivers.

7.4.1. CNVS Noise Management Approach

ARTC's Noise Prediction and Mitigation Guideline (ARTC, 2018) does not specify specific construction noise mitigation measures. Therefore, the TfNSW CNVS has been adopted to determine potential additional construction noise mitigation measures. This is the same approach taken in the EIS. The TfNSW CNVS provides additional

context to the management of construction noise as shown in Table 17, which summarises the CNVS management approach to noise based on the Predicted Noise Level (PNL) and the time for which works are occurring.

Separate additional noise mitigation measures are defined for the following periods:

- Standard hours: works carried out between 7 am and 6 pm Monday to Friday, and 8 am to 1 pm on Saturdays as defined by the CoA;
- OOHW Period 1: works carried out between 6 pm and 10 pm Monday to Friday, 7 am to 8 am and 1 pm to 10 pm on Saturdays, and 8 am to 6 pm on Sundays and Public Holidays; and
- OOHW Period 2: works carried out:
 - between 10 pm and 7 am Monday to Saturday; and
 - between 6 pm and 8 am on Sundays and Public Holidays.

Further details on the project-specific application of the CNVS construction noise mitigation measures as detailed in Table 17 are provided in Chapter 8 of this NVMP.

Table 17: CNVS Noise Management Approach

Predicted noise level at sensitive land use	Additional mitigation measures to be applied to affected sensitive receivers (refer Chapter 8 for detail)	
ANY TIME		
Highly affected: PNL > 75 dB $L_{Aeq,15min}$	<ul style="list-style-type: none"> • Notification¹ • Verification • Respite 	<ul style="list-style-type: none"> • Specific notification, individual briefings, or phone call
STANDARD WORKING HOURS: Mon – Fri 7 am – 6 pm, Sat 8 am – 1 pm		
Noticeable: PNL ≤ NML	<ul style="list-style-type: none"> • Standard mitigation measures only 	
Clearly audible: PNL ≤ NML+10 dB	<ul style="list-style-type: none"> • Standard mitigation measures only 	
Moderately intrusive: NML+10 dB < PNL ≤ NML+20 dB	<ul style="list-style-type: none"> • Notification¹ • Verification 	
Highly intrusive: PNL > NML+20 dB	<ul style="list-style-type: none"> • Notification¹ • Verification 	
OOHW PERIOD 1: Mon – Fri 6 pm – 10 pm, Sat 7 am – 8 am & 1 pm – 10 pm, Sun/Pub Hol, 8 am – 6 pm		
Noticeable: PNL ≤ NML+5 dB	<ul style="list-style-type: none"> • Standard OOHW mitigation measures only • Notification will be considered as required 	
Clearly audible: NML+5 dB < PNL ≤ NML+15 dB	<ul style="list-style-type: none"> • Notification¹ • Respite Period 1 	<ul style="list-style-type: none"> • Duration Respite

Predicted noise level at sensitive land use	Additional mitigation measures to be applied to affected sensitive receivers (refer Chapter 8 for detail)	
Moderately intrusive: $NML+15\text{ dB} < PNL \leq NML + 25\text{ dB}$	<ul style="list-style-type: none"> • Verification • Notification¹ 	<ul style="list-style-type: none"> • Duration Respite • Respite Period 1
Highly intrusive: $PNL > NML+25\text{ dB}$	<ul style="list-style-type: none"> • Verification • Individual briefings • Notification¹ • Respite Period 1 	<ul style="list-style-type: none"> • Duration Respite • Phone calls • Specific notifications²
OOHW PERIOD 2: Mon – Sat 10 pm – 7 am, Sun/Pub Hol, 6 pm – 8 am		
Noticeable: $PNL \leq NML+5\text{ dB}$	<ul style="list-style-type: none"> • Standard OOHW mitigation measures only • Notification will be considered as required 	
Clearly audible: $NML+5\text{ dB} < PNL \leq NML+15\text{ dB}$	<ul style="list-style-type: none"> • Verification • Notification¹ 	<ul style="list-style-type: none"> • Duration Respite • Respite Period 2
Moderately intrusive: $NML+15\text{ dB} < PNL \leq NML + 25\text{ dB}$	<ul style="list-style-type: none"> • Verification • Individual briefings • Notification¹ • Respite Period 2 	<ul style="list-style-type: none"> • Duration Respite • Phone calls • Specific notifications²
Highly intrusive: $PNL > NML+25\text{ dB}$	<ul style="list-style-type: none"> • Consideration of alternative accommodation • Verification • Individual briefings • Notification¹ 	<ul style="list-style-type: none"> • Respite Period 2 • Duration Respite • Phone calls • Specific notifications²

¹ Notifications will occur 5-14 working days prior to noisy works commencing.

² Specific notifications will occur 7-14 working days prior to noisy works commencing.

7.4.2. General Construction During Standard Construction Hours

A summary of predicted construction noise levels for each NCA and each phase of works is included as Table 18 for residential receivers and Table 19 for non-residential sensitive receivers. Table 18 and Table 19 present the maximum predicted construction noise level for each NCA as well as the number of receivers where predicted noise levels exceed the daytime NML at some point during each phase of works. Note that these are based on the works occurring in the worst case location for each sensitive receiver and the duration of the exceedance will depend upon the duration of the works in front of those receivers.

Based on the assumed construction scenarios and predicted construction noise levels shown in both the Tables and noise contour maps in Appendix B, exceedances of the NMLs are predicted at residential receivers within all NCAs during standard construction hours.

Exceedances of NMLs for non-residential receivers are predicted as follow:

- Industrial receivers within NCA 1 and NCA 4.
- Commercial receivers within NCA 1 and NCA 2.
- Classrooms within NCA 3.
- Places of worship within NCA 2.

In line with the predictions, mitigation measures for construction noise that will be implemented throughout the works are provided in Chapter 8 of this NVMP. The implementation of these measures will ensure consistency with the environmental performance outcomes identified in the EIS.

Standard mitigation measures will be implemented at all times, with increased mitigation measures applied where predicted noise levels exceed the predicted NML by more than 10 dB and with further measures applied where receivers are expected to be highly noise affected. These increased mitigation measures will apply in all NCAs.

In addition, noise mitigation measures for highly noise affected residences will be applied as per Chapter 8 of this NVMP for any residence within 40 m of construction works, unless it can be demonstrated through monitoring that construction noise levels are below the highly noise affected level of 75 dB(A). This requirement will apply to all NCAs.

Table 18: Predicted Construction Noise Levels at Residences from Standard Hours Works

Construction Activity	Standard hours NML, dB(A)	NCA			
		1	2	3	4
		48	48	47	47
CS01 - Site establishment	Maximum PNL, dB LAeq(15min)	48	54	59	93
	No of receivers exceeding NML	0	21	58	78
CS02 - Enabling Works	Maximum PNL, dB LAeq(15min)	76	73	77	62
	No of receivers exceeding NML	351	362	231	40
CS03 - Adjustment of existing services	Maximum PNL, dB LAeq(15min)	75	90	54	44
	No of receivers exceeding NML	708	438	46	0
CS04- Pavements	Maximum PNL, dB LAeq(15min)	75	90	54	44
	No of receivers exceeding NML	572	388	20	0
CS05 - Signals, testing and Commissioning	Maximum PNL, dB LAeq(15min)	58	79	36	27
	No of receivers exceeding NML	36	156	0	0
CS06 - Noise barrier construction	Maximum PNL, dB LAeq(15min)	74	85	50	43
	No of receivers exceeding NML	375	431	12	0
CS07 – Bridge construction pre-work	Maximum PNL, dB LAeq(15min)	40	40	40	40
	No of receivers exceeding NML	88	97	1	0
CS08 – Bridge construction work	Maximum PNL, dB LAeq(15min)	60	79	49	43
	No of receivers exceeding NML	159	120	7	0
CS09 – Bridge rail installation	Maximum PNL, dB LAeq(15min)	52	70	38	30
	No of receivers exceeding NML	3	34	0	0
CS10 - Retaining walls	Maximum PNL, dB LAeq(15min)	53	64	72	51
	No of receivers exceeding NML	78	152	275	7

CS11 – Track construction	Maximum PNL, dB L _{Aeq(15min)}	66	75	70	53
	No of receivers exceeding NML	169	253	203	18
CS12 – Track installation	Maximum PNL, dB L _{Aeq(15min)}	73	82	77	63
	No of receivers exceeding NML	484	386	384	86
CS13 – Finishing works	Maximum PNL, dB L _{Aeq(15min)}	44	49	56	90
	No of receivers exceeding NML	0	1	35	56

Table 19: Predicted Construction Noise Levels at Non-Residential Sensitive Uses Residences from Standard Hours Works

Non-residential receivers	Maximum PNL / No of receivers exceeding NML	NCA			
		1	2	3	4
Industrial	Maximum PNL, dB L _{Aeq(15min)}	80	-	-	98
	No of receivers exceeding NML	1	0	0	8
Commercial	Maximum PNL, dB L _{Aeq(15min)}	76	81	-	-
	No of receivers exceeding NML	7	5	0	0
Classrooms	Maximum PNL, dB L _{Aeq(15min)}	-	-	78	-
	No of receivers exceeding NML	0	0	6	0
Places of worship	Maximum PNL, dB L _{Aeq(15min)}	-	60	-	-
	No of receivers exceeding NML	0	1	0	0

7.4.3. Out-of-Hours Work

At times during the Project, OOHW will be required due to restrictions around works relating to the local road network and the operational rail corridor.

At this stage, the precise nature of proposed OOHW has not been confirmed. However, as a screening assessment, Table 20, Table 21 and Table 22 summarises predicted noise levels for the various NCAs for residential receivers, compared against the NMLs for OOHW during each OOHW assessment period.

It should be noted that this assessment is preliminary in nature as it assumes that relatively noisy elements of the works would be undertaken out of hours, which would be avoided where possible.

It demonstrates that noise-sensitive receivers in most NCAs may be exposed to construction noise levels above the relevant OOHW NMLs at times.

Typically, exceedances of the OOHW NMLs could be a concern for any works within 500 m of sensitive receivers.

To manage potential construction noise impacts of any OOHW, the works will be assessed in accordance with the OOHW Protocol in Appendix C of this NVMP. Specific OOHW mitigation measures will be applied in accordance with Chapter 8 of this NVMP.

Table 20: Predicted Construction Noise Levels at Residences from Potential Period 1 Day OOHW

Construction Activity	OOHW Period 1 Day NML, dB(A)	NCA			
		1	2	3	4
		43	43	42	42
CS01 - Site establishment	Maximum PNL, dB $L_{Aeq}(15min)$	48	54	59	93
	No of receivers exceeding NML	41	62	125	134
CS02 - Enabling Works	Maximum PNL, dB $L_{Aeq}(15min)$	76	73	77	62
	No of receivers exceeding NML	664	471	387	113
CS03 - Adjustment of existing services / Road earthworks	Maximum PNL, dB $L_{Aeq}(15min)$	75	90	54	44
	No of receivers exceeding NML	932	630	280	11
CS04- Pavements	Maximum PNL, dB $L_{Aeq}(15min)$	75	90	54	44
	No of receivers exceeding NML	903	546	221	7
CS05 - Signals, testing and Commissioning	Maximum PNL, dB $L_{Aeq}(15min)$	58	79	36	27
	No of receivers exceeding NML	90	223	0	0
CS06 - Noise barrier construction	Maximum PNL, dB $L_{Aeq}(15min)$	74	85	50	43
	No of receivers exceeding NML	838	618	129	2
CS07 – Bridge construction pre-work	Maximum PNL, dB $L_{Aeq}(15min)$	40	40	40	40
	No of receivers exceeding NML	439	251	53	0
CS08 – Bridge construction work	Maximum PNL, dB $L_{Aeq}(15min)$	60	79	49	43
	No of receivers exceeding NML	605	343	111	1
CS09 – Bridge rail installation	Maximum PNL, dB $L_{Aeq}(15min)$	52	70	38	30
	No of receivers exceeding NML	15	54	0	0
CS10 - Retaining walls	Maximum PNL, dB $L_{Aeq}(15min)$	53	64	72	51
	No of receivers exceeding NML	546	470	533	85
CS11 – Track construction	Maximum PNL, dB $L_{Aeq}(15min)$	66	75	70	53
	No of receivers exceeding NML	362	356	294	52
CS12 – Track installation	Maximum PNL, dB $L_{Aeq}(15min)$	73	82	77	63
	No of receivers exceeding NML	796	538	596	155
CS13 – Finishing works	Maximum PNL, dB $L_{Aeq}(15min)$	44	49	56	90
	No of receivers exceeding NML	0	28	75	98

Table 21: Predicted Construction Noise Levels at Residences from Potential Period 1 Evening OOHW

Construction Activity	OOHW Period 1 Day NML, dB(A)	NCA			
		1	2	3	4
		42	43	42	42
CS01 - Site establishment	Maximum PNL, dB $L_{Aeq}(15min)$	48	54	59	93
	No of receivers exceeding NML	52	62	125	134
CS02 - Enabling Works	Maximum PNL, dB $L_{Aeq}(15min)$	76	73	77	62
	No of receivers exceeding NML	723	471	387	113
CS03 - Adjustment of existing services / Road earthworks	Maximum PNL, dB $L_{Aeq}(15min)$	75	90	54	44
	No of receivers exceeding NML	970	630	280	11
CS04- Pavements	Maximum PNL, dB $L_{Aeq}(15min)$	75	90	54	44
	No of receivers exceeding NML	952	546	221	7
CS05 - Signals, testing and Commissioning	Maximum PNL, dB $L_{Aeq}(15min)$	58	79	36	27
	No of receivers exceeding NML	111	223	0	0
CS06 - Noise barrier construction	Maximum PNL, dB $L_{Aeq}(15min)$	74	85	50	43
	No of receivers exceeding NML	892	618	129	2
CS07 – Bridge construction pre-work	Maximum PNL, dB $L_{Aeq}(15min)$	40	40	40	40
	No of receivers exceeding NML	533	251	53	0
CS08 – Bridge construction work	Maximum PNL, dB $L_{Aeq}(15min)$	60	79	49	43
	No of receivers exceeding NML	675	343	111	1
CS09 – Bridge rail installation	Maximum PNL, dB $L_{Aeq}(15min)$	52	70	38	30
	No of receivers exceeding NML	18	54	0	0
CS10 - Retaining walls	Maximum PNL, dB $L_{Aeq}(15min)$	53	64	72	51
	No of receivers exceeding NML	650	470	533	85
CS11 – Track construction	Maximum PNL, dB $L_{Aeq}(15min)$	66	75	70	53
	No of receivers exceeding NML	414	356	294	52
CS12 – Track installation	Maximum PNL, dB $L_{Aeq}(15min)$	73	82	77	63
	No of receivers exceeding NML	830	538	596	155
CS13 – Finishing works	Maximum PNL, dB $L_{Aeq}(15min)$	44	49	56	90
	No of receivers exceeding NML	1	28	75	98

Table 22: Predicted Construction Noise Levels at Residences from Potential Period 2 Night OOHW

Construction Activity	OOHW Period 1 Day NML, dB(A)	NCA			
		1	2	3	4
		36	35	37	37
CS01 - Site establishment	Maximum PNL, dB $L_{Aeq}(15min)$	48	54	59	93
	No of receivers exceeding NML	324	307	293	165
CS02 - Enabling Works	Maximum PNL, dB $L_{Aeq}(15min)$	76	73	77	62
	No of receivers exceeding NML	932	1002	582	170
CS03 - Adjustment of existing services / Road earthworks	Maximum PNL, dB $L_{Aeq}(15min)$	75	90	54	44
	No of receivers exceeding NML	1226	1117	591	152
CS04- Pavements	Maximum PNL, dB $L_{Aeq}(15min)$	75	90	54	44
	No of receivers exceeding NML	1210	1020	579	128
CS05 - Signals, testing and Commissioning	Maximum PNL, dB $L_{Aeq}(15min)$	58	79	36	27
	No of receivers exceeding NML	255	363	0	0
CS06 - Noise barrier construction	Maximum PNL, dB $L_{Aeq}(15min)$	74	85	50	43
	No of receivers exceeding NML	1187	1158	489	139
CS07 – Bridge construction pre-work	Maximum PNL, dB $L_{Aeq}(15min)$	40	40	40	40
	No of receivers exceeding NML	830	648	318	35
CS08 – Bridge construction work	Maximum PNL, dB $L_{Aeq}(15min)$	60	79	49	43
	No of receivers exceeding NML	873	743	460	96
CS09 – Bridge rail installation	Maximum PNL, dB $L_{Aeq}(15min)$	52	70	38	30
	No of receivers exceeding NML	150	149	1	0
CS10 - Retaining walls	Maximum PNL, dB $L_{Aeq}(15min)$	53	64	72	51
	No of receivers exceeding NML	976	1046	607	162
CS11 – Track construction	Maximum PNL, dB $L_{Aeq}(15min)$	66	75	70	53
	No of receivers exceeding NML	797	582	557	127
CS12 – Track installation	Maximum PNL, dB $L_{Aeq}(15min)$	73	82	77	63
	No of receivers exceeding NML	1065	1035	614	173
CS13 – Finishing works	Maximum PNL, dB $L_{Aeq}(15min)$	44	49	56	90
	No of receivers exceeding NML	231	216	225	149

7.4.4. Sleep Disturbance

Construction activities are expected outside standard construction hours to minimise the impacts on rail and road traffic during construction. There is the potential for maximum noise level events if the predicted maximum noise level is above the screening criteria of 52 dBA.

The screening criteria of 52 dBA is predicted to be exceeded outside the building's façade at 1284 residential receivers. Therefore, a detailed maximum noise level assessment has been undertaken. The RNP states that maximum internal noise levels between 50 to 55 dBA are unlikely to awaken people from sleep. Typically, a window will provide a 10 dBA reduction when partially open and a 20 dBA reduction when closed. For a conservative assessment, the windows have been assumed to be partially open to assess sleep disturbance impacts. Based on this assessment, 102 sensitive receivers have the potential to experience sleep disturbance impacts. These receivers are shown in Figure 4. Potential sleep disturbance impacts near Warwick Farm Station would be due to operation of the rail compound (C1). This compound would be predominately used for storage and would require material deliveries during the early morning and late evening periods. Continuous impacts throughout the night-time period are considered unlikely. Community consultation and consideration of the additional mitigation measures in Chapter 8 should be applied if the sleep disturbance criterion is anticipated to be exceeded for more than two consecutive nights and cannot be avoided due to reasonable and feasible justification.



CABRAMATTA LOOP PROJECT Sleep disturbance impacted receivers		Legend Sleep disturbance impacted receivers Buildings	 200 400 m Map Projection AGD 1966 ISG 56 1
PROJECT NUMBER S210520 DRAWN BY MS CHECKED BY AP DATE ISSUED July 2021 CLIENT Fulton Hogan PREDICTION METHOD n/a CALIBRATION FACTOR n/a GROUND ABSORPTION n/a RECEIVER HEIGHT n/a ROAD SURFACE n/a IMAGERY NEARMAP PAGE SIZE A3			

Figure 4: Sleep Disturbance Impacted Receivers

7.4.5. Construction Traffic

Construction traffic routes are not detailed at this stage. Therefore, the preliminary EIS assessment has been used to inform this NVMP.

Construction vehicle movements would consist of light and heavy vehicles associated with staff movements, plant delivery and material delivery and removal. This has the potential to create construction traffic noise impacts.

Construction traffic impacts are assessed by determining whether the potential noise level increases would be perceptible when compared to existing traffic. The estimated peak vehicle numbers per hour are provided in Table 23.

Existing peak vehicle numbers per hour are provided in Table 24.

Table 23: Peak Number of Construction Vehicles Per Hour

Street	Road class	Possession (24 hours)		Non-possession (daytime working hours)	
		Heavy vehicle	Light vehicle	Heavy vehicle	Light vehicle
Hume Highway	Arterial	4	60	4	30
Cabramatta Road East	Sub-arterial	2	20	2	15
Junction Street	Local	2	20	2	15
Liverpool Street/ Sussex Street	Local	2	20	2	15
Broomfield Street	Collector	2	20	2	15
Mannix Parade/ Lawrence Hargrave Road/Nicholls Street/ Station Street/Railway Parade	Local	3	60	2	30
Sappho Road	Collector	2	20	2	15
Warwick Street	Local	4	60	4	30

Table 24: Existing Peak Traffic Volumes Per Hour

Location	Road classification	Direction	AM Peak Hour (veh/h)*	PM Peak Hour (veh/h)*
Hume Highway – between Mannix Road and Sappho Road	Arterial road	Eastbound	2,150	1,890
		Westbound	1,650	1,885
		Total	3,800	3,775
Cabramatta Road East	Sub arterial	Northbound	390	935
		Southbound	840	800
		Total	1,230	1,735
Broomfield Street	Local road	Northbound	135	140

Location	Road classification	Direction	AM Peak Hour (veh/h)*	PM Peak Hour (veh/h)*
		Southbound	150	160
		Total	285	300
Mannix Parade	Local road	Northbound	125	120
		Southbound	165	135
		Total	290	255
Lawrence Hargrave Road	Local road	Northbound	80	80
		Southbound	65	65
		Total	145	145
Sappho Road	Local road	Northbound	205	275
		Southbound	45	200
		Total	250	475

The noise increase associated with the additional traffic on these roads has been calculated as per the following formula:

$$Increase (dB) = 10 \log\left(\frac{Total\ traffic\ (existing\ plus\ construction)}{Existing\ traffic}\right)$$

The noise increase associated with the project roads is calculated to be as follows:

- Arterial and sub-arterial roads: <0.2 dB.
- Collector roads: 0.5 to 0.7 dB.
- Local roads: 0.5 to 1.8 dB.

Therefore, construction traffic is not expected to increase noise levels by more than 2 dBA for the roads in the study area. The objectives of the RNP are considered met and further consideration of noise impacts associated with construction traffic is not required. Traffic along local and collector roads would be managed in accordance with a traffic management plan to minimise the potential construction traffic noise impacts.

7.5. Vibration Impact Assessment

The propagation of vibration emitted from a source is site-specific with the level of vibration potentially experienced at a receiver dependent on the vibration energy generated by the source, the main frequencies of vibration, the localised geotechnical conditions and the interaction of structures and features which can dampen vibration. The recommended safe working distances for construction plant provided in Table 25 are referenced from the CNVS and from in-house measurement data from Resonate.

For buried services compliance with guideline values for structural damage would also be applied. Direct contact with services is always avoided both as a part of the vibration mitigations but also as a requirement of the safety management system.

Table 25: Vibration Safe Working Distances

Plant item	Rating / Description	Safe working distance, m					
		Cosmetic damage			Human response		
		Heritage structure	Residential structure	Commercial / industrial	Residence – night	Residence – day	Educational
Vibratory roller	<50 kN (typically 1-2t)	7	5	2	25	15	10
	<50 kN (typically 2-4t)	9	6	2	35	20	13
	<50 kN (typically 4-6t)	22	12	5	65	40	25
	<50 kN (typically 7-13t)	27	15	6	140	110	65
	<50 kN (typically 13-18t)	36	20	8	170	140	70
	<50 kN (typically >18t)	45	25	10	170	140	75
Handheld compactor	Up to 300 kg	7	5	2	30	20	12
Small hydraulic hammer	300 kg – 18-34t excavator	3	2	–	10	7	5
Medium hydraulic hammer	1600 kg – 5-12t excavator	12	7	3	35	23	15
Large hydraulic hammer	1600 kg – 12-18t excavator	30	22	9	100	73	45
Bored piling	< 800 mm	3	2	–	7	4	2
Excavation works	12-18t excavator	3	2	–	15	10	7
Jackhammer	Handheld	2	1	–	5	–*	–*

Notes: *Avoid contact with structure

The safe working distances are generally conservative, developed with reference to the more stringent objectives for continuous vibration for typical residential building constructions and the lowest applicable criterion for potential cosmetic building damage. It follows that work within the safe working distance does not necessarily mean that an impact will occur, but rather that further consideration may be required.

A map demonstrating the buildings located within the safe working distances for a 15 tonne vibratory roller is provided in Appendix D Figure A14. The map presented in Appendix D represents a conservative indication of the buildings that may require condition surveys. Offset distances are relative to the construction boundary and include the following:

- Typical structures located within the 20 m offset distance will require a Condition Survey.
- Heritage structures located within the 36 m offset distance will require a Condition Survey.

- 140 m offset for human comfort (daytime) is shown for reference.

7.5.1. Heritage Listed Structures

The heritage structures listed in Table 26 have been identified within 50 metres of the project site. A dilapidation survey of the heritage structures identified within the vibration safe working distance should be carried out. If the dilapidation survey indicates that the heritage buildings/items are structurally unsound, then the conservative criteria of 3.0 mm/s provided by DIN 4150-3 should be used. Piling works during bridge construction has the potential to cause cosmetic damage on the Cabramatta (Cabramatta Creek), Railway Parade and Sussex Street Underbridge (I19). The Federation Cottage has the potential to experience vibration levels above the allowable limits during road construction works if a 15 tonne vibratory roller is used. As such, the vibratory roller should be limited to below 15 tonnes to limit the potential impact on this structure. However, since the Federation Cottage’s listing in 2009, the structure has largely burnt down. Therefore, a dilapidation survey of this heritage structure for the purposes of determining whether it is unsound is deemed not required. Instead, the Federation Cottage will be deemed structurally unsound and the conservative criteria of 3.0 mm/s provided by DIN 4150-3 will be adopted until such time that Council confirms that this item is no longer a heritage item.

Table 26: Heritage Listed Structures

Site number	Site name	Address / Property description	Listings - Individual item	Significance	Location
I10	Federation cottage	132 Broomfield Street, Lot 11, section 6, DP 1656	Fairfield LEP 2013	Local (Fairfield LEP)	Next to project site
I19	Cabramatta (Cabramatta Creek), Railway Parade and Sussex Street Underbridge	Railway Parade and Sussex Street (Cabramatta Creek)	Fairfield LEP 2013 RailCorp Section 170 Register	State and local (Fairfield LEP, Section 170 register)	Within project site

In addition, the proposed locations for minor works in the form of new signalling are situated close to the following heritage listed items:

- Villawood Railway Station Group (I103), 19 Villawood Road
- Liverpool Railway Station Group, including station building, goods shed and jib crane (72), Bigge Street (off), Lot 31, DP 859887; Part Lot 5, DP 226933.

The proposed signalling works would be located outside of vibration buffer distances to ensure there are no vibration impacts to these sites.

7.5.2. Condition Surveys

In order to satisfy CoA E27, before commencement of any construction, a structural engineer will undertake condition surveys of all buildings, structures, utilities and the like identified as being within the minimum working distances as detailed in Table 25 of this NVMP. The results of the surveys will be documented in a Condition Survey Report for each item surveyed. Copies of Condition Survey Reports will be provided to owners of the items surveyed, and no later than one month before the commencement of construction, or as otherwise instructed or agreed to by the utility operator.

After completion of construction, condition surveys will be undertaken by a structural engineer of all items for which condition surveys were undertaken in accordance with CoA E27. The results of the surveys will be documented in a Condition Survey Report for each item surveyed. Copies of Condition Survey Reports will be provided to the landowners of the items surveyed no later than three (3) months following the completion of construction.

Fulton Hogan / ARTC, where liable, must rectify any property damage caused directly or indirectly (for example from vibration) by the construction of the CSSI at no cost to the owner unless otherwise agreed with the owner.

8. Environmental Mitigation Measures

Specific mitigation measures to address impacts on noise and vibration are outlined in Table 27.

Table 27: Noise and Vibration Mitigation Measures

ID	Mitigation Measure	Timing		Responsibility
		PC ¹	C ²	
NOISE				
NOISE: Standard Working Hours measures applied at all times				
NVMM1	Undertake works during Standard Hours. Where works must occur outside of Standard Hours, assess Out of Hours works in accordance with the <i>Out-of-Hours Protocol</i> provided in Appendix C.	✓	✓	Construction Manager
NVMM2	Implement a hot line (ARTC Enviroline 1300 550 402) and complaints handling procedure for noise and other construction related complaints.	✓	✓	Community Relations Manager
NVMM3	Ensure non-tonal reversing beepers (or an equivalent mechanism) are fitted and used on all construction vehicles and mobile plant regularly used on site and for any out of hours work, including delivery vehicles.	✓	✓	Foreman, Operators
NVMM4	Plan and conduct works in a manner to minimise the reversing of vehicles with audible reversing alarms.		✓	Construction Manager, Foreman
NVMM5	Ensure trucks travel via internal haul roads and major roads where practicable to minimise use of local roads.		✓	Foreman
NVMM6	Position site compounds, access points and roads as far as practicable away from residential receivers. Position equipment within site compounds as far as possible from sensitive receivers, to take advantage of natural shielding and shielding provided by buildings.		✓	Foreman
NVMM7	Ensure that truck tailgates are cleared and locked at the point of unloading.		✓	Foreman, Operators
NVMM8	Use two way radios at the minimum effective volume. Avoid slamming of doors, shouting and whistling. Reinforce behavioural practices such as no swearing and no unnecessary shouting. No uncontrolled release of compressed air and excessive revving of plant and vehicle engines.		✓	Foreman, Operators

ID	Mitigation Measure	Timing		Responsibility
		PC ¹	C ²	
NVMM9	<p>Use quieter work methods and equipment, including the use of mufflers and silencers where practicable.</p> <p>Vehicles will be fitted with a maintained original equipment manufacturer exhaust silencer that complies with the National Transport Commissions <i>National Stationary Exhaust Noise Test Procedures for In-service Motor Vehicles (2006)</i></p> <p>Where possible apply:</p> <ul style="list-style-type: none"> ▪ residential grade mufflers ▪ damped hammers such as ‘City’ Model Rammer Hammers ▪ air parking brake engagement silenced. 		✓	Construction Manager
NVMM10	<p>Consider compliance of plant and equipment noise levels with Appendix A and Table 20 of the CNVS in rental decisions.</p> <p>Ref: Planning-Environment-Sustainability-Construction-Noise-and-Vibration-Strategy-ST-157 (2).pdf</p>	✓	✓	Construction Manager
NVMM11	<p>Ensure vehicle warning devices, such as horns, are not used as signalling devices.</p>		✓	Foreman, Operators
NVMM12	<p>Undertake regular maintenance of plant and equipment, including silencers, to ensure that noise emissions do not increase over time. Servicing, refuelling and warm-up to be undertaken during standard construction hours.</p>		✓	Foreman, Operators
NVMM13	<p>Turn vehicles, machinery and lights off when not in use.</p>		✓	Foreman, Operators
NVMM14	<p>Only use necessary equipment, of an appropriate size and power, on site.</p> <p>In addition, quieter and less vibration emitting construction methods and equipment will be used where feasible and reasonable. For example, when piling is required, bored piles rather than impact-driven piles will minimise noise and vibration impacts.</p>		✓	Construction Manager
NVMM15	<p>Limit the use of engine compression brakes near residential areas where practicable and is to be avoided during the night-time period.</p>		✓	Foreman, Operators
NVMM16	<p>Not used</p>			
NVMM17	<p>Traffic flow, parking and loading/unloading areas will be planned to minimise reversing movements within the site.</p>	✓	✓	Construction Manager, Foreman

ID	Mitigation Measure	Timing		Responsibility
		PC ¹	C ²	
NVMM18	Consideration on the sequencing of construction along Broomfield Street to minimise the duration of time any section of the existing Broomfield Street noise barrier is partially or fully removed.	✓	✓	Construction Manager, Foreman
NVMM19	On-site storage capacity will be maximised to reduce the need for truck movements during sensitive times.		✓	Construction Manager, Foreman
NVMM20	Where practicable, materials will be pre-fabricated and/or prepared off-site to reduce noise with special audible characteristics occurring on site. Materials can then be delivered to site for installation. Note: these opportunities include: <ul style="list-style-type: none"> ▪ Bridge beams ▪ Head stocks ▪ Drainage pipes ▪ Pre-fabricated noise and retaining wall panels 	✓	✓	Construction Manager, Foreman
NVMM21	Use of the construction compound (C1) near Warwick Farm Station will where practicable, be limited to standard hours only with the exception of plant storage and material delivery.		✓	Construction Manager, Foreman
NOISE: Standard Hours where PNL exceeds NML by more than 10 dB				
	Implement all feasible and reasonable mitigation measures NVMM1 to NVMM21 inclusive.	✓	✓	As noted above
NVMM22	<i>Verification:</i> Measure noise levels from noise intensive plant prior to use and check against manufacturer’s specifications and/or the sound power levels listed in Appendix A. Measure noise levels in accordance with the CNVS.		✓	Construction Manager
NVMM23	<i>Notification:</i> Sensitive receivers will be notified of construction activities to be undertaken through letterbox drops five (5) to fourteen (14) working days prior to commencement of the proposed work.	✓	✓	Community Relations Manager, Construction Manager
NVMM24	Maximise the offset distance between noisy items of plant and sensitive receivers for each task and activity.		✓	Foreman, Operators
NVMM25	Locate plant and equipment to take advantage of barriers provided by existing site features and structures.		✓	Foreman, Operators

ID	Mitigation Measure	Timing		Responsibility
		PC ¹	C ²	
NVMM26	Orient plant and equipment known to emit noise strongly in one direction so that noise is directed away from noise sensitive areas.		✓	Foreman, Operators
NVMM27	Use traffic controllers to minimise occurrences of vehicles queuing, idling or reversing near noise sensitive receivers as much as is practical.		✓	Construction Manager, Foreman
NVMM28	Avoid metal-to-metal contact on equipment where feasible.		✓	Foreman, Operators
NVMM29	Avoid dropping material from a height into unlined metal trays (line trays with soil or similar to reduce noise).		✓	Foreman, Operators
NVMM30	Ensure stockpiles of excavated material are positioned to provide shielding to noise-sensitive land uses where possible.		✓	Construction Manager, Foreman, Operators
NVMM31	Use noise screens/shields where possible. Dedicated loading/unloading areas will be shielded if close to sensitive receivers, where reasonable and feasible.		✓	Construction Manager, Foreman
NVMM32	Where possible, avoid or otherwise minimise the occurrence of consecutive works within the same locality, and coincidence of noisy plant/equipment working close together (and adjacent to sensitive receivers).		✓	Construction Manager, Foreman
NVMM33	Ensure loading and unloading is carried out as far as practical away from sensitive receivers and delivery vehicles will be fitted with straps rather than chains for unloading, wherever possible.		✓	Construction Manager, Foreman
NVMM34	Ensure no queuing of trucks near sensitive receivers prior to 7.00 am of a Monday to Friday and prior to 8.00 am of a Saturday.		✓	Construction Manager, Foreman
NOISE: Standard Hours work where residences are predicted to be Highly Noise Affected (PNL > 75 dB(A))				
	Implement all feasible and reasonable mitigation measures NVMM1 to NVMM34 inclusive.	✓	✓	As noted above

ID	Mitigation Measure	Timing		Responsibility
		PC ¹	C ²	
NVMM35	<p>Undertake high noise impact activities only:</p> <ul style="list-style-type: none"> Between the hours of 8:00am to 6:00pm Mondays to Fridays; Between the hours of 8:00am to 1:00pm Saturdays; and In continuous blocks not exceeding three hours each with a minimum respite from those activities and works of not less than one hour between each block. 		✓	Construction Manager
NVMM36	<p><i>Phone calls:</i></p> <p>Phone calls detailing relevant information will be made to identified residences within seven (7) calendar days of proposed work. Phone calls will provide affected residences with specific contact details and advice regarding noise management measures to be implemented. If the resident is not able to be reached via phone, door knocking and/or personalised letterbox drops will be used.</p>	✓	✓	Community Relations Manager
NVMM37	<p><i>Respite offers:</i></p> <p>Consultation with highly noise affected residences will involve discussion of specific respite periods. If specific respite periods are not agreed, then mitigation measure ID NVMM35 will be followed.</p>	✓	✓	Community Relations Manager, Construction Manager, Foreman
VIBRATION				
VIBRATION: Standard Hours Works occurring within safe working distances for human comfort				
NVMM38	<p>Undertake works during standard construction hours. Where works must occur outside of standard hours, assess Out-of-Hours Works in accordance with the <i>Out-of-Hours Work Protocol</i> provided in Appendix C.</p>	✓	✓	Construction Manager
NVMM39	<p>Implement a hot line (ARTC Enviroline 1300 550 402) and complaints handling procedure for vibration and other construction related complaints.</p>	✓	✓	Community Relations Manager
NVMM40	<p>Avoid vibration intensive works within the safe working distances unless necessary.</p>	✓	✓	Foreman Construction Manager
NVMM41	<p>Restrict construction traffic speed to 20 km/h across the site, or 40 km/h for haul roads. Signpost the speed limit.</p>		✓	Foreman
NVMM42	<p>Restrict construction traffic to designated roadways.</p>		✓	Foreman
NVMM43	<p>Run plant that has high and low vibration operating settings on the lowest effective vibration setting, including static rolling where feasible.</p>		✓	Foreman

ID	Mitigation Measure	Timing		Responsibility
		PC ¹	C ²	
NVMM44	<p><i>Notification:</i></p> <p>Sensitive receivers will be notified of construction activities to be undertaken through letterbox drops five (5) to fourteen (14) working days prior to commencement of the proposed work.</p>	✓	✓	Community Relations Manager, Construction Manager
NVMM45	<p><i>Respite offers:</i></p> <p>Consultation with highly affected residences will involve discussion of specific respite periods. If specific respite periods are not agreed, then works will not be carried out for continuous blocks of more than three hours without a minimum respite period of one hour.</p>	✓	✓	Community Relations Manager, Construction Manager, Foreman
VIBRATION: Where works are occurring within safe working distances for cosmetic damage to buildings				
	Implement all feasible and reasonable mitigation measures NVMM38 to NVMM45 inclusive.			
NVMM46	<p>If vibration intensive plant is to be used within the safe working distance for cosmetic damage (as per Section 7.5), works would not proceed until attended vibration measurements are undertaken.</p> <p>A heritage specialist will be consulted with in relation to placement of sensors on heritage structures, such as the Cabramatta (Cabramatta Creek), Railway Parade and Sussex Street Underbridge (119).</p> <p>Where possible, alternative construction work methods to reduce vibration impacts will be considered, this may be the use of smaller rollers or static rolling.</p>		✓	Foreman, Environment Coordinator
NVMM47	<p>Where vibration intensive works are occurring for a continuous period of time within the safe working distance for cosmetic damage (as per Section 7.5), install a permanent vibration monitoring system to warn operators (via flashing light, audible alarm, SMS etc.) when vibration levels are approaching the cosmetic damage objective. Comply with the requirements of mitigation measure ID NVMM54.</p>		✓	Environment Coordinator Operators
NVMM48	<p>Undertake <u>pre-construction</u> dilapidation surveys of buildings and structures where construction works will occur within safe working distances for cosmetic damage, prior to that work being undertaken. These would be conducted by a structural engineer.</p>	✓	✓	Environment Coordinator

ID	Mitigation Measure	Timing		Responsibility
		PC ¹	C ²	
NVMM49	Undertake <u>post-construction</u> dilapidation surveys of buildings and structures where construction works has occurred within safe working distances for cosmetic damage. These would be conducted by a structural engineer.		✓	Environment Coordinator
NVMM50	Undertake surveys of buildings and structures immediately following a monitored exceedance of the relevant vibration criteria.		✓	Environment Coordinator
NVMM51	Not used.			
NVMM52	If following a dilapidation survey at heritage items the structures are found to be unsound, then a structural engineer will advise if there is a risk from increasing operational train numbers and identify strategies to avoid risks.	✓	✓	Environment Coordinator
NVMM53	The use of highly intensive noise and vibration generating equipment (such as jack and rock hammering, sheet and pile driving, rock breaking and vibratory rolling) in less sensitive times (eg the middle of the day).		✓	Foreman, Environment Coordinator
NVMM54	During vibration monitoring, if warning levels or alerts are triggered, works are to stop immediately. Assess the cause of the warnings and determine if there are any additional mitigation measures required. Ensure that these mitigation measures are in place prior to restarting work.		✓	Environment Coordinator

¹ PC means pre-construction; ² C means construction

Table 28: Out of Hours Noise and Vibration Mitigation Measures

ID	Mitigation Measure	Timing		Responsibility
		PC ¹	C ²	
OOHW NOISE				
OOHW STAGE 1				
ANY OOHW: NML EXCEEDANCE ≤ 5 dB(A) & NO EXCEEDANCE OF SLEEP DISTURBANCE CRITERIA				
OOHMM1	<p>Assess Out of Hours works in accordance with the <i>Out-of-Hours Work Protocol</i> in Appendix C, including:</p> <ul style="list-style-type: none"> ○ Justification for Out of Hours work. ○ Noise assessment. ○ Notification to and consultation with ARTC, the ER and with the affected community. The notification would include details as required by ARTC EPL 3142 Condition O9.13. <p>Implementation of reasonable and feasible mitigation measures for receivers where night-time NMLs are predicted to be exceeded.</p>	✓	✓	Environment Coordinator, Community Relations Manager
OOHMM2	Implement a hot line (ARTC Enviroline 1300 550 402) and complaints handling procedure for noise and other construction related complaints.	✓	✓	Community Relations Manager
OOHMM3	Ensure all mobile construction equipment have non-tonal reversing alarms.	✓	✓	Foreman, Operators
OOHMM4	Plan and conduct works in a manner to minimise the reversing of vehicles with audible reversing alarms.		✓	Construction Manager, Foreman
OOHMM5	Ensure trucks travel via internal haul roads and major roads where practicable to minimise use of local roads.		✓	Foreman
OOHMM6	Position site access points and roads as far as practicable away from residential receivers.		✓	Foreman
OOHMM7	Ensure that truck tailgates are cleared and locked at the point of unloading.		✓	Foreman, Operators
OOHMM8	Use two way radios at the minimum effective volume.		✓	Foreman, Operators

ID	Mitigation Measure	Timing		Responsibility
		PC ¹	C ²	
OOHMM9	<p>Use quieter work methods and equipment, including the use of mufflers and silencers where practicable.</p> <p>Vehicles will be fitted with a maintained original equipment manufacturer exhaust silencer that complies with the National Transport Commissions <i>National Stationary Exhaust Noise Test Procedures for In-service Motor Vehicles (2006)</i></p> <p>Use damped hammers such as ‘City’ Model Rammer Hammers</p> <p>Highly intensive noise and vibration generating equipment (such as jack and rock hammering, sheet and pile driving, rock breaking and vibratory rolling) will not be used for more than two consecutive nights over any seven day period adjacent to the same sensitive receivers.</p>		✓	Construction Manager
OOHMM10	<p>Consider compliance of plant and equipment noise levels with Appendix A and Table 20 of the CNVS in rental decisions.</p> <p>Ref: Planning-Environment-Sustainability-Construction-Noise-and-Vibration-Strategy-ST-157 (2).pdf</p>	✓	✓	Construction Manager Procurement Manager
OOHMM11	<p>Ensure vehicle warning devices, such as horns, are not used as signalling devices.</p>		✓	Foreman, Operators
OOHMM12	<p>Undertake regular maintenance of plant and equipment, including silencers, to ensure that noise emissions do not increase over time. Servicing, refuelling and warm-up to be undertaken during standard construction hours.</p>		✓	Foreman, Operators
OOHMM13	<p>Turn vehicles, machinery and lights off when not in use.</p>		✓	Foreman, Operators
OOHMM14	<p>Only use necessary equipment, of an appropriate size and power, on site. This includes consideration for quieter plant or plant which cause less potential vibration</p>		✓	Construction Manager
OOHMM15	<p>Limit the use of engine compression brakes near residential areas where practicable.</p>		✓	Foreman, Operators

ID	Mitigation Measure	Timing		Responsibility
		PC ¹	C ²	
OOHMM16	<p>Undertake consultation with the affected community to identify appropriate respite for out-of-hours work. This includes providing the community with a schedule of likely out-of-hours work for a period no less than three (3) months including the potential works, location and duration, the noise characteristics and likely noise levels of the works and likely mitigation and management measures.</p> <p>The outcomes of the community consultation, the identified respite periods and the scheduling of the likely out-of-hours works must be provided to the EPA and the Planning Secretary.</p>	✓	✓	Construction Manager, Community Relations Manage
<p>OOHW STAGE 2</p> <p>OOHW PERIOD 1: NML EXCEEDANCE > 5 dB(A) AND ≤ 25 dB(A)</p> <p>OOHW PERIOD 2: NML EXCEEDANCE > 5 dB(A) AND ≤ 15 dB(A) AND NO EXCEEDANCE OF SLEEP DISTURBANCE CRITERIA</p>				
	Implement all feasible and reasonable mitigation measures OOHMM1 to OOHMM16 inclusive.	✓	✓	As noted above
OOHMM17	<p><i>Verification:</i></p> <p>Measure noise levels from noise intensive plant prior to use and check against manufacturer’s specifications and/or the sound power levels listed in Appendix A.</p> <p>Measure noise levels in accordance with the CNVS.</p>		✓	Construction Manager
OOHMM18	<p><i>Notification:</i></p> <p>Sensitive receivers will be notified of construction activities to be undertaken through letterbox drops. Timeframes for all communication and notification types are included in the Communication Strategy.</p>	✓	✓	Community Relations Manager, Construction Manager
OOHMM19	<p><i>Respite Period 1 (OOHW Period 1 only):</i></p> <p>Out of hours construction noise will be limited to no more than three consecutive periods per week impacting particular sensitive receivers except where there is a Duration Respite (OOHMM21). For the purposes of this measure, a separation distance of 150 m is considered sufficient to provide respite.</p>	✓	✓	Community Relations Manager, Construction Manager
OOHMM20	<p><i>Respite Period 2 (OOHW Period 2 only):</i></p> <p>Out of hours construction noise will be limited to no more than two consecutive periods per week impacting particular sensitive receivers except where there is a Duration Respite (OOHMM21). For the purposes of this measure, a separation distance of 150 m is considered sufficient to provide respite.</p>	✓	✓	Community Relations Manager, Construction Manager

ID	Mitigation Measure	Timing		Responsibility
		PC ¹	C ²	
OOHMM21	<i>Duration Respite:</i> Engagement will be undertaken with the affected community to offer limiting respite periods to ensure works are completed more quickly.	✓	✓	Community Relations Manager, Construction Manager
OOHMM22	Maximise the offset distance between noisy items of plant and sensitive receivers for each task and activity.		✓	Foreman, Operators
OOHMM23	Locate plant and equipment to take advantage of barriers provided by existing site features and structures.		✓	Foreman, Operators
OOHMM24	Orient plant and equipment known to emit noise strongly in one direction so that noise is directed away from noise sensitive areas.		✓	Foreman, Operators
OOHMM25	Use traffic controllers to minimise occurrences of vehicles queuing, idling or reversing near noise sensitive receivers as much as is practical.		✓	Construction Manager, Foreman
OOHMM26	Position site access points and roads as far as practicable away from residential receivers.		✓	Foreman, Operators
OOHMM27	Avoid metal-to-metal contact on equipment where feasible.		✓	Foreman, Operators
OOHMM28	Avoid dropping material from a height into unlined metal trays (line trays with soil or similar to reduce noise).		✓	Foreman, Operators
OOHW STAGE 3 OOHW PERIOD 1: NML EXCEEDANCE > 25 dB(A) OOHW PERIOD 2: NML EXCEEDANCE > 15 dB(A) AND ≤ 25 dB(A), AND/OR EXCEEDANCE OF SLEEP DISTURBANCE CRITERIA				
	Implement all feasible and reasonable mitigation measures OOHMM1 to OOHMM28 inclusive.	✓	✓	As noted above
OOHMM29	<i>Individual briefings:</i> <ul style="list-style-type: none"> Where possible with agreement, individual visits made with identified stakeholders at least 48 hours ahead of potentially disturbing construction activities. 	✓	✓	Community Relations Manager

ID	Mitigation Measure	Timing		Responsibility
		PC ¹	C ²	
OOHMM30	<p><i>Phone calls:</i></p> <p>Phone calls detailing relevant information will be made to identified residences within seven calendar days of proposed work. Phone calls will provide affected residences with specific contact details and advice regarding noise management measures to be implemented. If the resident is not able to be reached via phone, door knocking and/or personalised letterbox drops will be used.</p>	✓	✓	Community Relations Manager
OOHMM31	<p><i>Specific notification:</i></p> <p>Personalised letterbox drops made to identified residences at least seven calendar days ahead of works with specific details on works and management measurements in place.</p> <p>Alternatively (or in addition to), communications representatives from the contractor would visit identified stakeholders at least 48 hours ahead of potentially disturbing construction activities and provide an individual briefing.</p> <ul style="list-style-type: none"> ▪ Letters may be letterbox dropped or hand distributed ▪ Phone calls provide affected stakeholders with personalized contact and tailored advice, with the opportunity to provide comments on the proposed work and their specific needs ▪ Individual briefings are used to inform stakeholders about the impacts of noisy activities and mitigation measures that will be implemented. Individual briefings provide affected stakeholders with personalised contact and tailored advice, with the opportunity to comment on the project <p>Specific notifications are used to support periodic notifications, or to advertise unscheduled works and must be approved by ARTC prior to implementation/distribution.</p> <p>A full range of notification requirements is included in the project Communication Strategy.</p>	✓	✓	Community Relations Manager
<p>OOHW STAGE 4</p> <p>OOHW PERIOD 2: NML EXCEEDANCE > 25 dB(A) AND EXCEEDANCE OF SLEEP DISTURBANCE CRITERIA</p>				
	<p>Implement all feasible and reasonable mitigation measures OOHMM1 to OOHMM31 inclusive.</p>	✓	✓	As noted above
OOHMM32	<p>Install temporary hoarding where feasible to shield noise to affected sensitive receivers.</p>		✓	Construction Manager

ID	Mitigation Measure	Timing		Responsibility
		PC ¹	C ²	
OOHMM33	<p><i>Alternative Accommodation</i></p> <p>Consider temporary relocation of receivers where the construction noise level exceeds the night-time NML by more than 25 dB(A) for an extended period of time. As per the CNVS, the specifics of any offer will be considered on a case-by-case basis and should provide a like-for-like replacement for permanent residents, including provisions for pets, where reasonable and feasible.</p>	✓	✓	Community Relations Manager
OOHW VIBRATION				
VIBRATION: Works occurring within safe working distances for human comfort				
OOHMM34	Not used			
OOHMM35	<p>Assess Out of Hours works in accordance with the <i>Out-of-Hours Work Protocol</i> in Appendix C, including:</p> <ul style="list-style-type: none"> ○ Justification for Out of Hours work. ○ Vibration assessment. ○ Notification to and consultation with ARTC and with the affected community. <p>Implementation of reasonable and feasible mitigation measures for receivers where night-time human comfort 'Maximum' criteria are predicted to be exceeded.</p>	✓	✓	Construction Manager
OOHMM36	Implement a hot line (ARTC Enviroline 1300 550 402) and complaints handling procedure for vibration and other construction related complaints.	✓	✓	Community Relations Manager
OOHMM37	<p>Avoid vibration intensive works within the safe working distances unless necessary.</p> <p>Ensure a Hold Point is released prior to commencement of any impact piling, hammering or ripping, demolition operations or any other activities which may cause damage through vibration.</p>	✓	✓	Foreman Construction Manager
OOHMM38	Restrict construction traffic speed to 20 km/h across the site, or 40 km/h for haul roads. Signpost the speed limit.		✓	Foreman
OOHMM39	Restrict construction traffic to designated roadways.		✓	Foreman
OOHMM40	Run plant that has high and low vibration operating settings on the lowest effective vibration setting, including static rolling where feasible.		✓	Foreman

ID	Mitigation Measure	Timing		Responsibility
		PC ¹	C ²	
OOHMM41	<p><i>Notification:</i></p> <p>Sensitive receivers will be notified of construction activities to be undertaken through letterbox drops. Timeframes for all communication and notification types are included in the Communication Strategy.</p>	✓	✓	Community Relations Manager, Construction Manager
OOHMM42	<p><i>Respite offers:</i></p> <p>Consultation with highly affected residences will involve discussion of specific respite periods. If specific respite periods are not agreed, then works will not be carried out for continuous blocks of more than three hours without a minimum respite period of one hour.</p>	✓	✓	Community Relations Manager, Construction Manager, Foreman
OOHMM43	<p><i>Individual briefings:</i></p> <p>Where possible with agreement, individual visits made with identified stakeholders at least 48 hours ahead of potentially disturbing construction activities.</p>	✓	✓	Community Relations Manager
OOHMM44	<p><i>Phone calls:</i></p> <p>Phone calls detailing relevant information will be made to identified residences within seven calendar days of proposed work. Phone calls will provide affected residences with specific contact details and advice regarding noise management measures to be implemented. If the resident is not able to be reached via phone, door knocking and/or personalised letterbox drops will be used.</p>	✓	✓	Community Relations Manager
OOHMM45	<p><i>Specific notification:</i></p> <p>Personalised letterbox drops made to identified residences at least seven calendar days ahead of works with specific details on works and management measurements in place.</p> <p>Full details on the types of communication strategies used are detailed in the Communication Strategy.</p>	✓	✓	Community Relations Manager
OOHMM46	<p><i>Alternative Accommodation (OOHW Period 2 only)</i></p> <p>Consider temporary relocation of receivers where the vibration levels will considerably exceed the night-time human comfort criteria for extended periods of time and where respite periods may not be feasible. As per the CNVS, the specifics of any offer will be considered on a case-by-case basis and should provide a like-for-like replacement for permanent residents, including provisions for pets, where reasonable and feasible.</p>	✓	✓	Community Relations Manager
<p>VIBRATION: Where works are occurring within safe working distances for cosmetic damage to buildings</p>				

ID	Mitigation Measure	Timing		Responsibility
		PC ¹	C ²	
	Implement all feasible and reasonable mitigation measures OOHMM35 to OOHMM46 inclusive.			
OOHMM47	If vibration intensive plant is to be used within the safe working distance for cosmetic damage (as per Section 7.5, works would not proceed until attended vibration measurements are undertaken. A heritage specialist will be consulted with in relation to placement of sensors on heritage structures.		✓	Foreman, Environment Coordinator
OOHMM48	Where vibration intensive works are occurring for a continuous period of time within the safe working distance for cosmetic damage (as per Section 7.5), install a permanent vibration monitoring system to warn operators (via flashing light, audible alarm, SMS etc.) when vibration levels are approaching the cosmetic damage objective. Comply with the requirements of mitigation measure ID OOHMM53.		✓	Environment Coordinator Operators
OOHMM49	Undertake <u>pre-construction</u> dilapidation surveys of buildings and structures where construction works will occur within safe working distances for cosmetic damage, prior to that work being undertaken. These would be conducted by a structural engineer.	✓	✓	Environment Coordinator
OOHMM50	Undertake <u>post-construction</u> dilapidation surveys of buildings and structures where construction works has occurred within safe working distances for cosmetic damage. These would be conducted by a structural engineer.		✓	Environment Coordinator
OOHMM51	Undertake surveys of buildings and structures immediately following a monitored exceedance of the relevant vibration criteria.		✓	Environment Coordinator
OOHMM52	Not used.			
OOHMM53	During vibration monitoring, if warning levels or alerts are triggered works are to stop immediately. Assess the cause of the warnings and determine if there are any additional mitigation measures required. Ensure that these mitigation measures are in place prior to restarting work.		✓	Environment Coordinator

¹ PC means pre-construction; ² C means construction

9. Compliance Management

9.1. Roles and Responsibilities

Fulton Hogan's Project Team organisational structure and overall roles and responsibilities are outlined in Section 4.1 of the CEMP. Specific responsibilities for the implementation of environmental controls are detailed in Table 27 of this NVMP.

9.2. Training

All employees, subcontractors and utility staff working on site will undergo site induction training relating to noise and vibration management issues, including:

- requirements of this NVMP
- relevant legislation
- roles and responsibilities for noise and vibration management
- safe working distances and vibration warning system where relevant
- all relevant project specific and standard noise and vibration mitigation measures
- relevant licence and approval conditions
- permissible hours of work
- any limitations on noise generating activities with special audible characteristics
- location of nearest sensitive receivers
- construction employee parking areas
- designated loading/unloading areas and procedures
- site opening/closing times (including deliveries)
- environmental incident procedures
- OOHW management, communication, approval and mitigation measures

Targeted training in the form of toolbox talks or specific environmental training will also be provided to personnel with a key role in noise and vibration management. An example of a training topic could include noise meter operation for environment or designated staff.

Further details regarding staff induction and training are outlined in Chapter 5 of the CEMP.

9.3. Complaints

Complaints will be recorded and addressed in accordance with Section 6.2.3 of the CEMP and the Communication Strategy (CS).

9.4. Inspections and Monitoring

General requirements and responsibilities in relation to inspections and monitoring are documented in Sections 8.1 and 8.2 of the CEMP respectively.

Where actual noise levels are found to consistently exceed the predicted worst-case levels (i.e. an exceedance of more than 3 dB(A)), the source of excessive noise generations will be identified, and any additional feasible and reasonable measures available will be implemented to either reduce noise emissions or reduce the impacts on receivers. Vibration generating activities with potential impact on buildings and heritage items require vibration monitoring before and during the activities. Minimum working distances are to be identified to prevent cosmetic damage.

In the event that the vibration testing and monitoring shows that the preferred values for vibration are likely to be exceeded, review the construction methodology is required. Additional mitigation measurements have to be implemented if necessary.

The results of the Construction Monitoring Program to be made publicly available in the form of a Construction Monitoring Report as documented in Chapter 9 of the CEMP.

9.4.1. Noise Monitoring

The following noise monitoring will be undertaken:

- Monthly noise monitoring at nominated sensitive receiver locations to determine the effectiveness of mitigation measures against predicted impacts;
- Where complaints are received, additional noise monitoring may be undertaken at sensitive receivers to determine if the actual construction noise generated exceeds the predicted 'worst case' construction noise levels identified in Section 7 and Appendix B of this NVMP;
- Noise monitoring may be carried out for the purpose of refining construction methods or techniques to minimise noise; and
- Ongoing spot checks of noise intensive plant and equipment will be undertaken throughout construction to ensure compliance with manufacturer's specifications.
- OOHW noise monitoring to confirm compliance with the noise model will be confirmed for each OOHW activity onsite.

Where actual noise levels are found to exceed the predicted worst-case levels (i.e. an exceedance of more than 3 dB), the source of excessive noise generations will be identified, and any additional feasible and reasonable measures available will be implemented to either reduce noise emissions or reduce the impacts on receivers. At a minimum, the noise mitigation measures detailed in Chapter 8 for the measured exceedance of the relevant NML will be applied.

Details of site activity and equipment usage will be noted during construction noise monitoring.

Acoustic instrumentation employed in the noise monitoring surveys will comply with the requirements of AS IEC 61672-2019 Electroacoustics – Sound Level Meters.

9.4.2. Vibration monitoring

The following attended vibration monitoring will be undertaken:

- For the protection of buildings, monitoring will be carried out at the commencement of vibratory compaction work and any rock-breaking within 50 metres of buildings to ensure that safe vibration working distances specified in Table 25 are not exceeded and to confirm safe working distances
- When vibration intensive activities are required, vibration monitoring will be carried out within the established buffer zones, or where there is considered to be a risk that levels may exceed the relevant structural damage goals
- Vibration monitoring may be carried out in response to complaints, exceedances, or for the purpose of refining construction methods or techniques to minimise vibrations
- Vibration monitoring will continue throughout construction, where appropriate, at nominated sensitive receiver locations to determine the effectiveness of mitigation strategies.

Where vibration is found to exceed safe levels, impacts will be avoided by changing work methods and/or equipment, or through the provision of building protection measures where possible. In the event a complaint relating to property damage is received, an inspection of the property would be undertaken and an interim building condition survey prepared.

Longer-term unattended monitoring may be conducted in situations where there is a requirement to work within safe working distances and attended monitoring has demonstrated that there is a reasonable risk of exceeding the established vibration criteria at sensitive receivers or structures. These monitors would have the capability to send automated alerts or include audible or visual alarms.

Vibration monitoring will be carried out in accordance with:

- For structural damage vibration – German Standard DIN 4150 and BS 7385: Part 2 – 1993

- For human exposure to vibration – the evaluation criteria presented in the Environmental Noise Management Assessing Vibration: A Technical Guideline (DECC 2006).

9.4.3. Monitoring Program Summary

A monitoring (and inspection) program summary is included in Table 29.

The nominated monthly attended noise monitoring locations are shown on the map in Appendix E and listed below:

- Location 1: 225 Railway Parade, Cabramatta
- Location 2: 150 Broomfield Street, Cabramatta
- Location 3: Corner of Station Street and Lawrence Hargrave Road
- Location 4: In railway corridor north of Warwick Farm Station

The monitoring locations are selected to cover each NCA and proximity to key construction zones and most potentially affected sensitive receivers. These locations will be reviewed during construction and amended if necessary.

These locations have also been selected, where possible, to coincide with the approximate locations where previous baseline monitoring occurred during the EIS. For these locations, the EIS baseline noise monitoring data will be used as the baseline data for the construction noise monitoring.

Information regarding non-conformances and reporting requirements are documented in Section 9.7 and 9.6 respectively of this NVMP.

Table 29: Noise and Vibration Monitoring Summary

Monitoring details	Record	Frequency	Responsibility	Test procedures/ Methods
INSPECTIONS				
Inspection of works to ensure that noise and vibration mitigation measures are being implemented on site.	Environmental Inspection Checklist	Weekly	Environmental Manager	Nil
ATTENDED NOISE MONITORING				
Attended noise monitoring at monitoring locations identified at locations listed above and shown in Appendix E.	Noise Monitoring Record	Monthly	Environmental Manager	<p>If monitoring cannot be undertaken at the nearest relevant sensitive receiver, a suitable representative location will be selected. The testing method includes:</p> <ul style="list-style-type: none"> • SLM set to “Fast” time weighting and “A” frequency weighting. • Test environment free from reflecting objects where possible. Where noise monitoring is conducted within 3.5metres of large walls or a building facade, then a reflection correction of up to -2.5dB(A) will be applied to remove of increased noise due to sound reflections. • Tests will not be carried out during rain or when wind speed > 5m/s.
Where Verification is required in accordance with CNVS and mitigation measures in Chapter 8.	Noise Monitoring Record	As required	Environmental Manager	

Monitoring details	Record	Frequency	Responsibility	Test procedures/ Methods
Where complaint is received and monitoring is considered an appropriate response to determine if noise levels exceed predicted construction noise levels documented in this NVMP.	Noise Monitoring Record	As required	Environmental Manager	<ul style="list-style-type: none"> Conditions such as wind velocity and direction, temperature, relative humidity and cloud cover will be recorded from the nearest Bureau of Meteorology station or on-site weather station/observations. The monitoring period should be sufficient such that measured noise levels are representative of noise over a 15-minute period. At a minimum L_{eq}, L_{max}, L_{10} and L_{90} levels will be reported. <p>The observations of the person undertaking the measurements will be reported including audibility of construction noise, other noise in the environment and any discernible construction activities contributing to the noise at the receiver.</p>
Spot checks of noise intensive plant where it is required to check noise emission against manufacturer's specifications.	Noise Monitoring Record	Monthly for construction activities with $PNL > 60$ dB $L_{Aeq(15min)}$	Environmental Manager	<p>Stationary test procedures according to AS 2012.1 Acoustics – Measurement of airborne noise emitted by earth-moving machinery and agricultural tractors – Stationary test condition (superseded by AS ISO 6393:2019 Earth-moving machinery- Determination of sound power level- Stationary test conditions). The testing method includes:</p> <ul style="list-style-type: none"> Sound level meter configured for “Fast” time weighting and “A” frequency weighting. The test environment will be free from reflecting objects. Tests will not be carried out during rain or when wind speed exceeds 5m/s. <p>In accordance with AS 2012.1 / AS ISO 6393:2019, a minimum of three (3) measurement points will be defined at locations on the</p>
Spot checks for worst-case noise impact scenarios or when new predicted high noise impact activities commence	Noise Monitoring Record	As required	Environmental Manager	<ul style="list-style-type: none"> The test environment will be free from reflecting objects. Tests will not be carried out during rain or when wind speed exceeds 5m/s. <p>In accordance with AS 2012.1 / AS ISO 6393:2019, a minimum of three (3) measurement points will be defined at locations on the</p>

Monitoring details	Record	Frequency	Responsibility	Test procedures/ Methods
Where required for the purposes of refining construction methods or techniques to reduce noise levels.	Noise Monitoring Record	As required	Environmental Manager	hemispherical surface around the plant with the radius determined by the basic length of the machine. <ul style="list-style-type: none"> The A-weighted L_{eq} background noise at the measurement locations will be at least 6 dB and preferably 10 dB below the level with the plant operating. Both L_{eq} and L_{10} levels will be measured and reported.
ATTENDED AND UNATTENDED VIBRATION MONITORING				
At start of vibratory compaction work or rock-breaking within 50 m of residential buildings.	Vibration Monitoring Record	As required	Environmental Manager	Attended vibration monitoring will be undertaken when checking the safe working distances from construction plant (e.g. compaction plant) or in response to a complaint. <p>The testing method includes:</p> <ul style="list-style-type: none"> Monitoring to be conducted for at least three distances from the plant, including a representative distance for the nearest sensitive structures and/or receivers. The testing will be conducted at each location to obtain a suitable representation of the range of vibration levels that would occur from the tested plant. The plant will be tested in the settings in which it is expected to operate. For vibratory rollers this may include both “High” and “Low” settings.
Where Verification is required in accordance with CNVS and mitigation measures in Chapter 8.				

Monitoring details	Record	Frequency	Responsibility	Test procedures/ Methods
Where a complaint is received and monitoring is considered an appropriate response.				Peak (PPV) vibration levels and the dominant frequency of the vibration will be recorded for assessment against the structural and cosmetic damage criteria. In situations in which human comfort is also of concern then the rms vibration level should also be recorded.
Where an activity may occur within safe working distances for cosmetic damage for no more than one day continuously.				
During construction to confirm minimum safe working distances in Section 7.5 and refine construction methods if vibration levels exceed guideline values.				

Monitoring details	Record	Frequency	Responsibility	Test procedures/ Methods
<p>Where an activity may occur within safe working distances for cosmetic damage for a period of more than one day continuously.</p>	<p>Vibration Monitoring Record</p>	<p>As required</p>	<p>Environmental Manager</p>	<p>Continuous vibration monitoring will be undertaken where vibration from a construction activity may exceed cosmetic damage criteria at a sensitive structure, where activities may occur within safe working distances for cosmetic damage. The testing method includes:</p> <ul style="list-style-type: none"> • Vibration logger to continuously measure vibration while relevant works are occurring within the safe working distance for cosmetic damage. • Measurement to be conducted as close as possible to the sensitive structure. • A warning system will be implemented including one or both of an audible and/or visual warning alarm, and/or SMS and/or email alerts to site staff.
<p>Dilapidation surveys of buildings and structures where construction works occurs within the safe working distance for cosmetic damage. At a minimum, this will include all buildings where buffer distances will be less than those identified in Section 7.5 in areas where vibratory compaction and/or rock-breaking will occur.</p>	<p>Dilapidation Report</p>	<p>At least 1 month prior to that work being undertaken and no later than 3 months post-construction</p>	<p>Construction Manager</p>	<p>At a minimum, dilapidation surveys and reports will comprise:</p> <ul style="list-style-type: none"> • Inspector’s qualifications and expertise • A visual inspection of the structure, including all internal and external walls, ground level floors and external pavements, all connections of other structures above ground level and their connection at ground level and any exposed foundations. • Full written report outlining condition of internal and external components of each property. • A series of photographs of each identified defect/crack. • A sketched floor plan showing exact locations of defect and measurements of crack width/defect size. • Identification of any condition changes relative to pre-construction and the likely cause of the change (post-construction only)

9.5. Auditing

Auditing (both internal and external) will be undertaken to assess the effectiveness of environmental mitigation measures, compliance with this NVMP, ARTC specifications and other relevant approvals, permits and licences. Auditing requirements are detailed in Section 8.4 of the CEMP.

9.6. Reporting

General reporting requirements and responsibilities are documented in Chapter 9 of the CEMP.

9.7. Non-conformances

Non-conformances will be dealt with and documented in accordance with Chapter 10 of the CEMP.

10. Review and Improvement of NVMP

The NVMP will be reviewed to ensure compliance with legislative requirements and its suitability and effectiveness for the project.

The review may be in the form of:

- A formal management review
- A second party audit, and/or
- An inclusion as a separate item at a site meeting.

The Environmental Manager may review and update the NVMP more regularly where:

- Significant changes in construction activities occur
- Where targets are not being achieved, or
- In response to audits and non-conformance reports.

Any changes to the NVMP will be approved by the ER and made in accordance with the process outlined in Section 1.6 of the CEMP.

Appendix A: Indicative Plant and Equipment Sound Power Levels

Appendix A Indicative Plant and Equipment Sound Power Levels

Maximum sound power levels for the typical operation of construction plant and equipment applied in noise modelling are listed in Table 30.

The sound power levels are based on previous measurements of similar construction equipment conducted by Resonate, as well as reference to the CNVS where required. The overall activity sound power levels are based on the typical loudest combination of equipment likely occurring for each activity. Note that the overall sound power levels have not generally been obtained by combining predicted noise levels for all items of equipment listed as this is not a typical operating scenario.

Table 30: Sound Power Levels

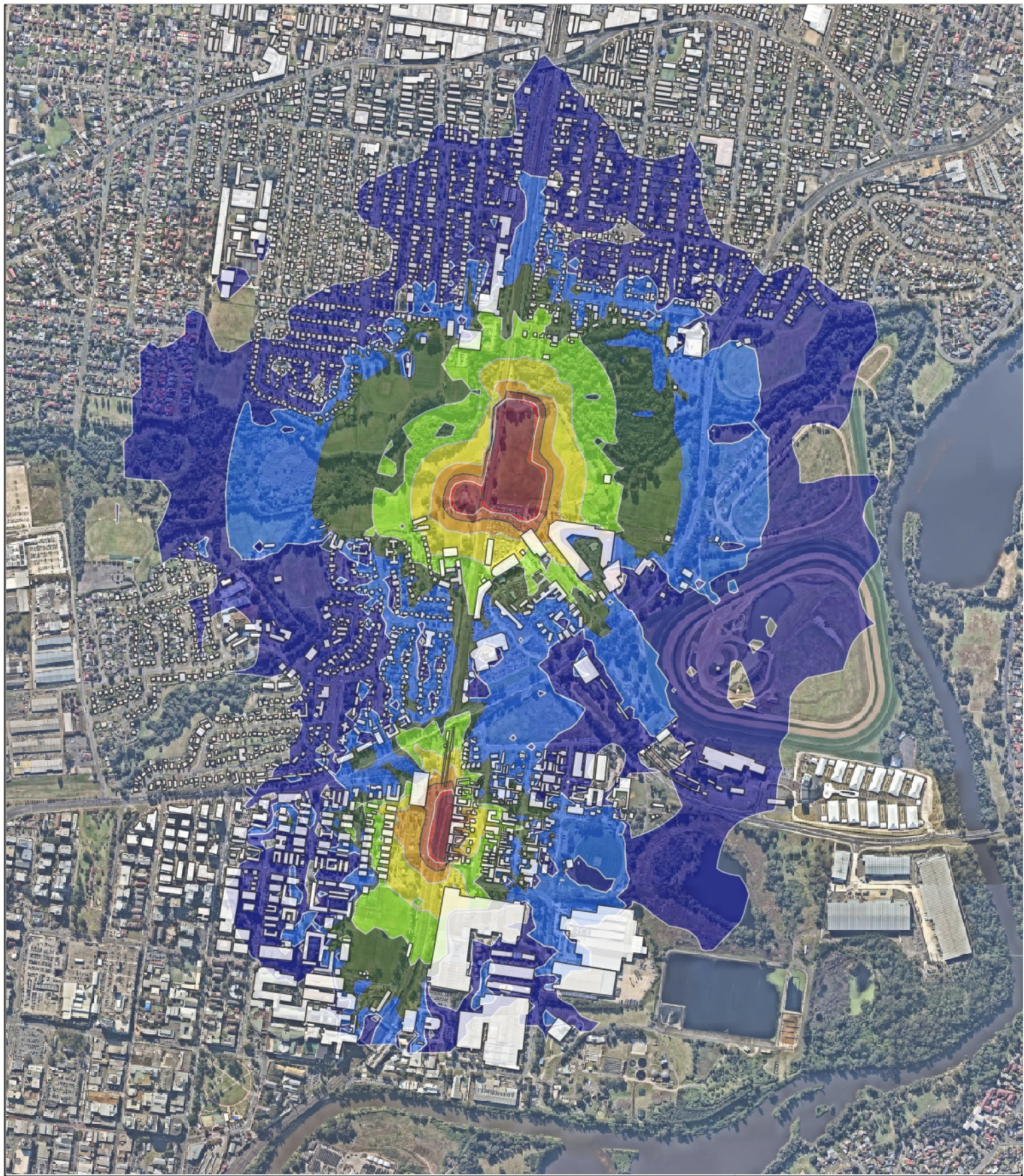
Stage	Plant and equipment	Plant items	SWL, dB(A)
CS01 - Site establishment	Cherry picker	1	98
	Crane	1	113
	Excavator	1	110
	Ute/crew truck	1	103
	Road truck 39t	1	108
	Water cart	1	107
	Total SWL		116
	Total SWL including operating times		112
CS02 - Enabling Works	Plate compactor/wacker packer	1	106
	Crane (mobile)	1	113
	Chipper/mulcher	1	116
	Ute/crew truck	1	103
	Excavator	1	110
	Vacuum truck	1	109
	Water cart	1	107
	Total SWL		119
	Total SWL including operating times		115
CS03 - Adjustment of existing services / Road earthworks	Backhoe with auger	1	111
	Plate compactor/wacker packer	1	106
	Crane (mobile)	1	113
	Excavator	1	110
	Excavator with hammer	1	122
	Grader	1	113

Stage	Plant and equipment	Plant items	SWL, dB(A)
	Ute/crew truck	1	103
	Vacuum truck	1	109
	Roller (vibratory)	1	109
	Water cart	1	107
	Total SWL		124
	Total SWL including operating times		121
CS04- Pavements	Asphalt truck & sprayer	1	106
	Concrete pump truck	1	109
	Concrete Vibrator	1	113
	Crane (mobile)	1	113
	Ute/crew truck	2	103
	Milling machine	2	116
	Water cart	1	107
	Total SWL		120
	Total SWL including operating times		117
CS05 - Signals, testing and Commissioning	Wheeled mobile crane	1	98
	Concrete pump truck	1	109
	Franna crane	1	98
	Ute/crew truck	1	103
	Tipper truck	1	103
	Total SWL		111
	Total SWL including operating times		107
CS06 - Noise barrier construction	Concrete pump truck	1	109
	Franna crane	1	98
	Excavator with hammer	1	122
	Grinder	1	108
	Chipper/mulcher	1	116
	Road truck 39t	1	108
	Water cart	1	107
	Total SWL		124
	Total SWL including operating times		121

Stage	Plant and equipment	Plant items	SWL, dB(A)
CS07 – Bridge construction pre-work	Road truck 39t	2	108
	Franna crane	1	98
	Ute/crew truck	1	103
	Excavator	1	110
	Hand tools (electric)	2	102
	Front end loader	1	112
	Total SWL		116
	Total SWL including operating times		115
CS08 – Bridge construction work	Concrete pump truck	1	109
	Concrete pump	1	103
	Concrete Vibrator	1	113
	Excavator	1	110
	Front end loader	1	112
	Jackhammer	1	121
	Ute/crew truck	1	103
	Tipper truck	1	103
	Total SWL		123
	Total SWL including operating times		118
CS09 – Bridge rail installation	Cherry picker	1	98
	Crane (mobile)	1	113
	Ute/crew truck	1	103
	Tipper truck	1	103
	Total SWL		114
	Total SWL including operating times		110
CS10 - Retaining walls	Concrete pump truck	1	109
	Franna crane	1	98
	Excavator	1	110
	Excavator with hammer	1	122
	Grader	1	113
	Grinder	1	108
	Jackhammer	1	121

Stage	Plant and equipment	Plant items	SWL, dB(A)
	Ute/crew truck	1	103
	Tipper truck	1	103
	Water cart	1	107
	Total SWL		125
	Total SWL including operating times		121
CS11 – Track construction	Backhoe with auger	1	111
	Concrete pump truck	1	109
	Franna crane	1	98
	Excavator	1	110
	Ute/crew truck	1	103
	Roller (vibratory)	1	109
	Total SWL		116
	Total SWL including operating times		115
CS12 – Track installation	Ballast train	1	116
	Cherry picker	1	98
	Franna crane	2	98
	Ute/crew truck	9	103
	Rail regulator	1	114
	Tail tamper (vibration)	1	113
	Rail train	1	116
	Total SWL		121
	Total SWL including operating times		120
CS13 – Finishing works	Cherry picker	1	98
	Franna crane	1	98
	Excavator	1	110
	Ute/crew truck	2	103
	Tipper truck	3	103
	Total SWL		112
	Total SWL including operating times		112

Appendix B: Typical Worst-Case Construction Noise Contours









CABRAMATTA LOOP FIGURE A1

Construction noise contours CS01

PROJECT NUMBER	S210520
DRAWN BY	MS
CHECKED BY	AP
DATE ISSUED	JULY 2021
CLIENT	Fulton Hogan
PREDICTION METHOD	ISO 9613 - 2
CALIBRATION FACTOR	n/a
GROUND ABSORPTION	0.5
RECEIVER HEIGHT	1.5 m
ROAD SURFACE	n/a
IMAGERY	NEARMAP
PAGE SIZE	A3

Legend

Predicted Construction Noise Levels  Buildings

-  >75 dB(A)
-  70 - 75 dB(A)
-  65 - 70 dB(A)
-  60 - 65 dB(A)
-  55 - 60 dB(A)
-  50 - 55 dB(A)
-  45 - 50 dB(A)
-  40 - 45 dB(A)
-  35 - 40 dB(A)



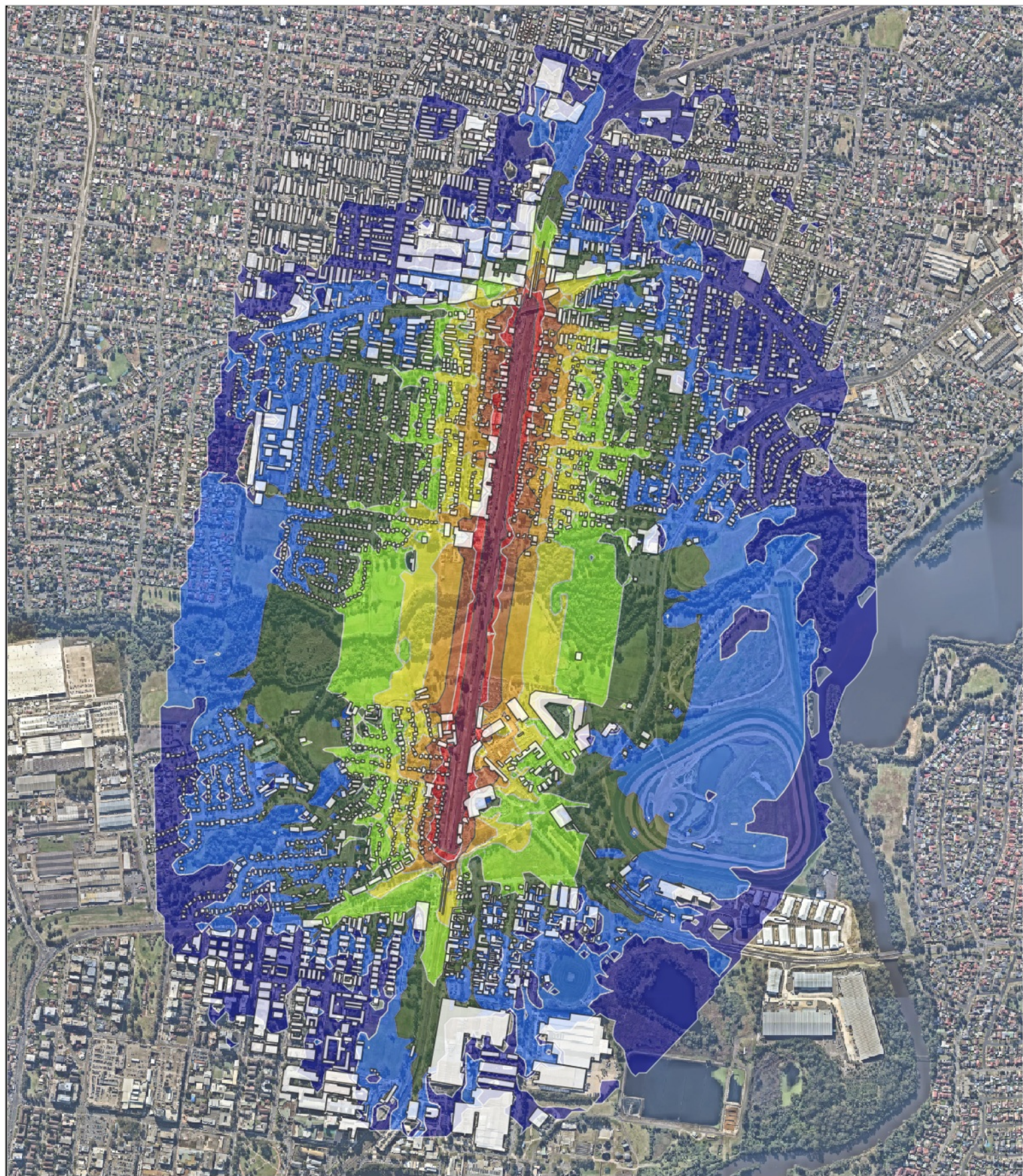
300 600 m



AGD 1966 ISG 56 1

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CABRAMATTA LOOP FIGURE A2

Construction noise contours CS02

PROJECT NUMBER	S210520
DRAWN BY	MS
CHECKED BY	AP
DATE ISSUED	JULY 2021
CLIENT	Fulton Hogan
PREDICTION METHOD	ISO 9613 - 2
CALIBRATION FACTOR	n/a
GROUND ABSORPTION	0.5
RECEIVER HEIGHT	1.5 m
ROAD SURFACE	n/a
IMAGERY	NEARMAP
PAGE SIZE	A3

Legend

Predicted Construction Noise Levels Buildings

- >75 dB(A)
- 70 - 75 dB(A)
- 65 - 70 dB(A)
- 60 - 65 dB(A)
- 55 - 60 dB(A)
- 50 - 55 dB(A)
- 45 - 50 dB(A)
- 40 - 45 dB(A)
- 35 - 40 dB(A)



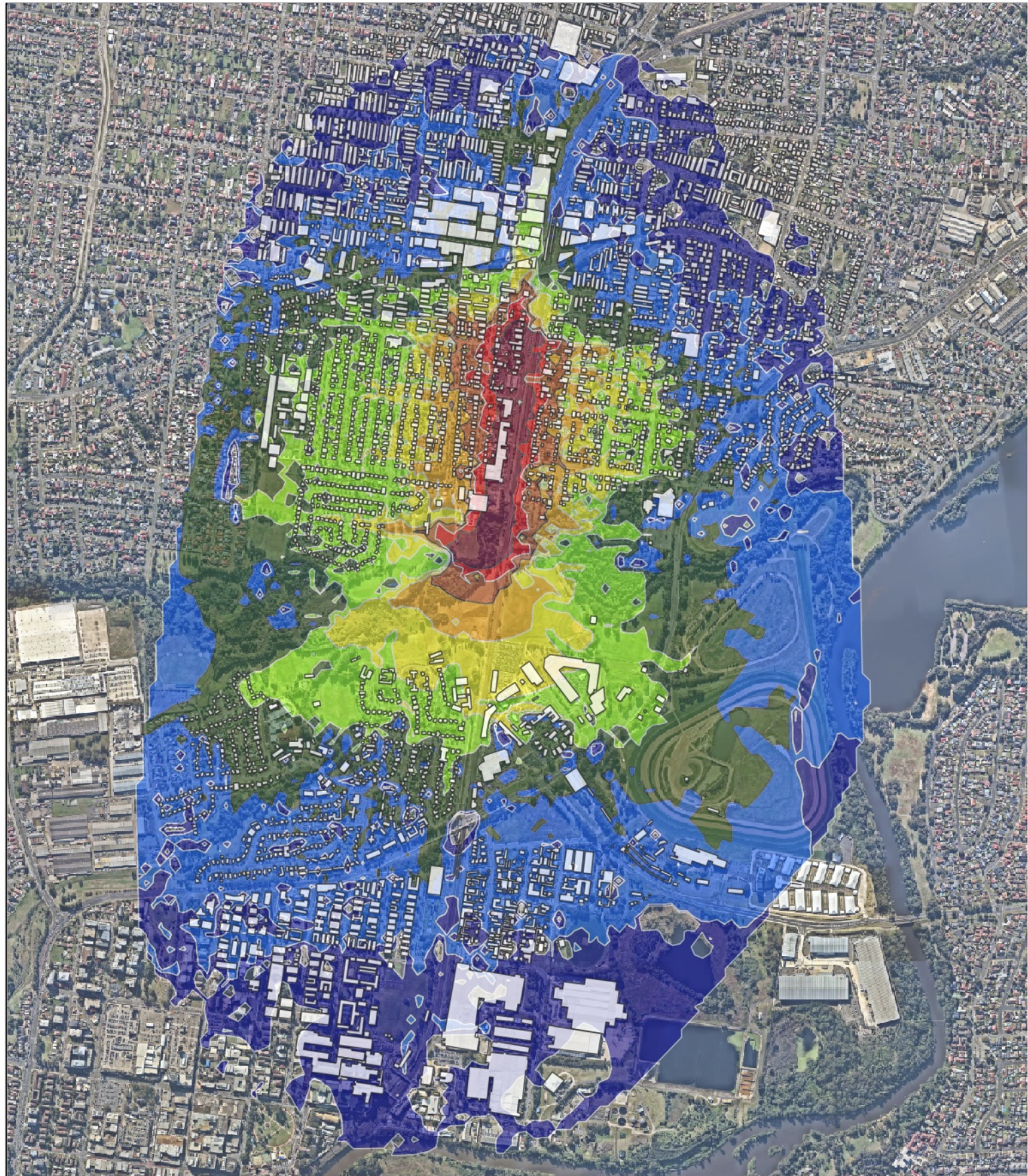
300 600 m



AGD 1966 ISG 56 1

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CABRAMATTA LOOP FIGURE A3

Construction noise contours CS03

PROJECT NUMBER	S210520
DRAWN BY	MS
CHECKED BY	AP
DATE ISSUED	JULY 2021
CLIENT	Fulton Hogan
PREDICTION METHOD	ISO 9613 - 2
CALIBRATION FACTOR	n/a
GROUND ABSORPTION	0.5
RECEIVER HEIGHT	1.5 m
ROAD SURFACE	n/a
IMAGERY	NEARMAP
PAGE SIZE	A3

Legend

Predicted Construction Noise Levels  Buildings

-  >75 dB(A)
-  70 - 75 dB(A)
-  65 - 70 dB(A)
-  60 - 65 dB(A)
-  55 - 60 dB(A)
-  50 - 55 dB(A)
-  45 - 50 dB(A)
-  40 - 45 dB(A)
-  35 - 40 dB(A)



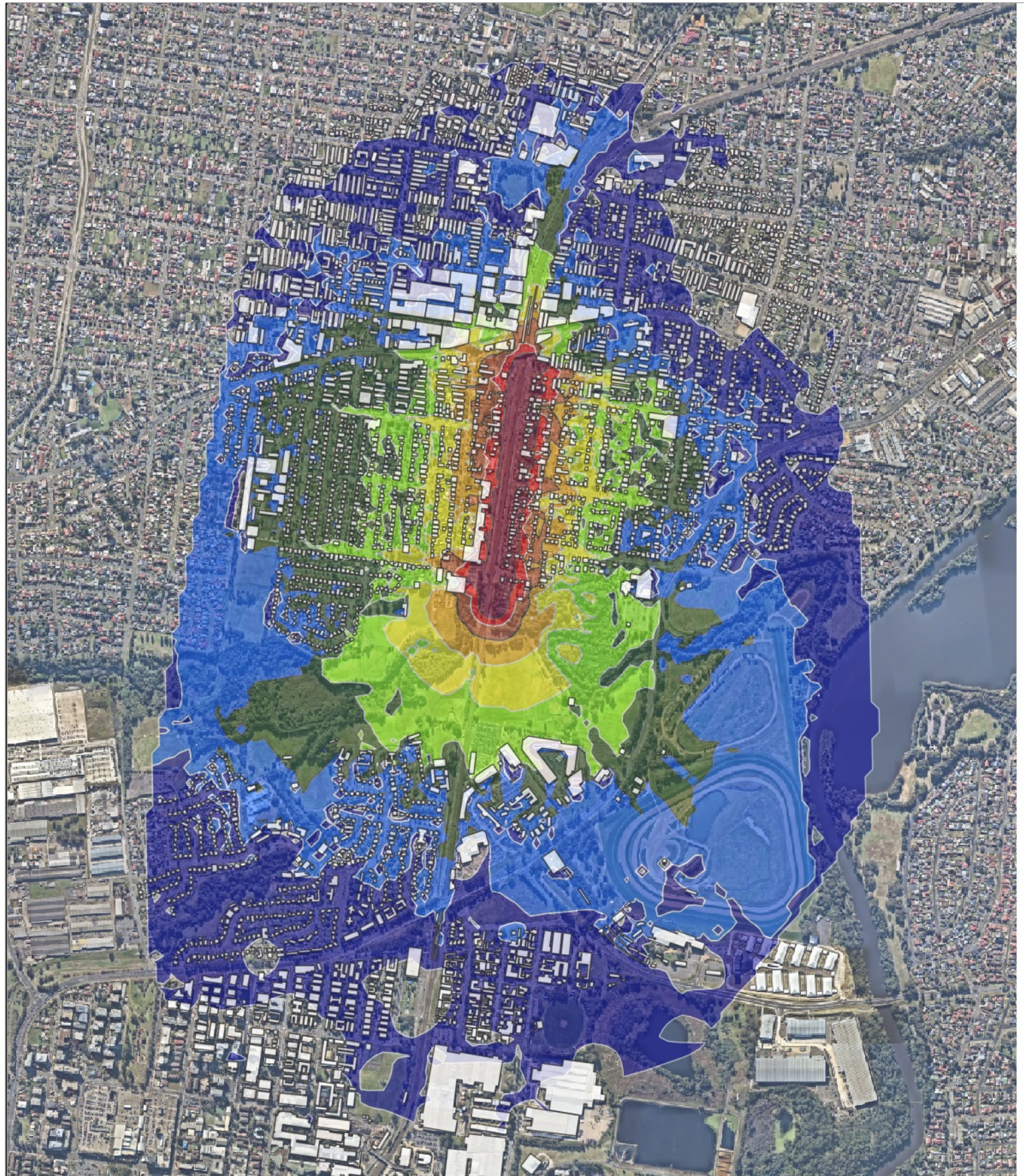
300 600 m



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



CABRAMATTA LOOP FIGURE A4

Construction noise contours CS04

PROJECT NUMBER	S210520
DRAWN BY	MS
CHECKED BY	AP
DATE ISSUED	JULY 2021
CLIENT	Fulton Hogan
PREDICTION METHOD	ISO 9613 - 2
CALIBRATION FACTOR	n/a
GROUND ABSORPTION	0.5
RECEIVER HEIGHT	1.5 m
ROAD SURFACE	n/a
IMAGERY	NEARMAP
PAGE SIZE	A3

Legend

Predicted Construction Noise Levels  Buildings

-  >75 dB(A)
-  70 - 75 dB(A)
-  65 - 70 dB(A)
-  60 - 65 dB(A)
-  55 - 60 dB(A)
-  50 - 55 dB(A)
-  45 - 50 dB(A)
-  40 - 45 dB(A)
-  35 - 40 dB(A)



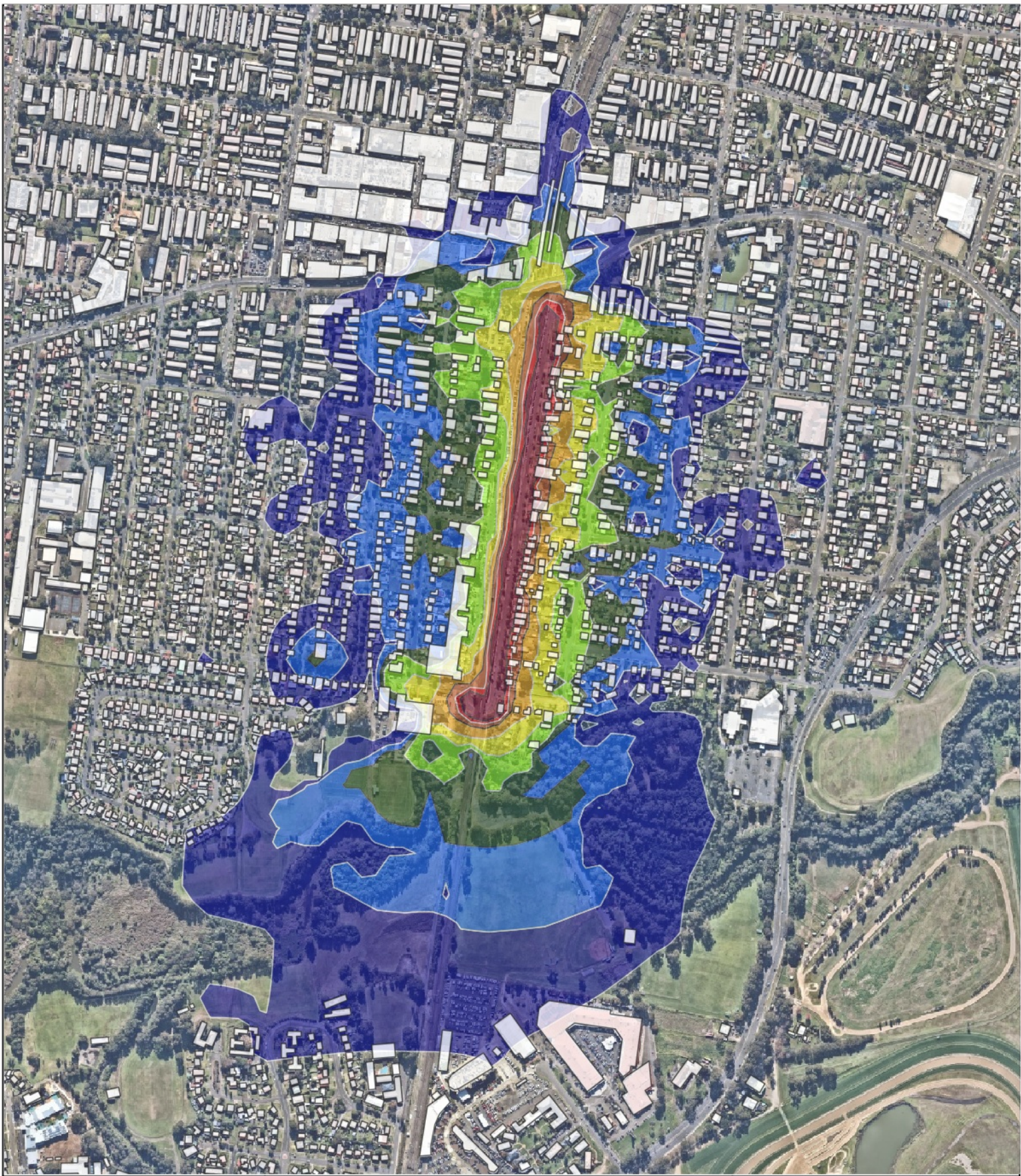
300 600 m



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




CABRAMATTA LOOP FIGURE A5

Construction noise contours CS05

PROJECT NUMBER	S210520
DRAWN BY	MS
CHECKED BY	AP
DATE ISSUED	JULY 2021
CLIENT	Fulton Hogan
PREDICTION METHOD	ISO 9613 - 2
CALIBRATION FACTOR	n/a
GROUND ABSORPTION	0.5
RECEIVER HEIGHT	1.5 m
ROAD SURFACE	n/a
IMAGERY	NEARMAP
PAGE SIZE	A3

Legend

Predicted Construction Noise Levels  Buildings

-  >75 dB(A)
-  70 - 75 dB(A)
-  65 - 70 dB(A)
-  60 - 65 dB(A)
-  55 - 60 dB(A)
-  50 - 55 dB(A)
-  45 - 50 dB(A)
-  40 - 45 dB(A)
-  35 - 40 dB(A)



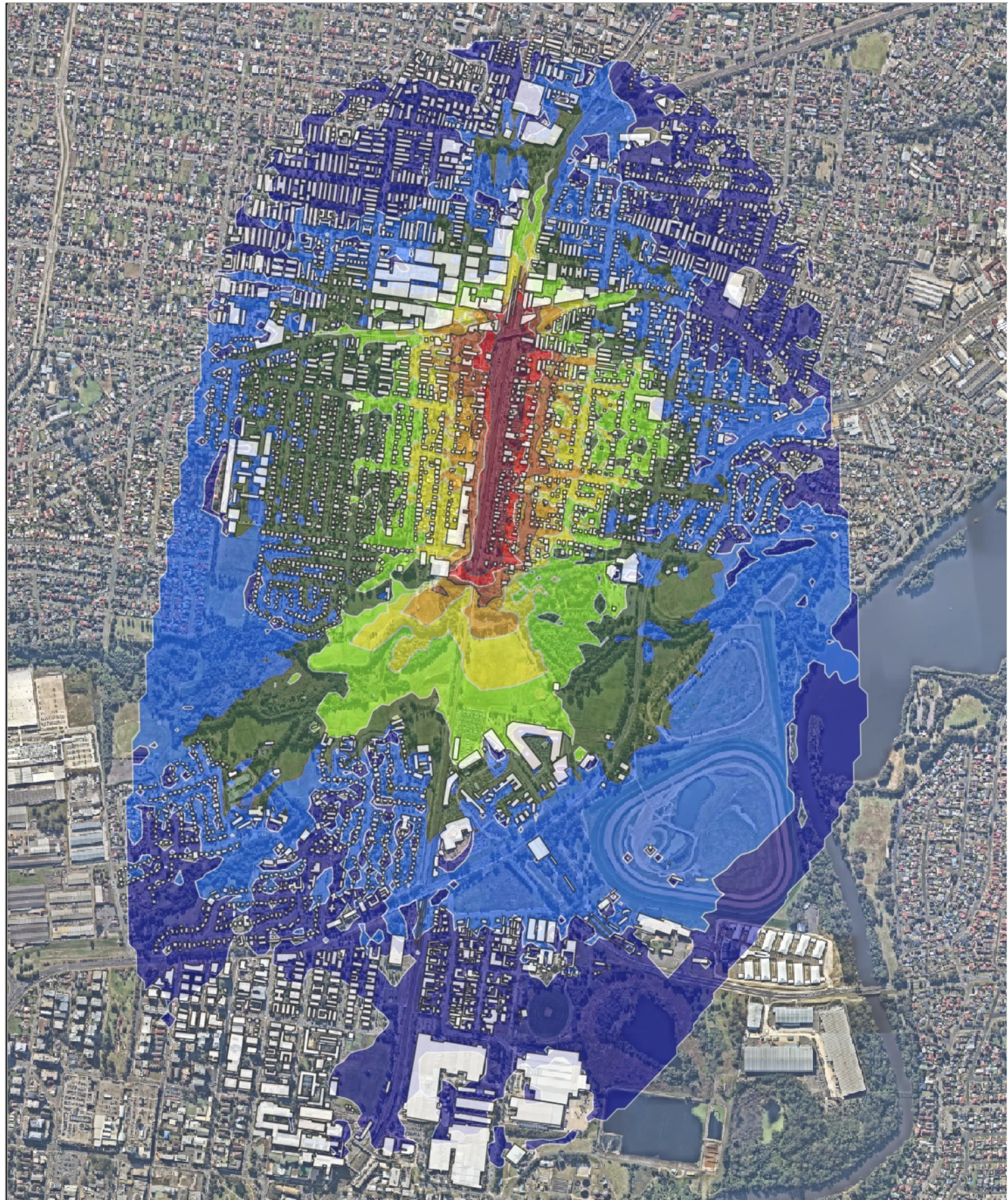
200 400 m



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CABRAMATTA LOOP FIGURE A6

Construction noise contours CS06

PROJECT NUMBER	S210520
DRAWN BY	MS
CHECKED BY	AP
DATE ISSUED	JULY 2021
CLIENT	Fulton Hogan
PREDICTION METHOD	ISO 9613 - 2
CALIBRATION FACTOR	n/a
GROUND ABSORPTION	0.5
RECEIVER HEIGHT	1.5 m
ROAD SURFACE	n/a
IMAGERY	NEARMAP
PAGE SIZE	A3

Legend

Predicted Construction Noise Levels  Buildings

-  >75 dB(A)
-  70 - 75 dB(A)
-  65 - 70 dB(A)
-  60 - 65 dB(A)
-  55 - 60 dB(A)
-  50 - 55 dB(A)
-  45 - 50 dB(A)
-  40 - 45 dB(A)
-  35 - 40 dB(A)



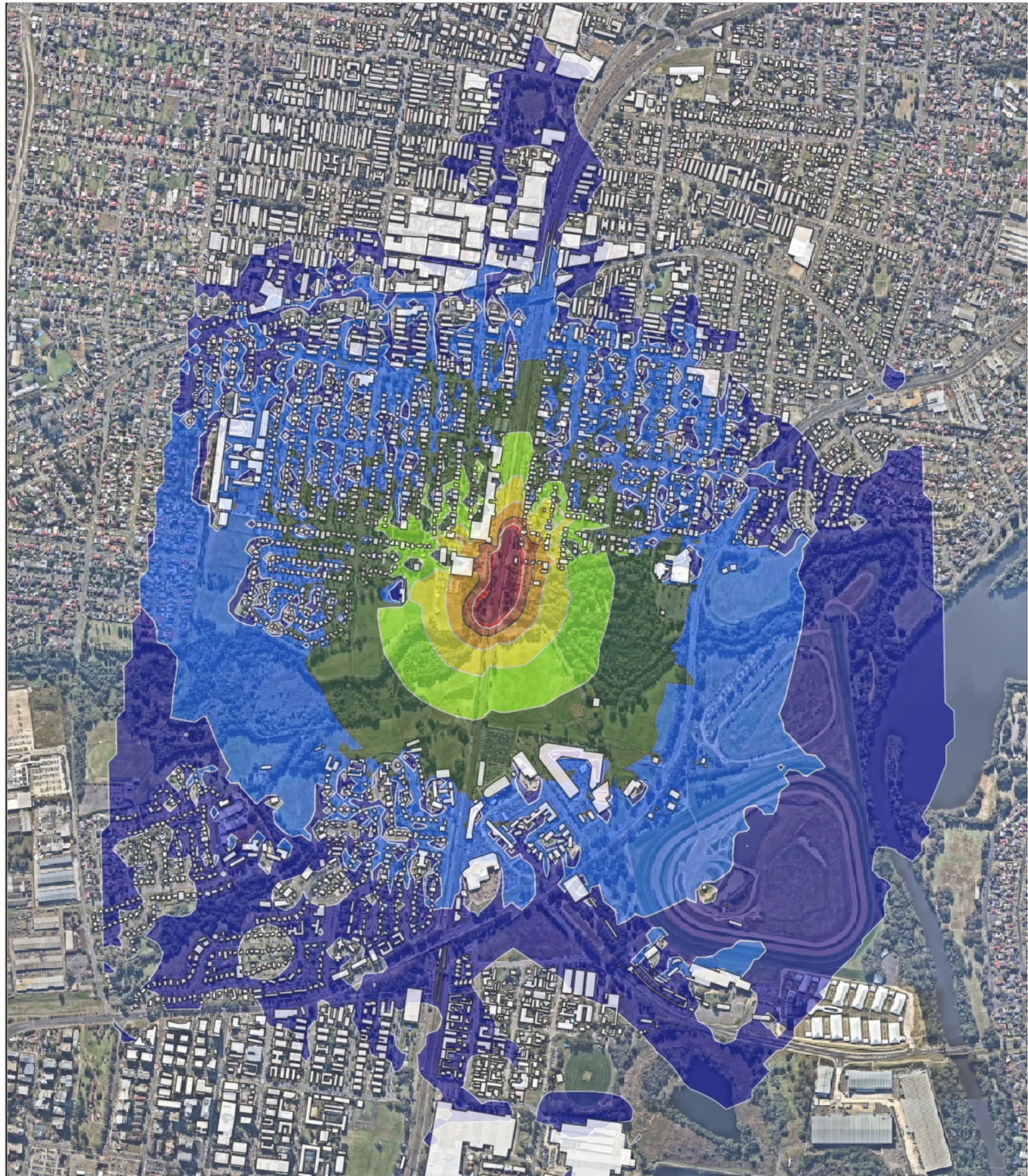
300 600 m



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






CABRAMATTA LOOP FIGURE A7

Construction noise contours CS07

PROJECT NUMBER	S210520
DRAWN BY	MS
CHECKED BY	AP
DATE ISSUED	JULY 2021
CLIENT	Fulton Hogan
PREDICTION METHOD	ISO 9613 - 2
CALIBRATION FACTOR	n/a
GROUND ABSORPTION	0.5
RECEIVER HEIGHT	1.5 m
ROAD SURFACE	n/a
IMAGERY	NEARMAP
PAGE SIZE	A3

Legend

Predicted Construction Noise Levels  Buildings

-  >75 dB(A)
-  70 - 75 dB(A)
-  65 - 70 dB(A)
-  60 - 65 dB(A)
-  55 - 60 dB(A)
-  50 - 55 dB(A)
-  45 - 50 dB(A)
-  40 - 45 dB(A)
-  35 - 40 dB(A)



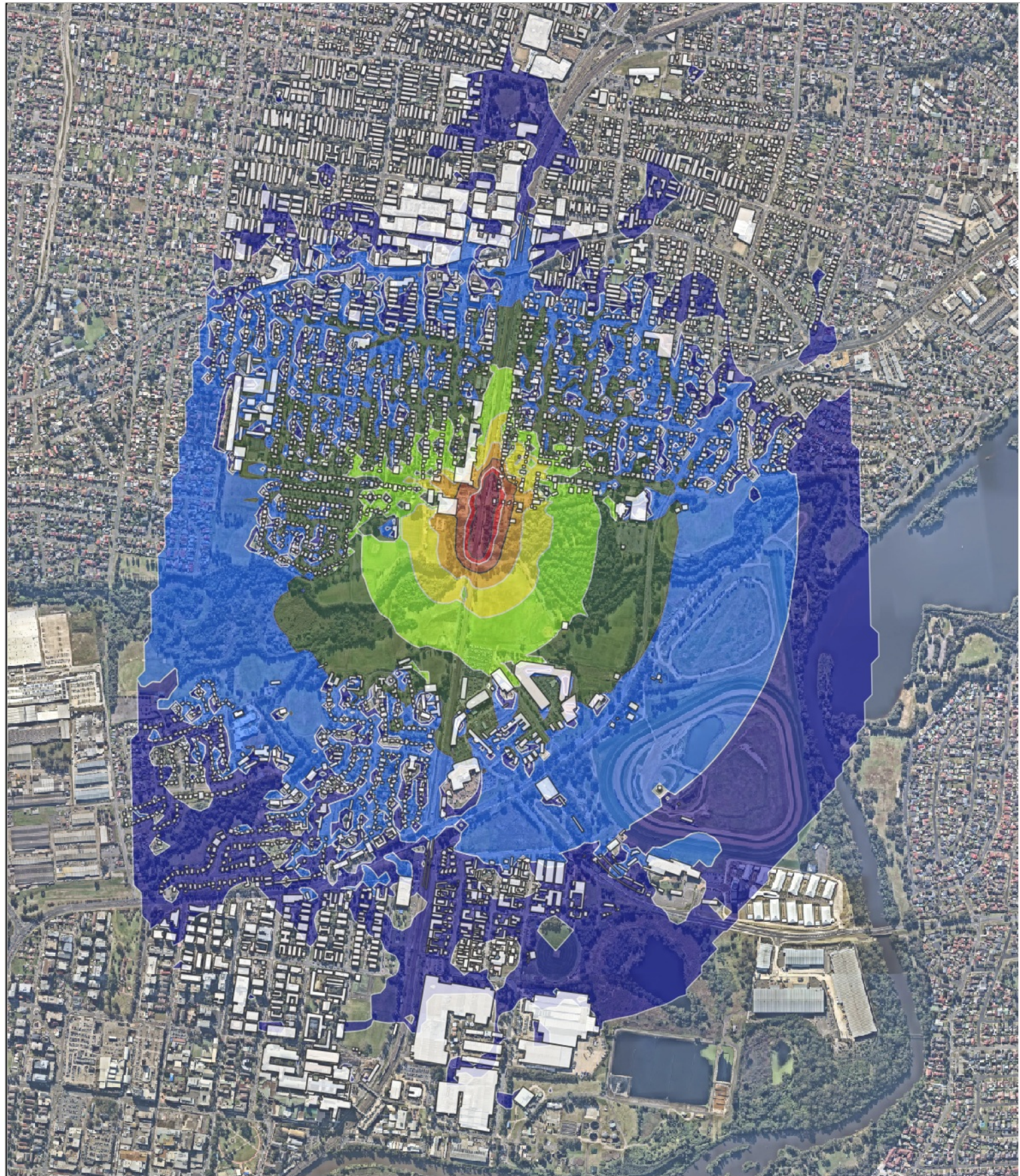
300 600 m



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CABRAMATTA LOOP FIGURE A8

Construction noise contours CS08

PROJECT NUMBER	S210520
DRAWN BY	MS
CHECKED BY	AP
DATE ISSUED	JULY 2021
CLIENT	Fulton Hogan
PREDICTION METHOD	ISO 9613 - 2
CALIBRATION FACTOR	n/a
GROUND ABSORPTION	0.5
RECEIVER HEIGHT	1.5 m
ROAD SURFACE	n/a
IMAGERY	NEARMAP
PAGE SIZE	A3

Legend

Predicted Construction Noise Levels Buildings

- >75 dB(A)
- 70 - 75 dB(A)
- 65 - 70 dB(A)
- 60 - 65 dB(A)
- 55 - 60 dB(A)
- 50 - 55 dB(A)
- 45 - 50 dB(A)
- 40 - 45 dB(A)
- 35 - 40 dB(A)



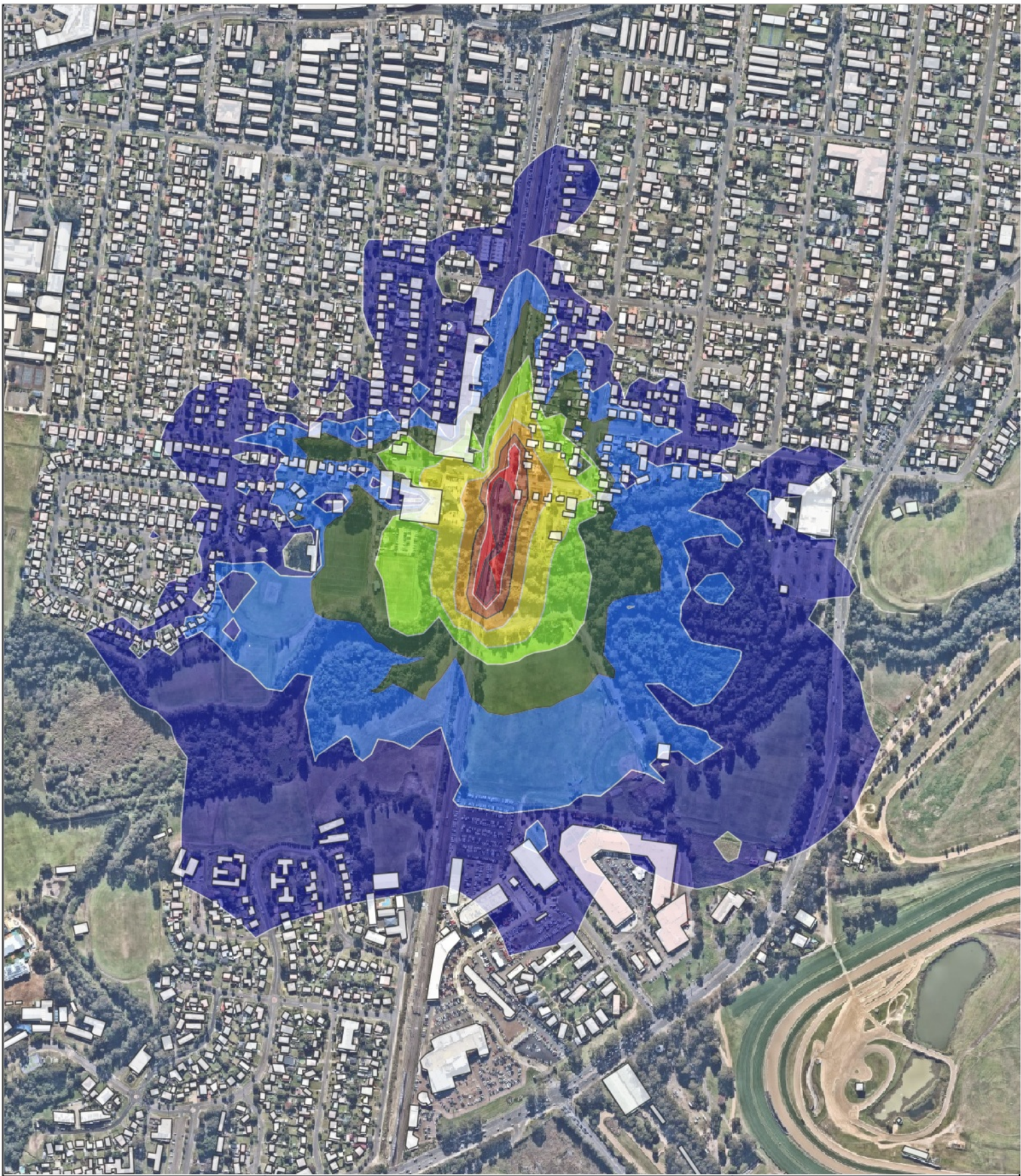
300 600 m



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


CABRAMATTA LOOP FIGURE A9

Construction noise contours CS09

PROJECT NUMBER	S210520
DRAWN BY	MS
CHECKED BY	AP
DATE ISSUED	JULY 2021
CLIENT	Fulton Hogan
PREDICTION METHOD	ISO 9613 - 2
CALIBRATION FACTOR	n/a
GROUND ABSORPTION	0.5
RECEIVER HEIGHT	1.5 m
ROAD SURFACE	n/a
IMAGERY	NEARMAP
PAGE SIZE	A3

Legend

Predicted Construction Noise Levels  Buildings

-  >75 dB(A)
-  70 - 75 dB(A)
-  65 - 70 dB(A)
-  60 - 65 dB(A)
-  55 - 60 dB(A)
-  50 - 55 dB(A)
-  45 - 50 dB(A)
-  40 - 45 dB(A)
-  35 - 40 dB(A)



200

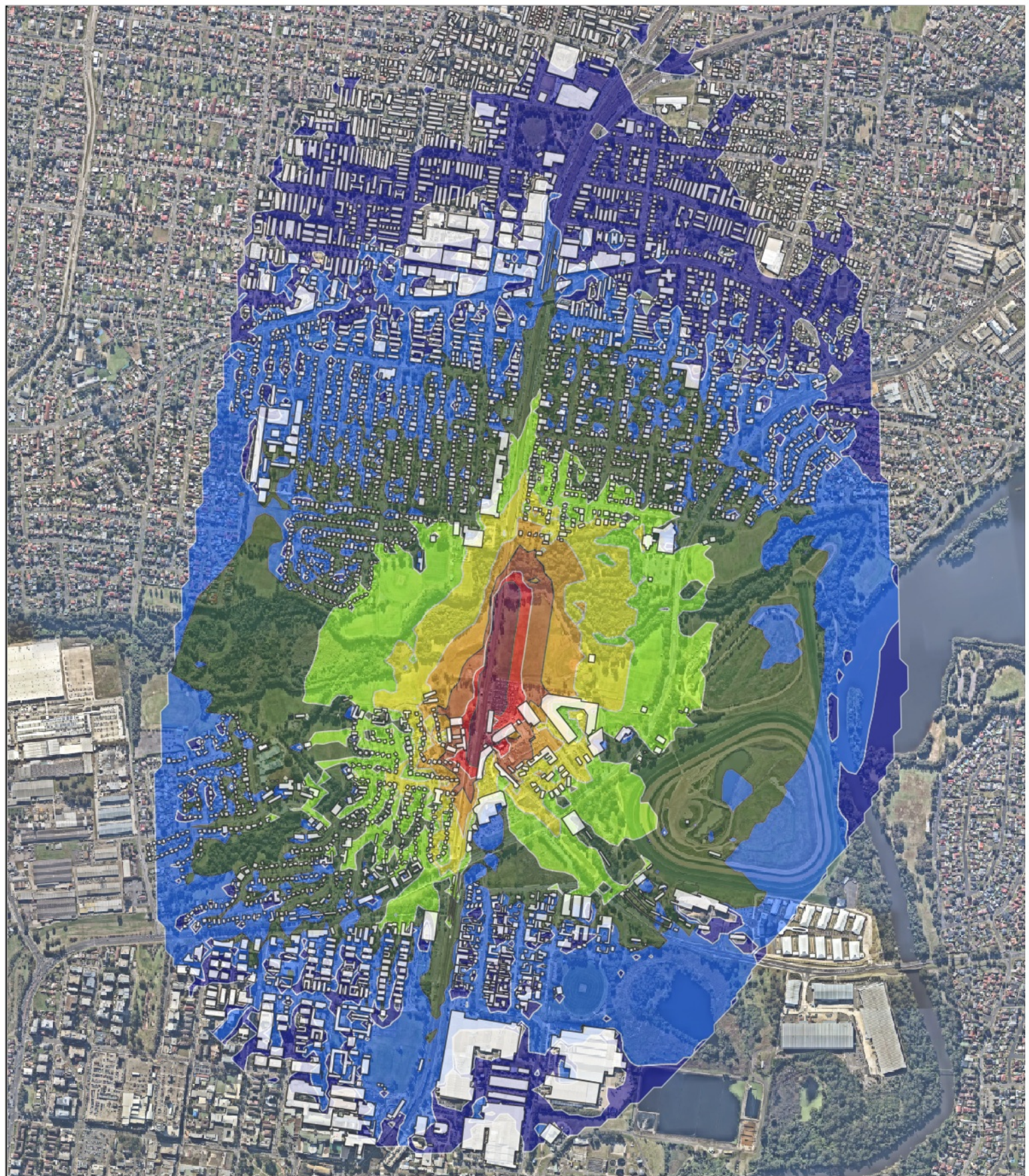
400 m



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

CABRAMATTA LOOP FIGURE A10

Construction noise contours CS10

PROJECT NUMBER	S210520
DRAWN BY	MS
CHECKED BY	AP
DATE ISSUED	JULY 2021
CLIENT	Fulton Hogan
PREDICTION METHOD	ISO 9613 - 2
CALIBRATION FACTOR	n/a
GROUND ABSORPTION	0.5
RECEIVER HEIGHT	1.5 m
ROAD SURFACE	n/a
IMAGERY	NEARMAP
PAGE SIZE	A3

Legend

Predicted Construction Noise Levels  Buildings

-  >75 dB(A)
-  70 - 75 dB(A)
-  65 - 70 dB(A)
-  60 - 65 dB(A)
-  55 - 60 dB(A)
-  50 - 55 dB(A)
-  45 - 50 dB(A)
-  40 - 45 dB(A)
-  35 - 40 dB(A)



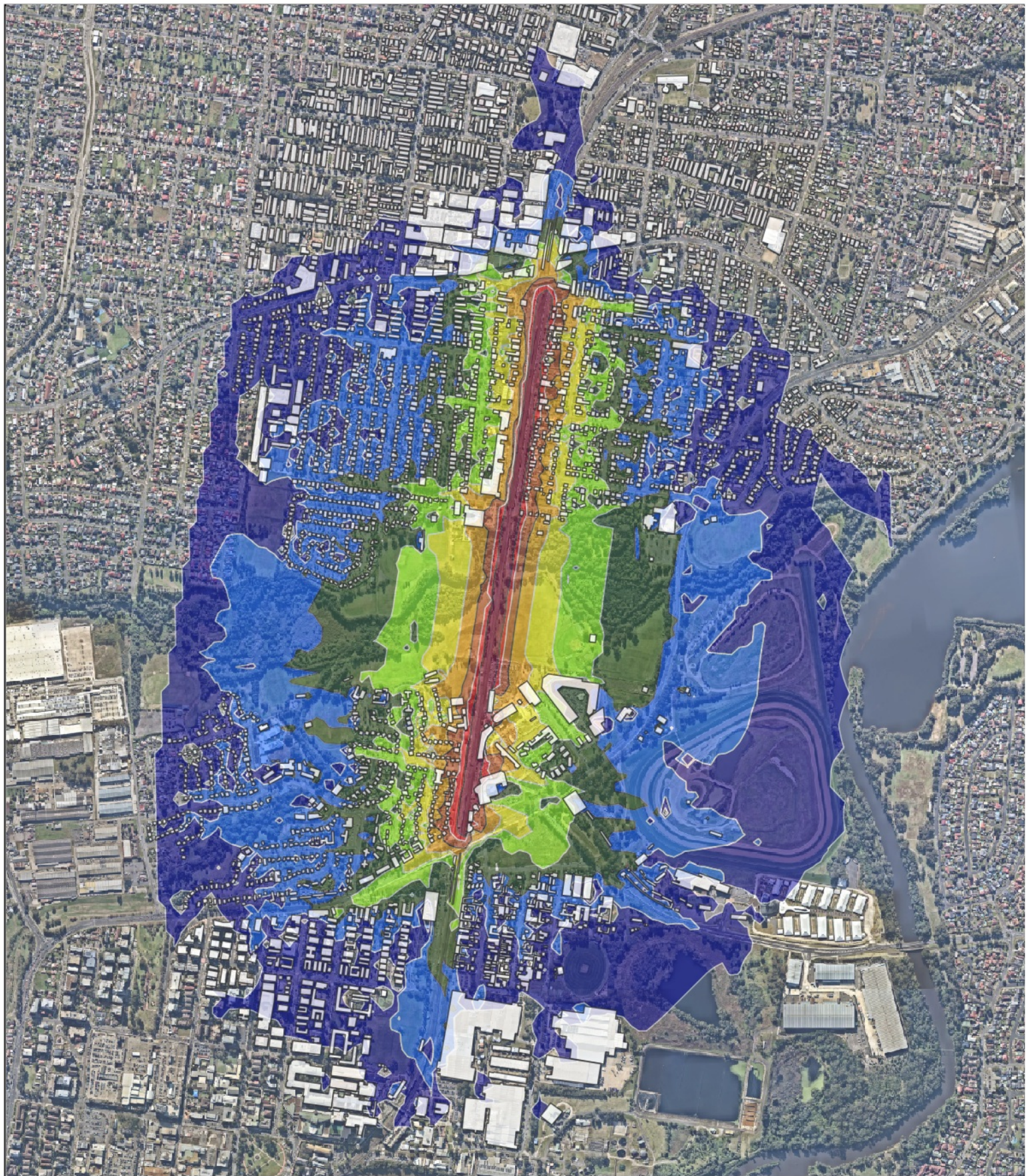
300 600 m



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CABRAMATTA LOOP FIGURE A11

Construction noise contours CS11

PROJECT NUMBER	S210520
DRAWN BY	MS
CHECKED BY	AP
DATE ISSUED	JULY 2021
CLIENT	Fulton Hogan
PREDICTION METHOD	ISO 9613 - 2
CALIBRATION FACTOR	n/a
GROUND ABSORPTION	0.5
RECEIVER HEIGHT	1.5 m
ROAD SURFACE	n/a
IMAGERY	NEARMAP
PAGE SIZE	A3

Legend

Predicted Construction Noise Levels  Buildings

-  >75 dB(A)
-  70 - 75 dB(A)
-  65 - 70 dB(A)
-  60 - 65 dB(A)
-  55 - 60 dB(A)
-  50 - 55 dB(A)
-  45 - 50 dB(A)
-  40 - 45 dB(A)
-  35 - 40 dB(A)



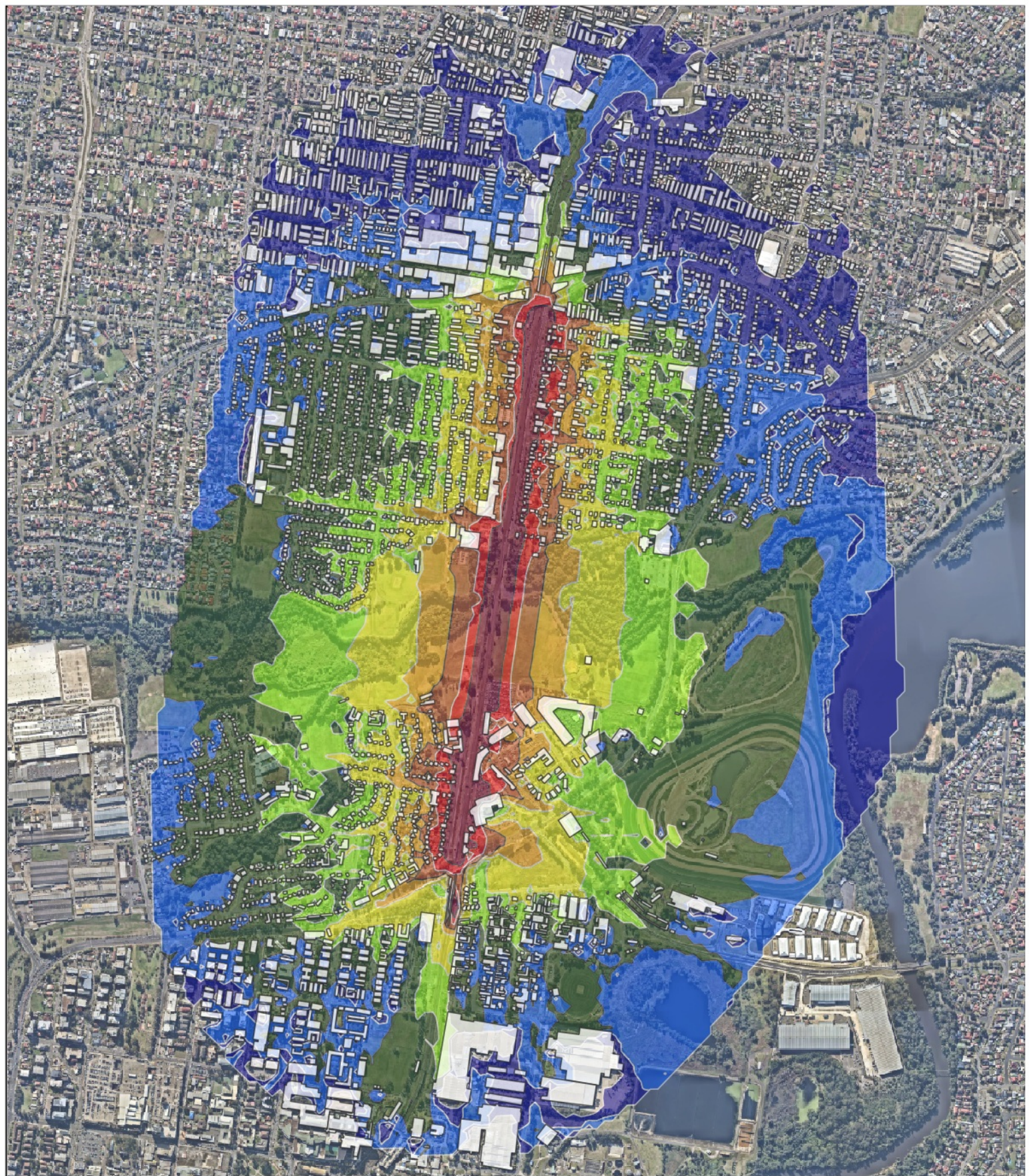
300 600 m



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CABRAMATTA LOOP FIGURE A12

Construction noise contours CS12

PROJECT NUMBER	S210520
DRAWN BY	MS
CHECKED BY	AP
DATE ISSUED	JULY 2021
CLIENT	Fulton Hogan
PREDICTION METHOD	ISO 9613 - 2
CALIBRATION FACTOR	n/a
GROUND ABSORPTION	0.5
RECEIVER HEIGHT	1.5 m
ROAD SURFACE	n/a
IMAGERY	NEARMAP
PAGE SIZE	A3

Legend

Predicted Construction Noise Levels  Buildings

-  >75 dB(A)
-  70 - 75 dB(A)
-  65 - 70 dB(A)
-  60 - 65 dB(A)
-  55 - 60 dB(A)
-  50 - 55 dB(A)
-  45 - 50 dB(A)
-  40 - 45 dB(A)
-  35 - 40 dB(A)



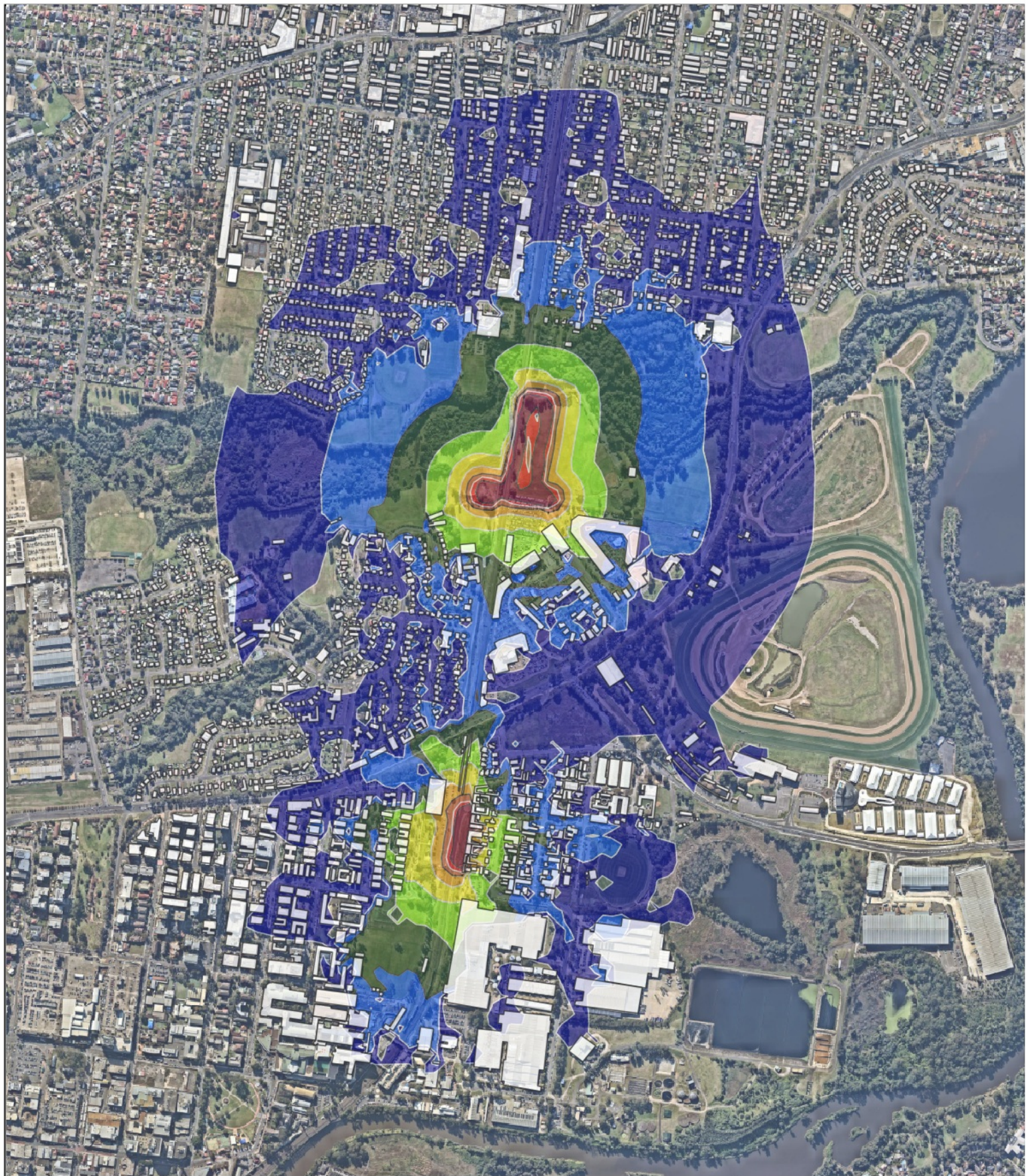
300 600 m



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CABRAMATTA LOOP FIGURE A13

Construction noise contours CS13

PROJECT NUMBER	S210520
DRAWN BY	MS
CHECKED BY	AP
DATE ISSUED	JULY 2021
CLIENT	Fulton Hogan
PREDICTION METHOD	ISO 9613 - 2
CALIBRATION FACTOR	n/a
GROUND ABSORPTION	0.5
RECEIVER HEIGHT	1.5 m
ROAD SURFACE	n/a
IMAGERY	NEARMAP
PAGE SIZE	A3

Legend

Predicted Construction Noise Levels  Buildings

-  >75 dB(A)
-  70 - 75 dB(A)
-  65 - 70 dB(A)
-  60 - 65 dB(A)
-  55 - 60 dB(A)
-  50 - 55 dB(A)
-  45 - 50 dB(A)
-  40 - 45 dB(A)
-  35 - 40 dB(A)



300 600 m



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Appendix C: Out-of-Hours Work Protocol (OOHW Protocol)

Appendix C Out-of-Hours Work Protocol (OOHW Protocol)

This protocol has been developed to assist compliance with environmental legislation and project obligations, and to effectively manage potential environmental impacts associated with noise during construction of the project.

It has been prepared in accordance with the Conditions of Approval (CoA), ARTC Environment Protection Licence (EPL) 3142 (held by ARTC for railway activities – railway infrastructure operations), ICNG and NVMP. The protocol is to be applied where Out-of-Hours Work (OOHW) is proposed for the project.

Objectives

This protocol outlines the project requirements for construction working hours and documents a process to be implemented when work outside of standard hours is required. The key objective of the protocol is to ensure that impacts to the local community are avoided.

Specific objectives include:

- Minimise potential adverse noise impacts to the community
- Identify sensitive receivers and ensure appropriate noise control measures are implemented during construction activities
- Ensure appropriate measures are implemented to comply with all relevant legislation and other requirements as described in the NVMP.
- Ensure appropriate measures are implemented to meet the CoA and the intent of the ARTC EPL 3142 and ICNG.

OOHW Approval Pathways

There are two different approval pathways for OOHW. One via ARTC EPL Number 3142 and the other via the Minister's conditions of approval i.e. CoA E11-E17. Refer to the flowchart provided in Figure 5.

For OOHW works required within the premise boundary of ARTC EPL 3142 which comply with the EPL's "exception to standard railway construction hours" conditions (O9.8-O9.10), OOHW will be undertaken in accordance with ARTC EPL 3142. Assessment of planned OOHW works for compliance with ARTC EPL 3142 will be undertaken by Fulton Hogan. Notification will be provided to the EPA, ARTC and the ER for all OOHW under ARTC EPL 3142.

For OOHW works required outside of the premise boundary of ARTC EPL 3142 or its conditions, OOHW will be undertaken in accordance with CoA E11-E17. Assessment of planned OOHW works for compliance with the CoA will be undertaken internally first and then submitted for approval to the ER (for low risk activities) or the Planning Secretary (for high risk activities). Notification will be provided to the EPA, ARTC, ER (if not approver) and the DPIE for all OOHW under the CoA.

The internal OOHW application process and request form (Attachment 1) is the same for both OOHW approval pathways. When external approval is required, the internally approved request form (Attachment 1) will be submitted as part of the supporting documentation for the external OOHW application.

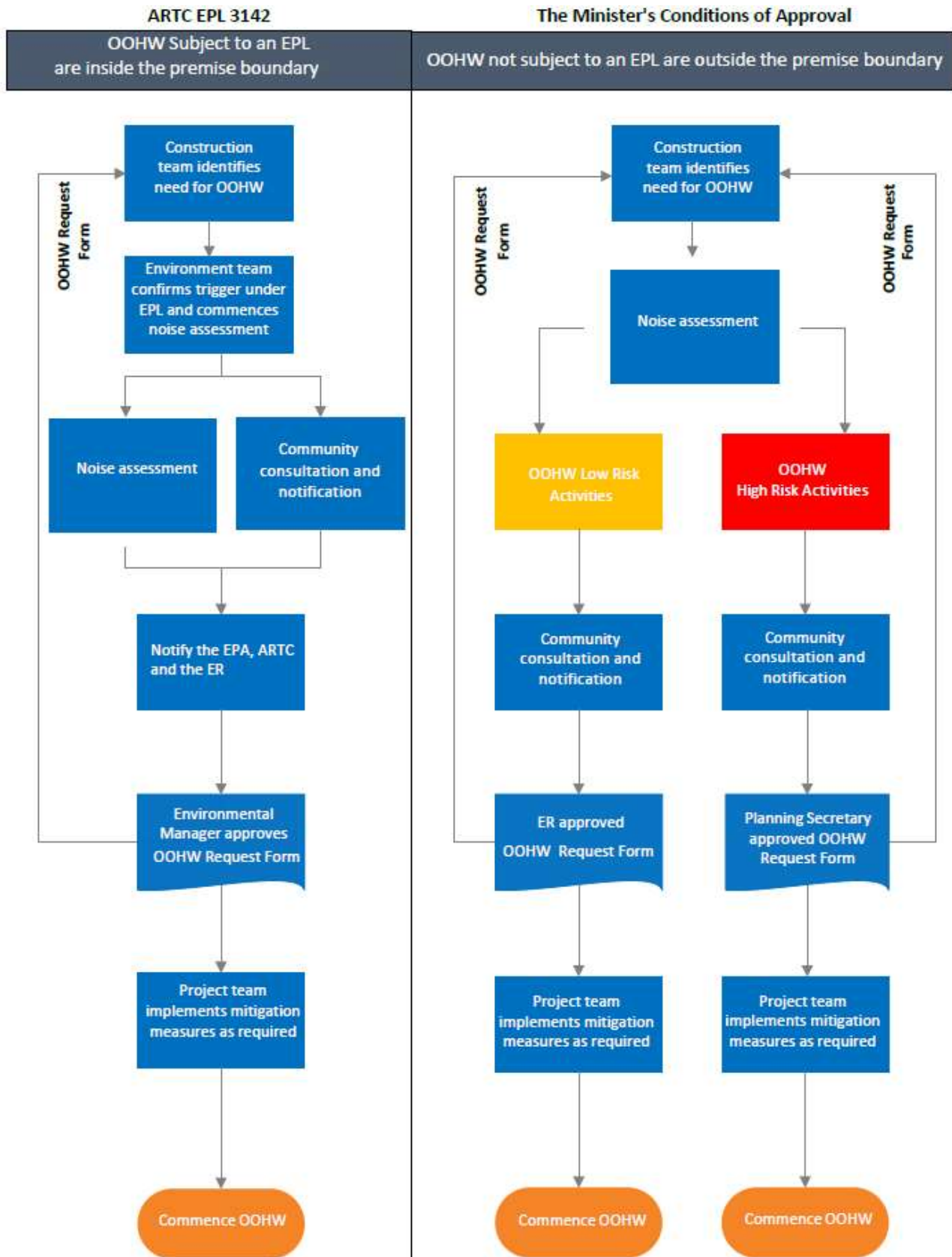


Figure 5: OOHW Approval Pathways Flowchart

Expected OOHW

It is likely that, from time to time, work outside of standard working hours will be required. OOHW that are expected as part of the project may include but not necessarily be limited to those detailed in Section 7.4.3 and 7.1.3 of the NVMP.

OOHW Assessment and Application Process

To enable the OOHW detailed in Section 7.4.3 and 7.1.3 to occur outside of standard construction hours, the following process will be implemented:

1. Project Engineers will consult with the Environmental Manager (EM) and Community Relations Manager about six (6) weeks in advance of proposed out of hours works. The engineer is to submit an OOHW request form (refer to Attachment 1) which will allow the EM to determine the justification for the OOHW and the predicted noise and vibration level (if required).
2. The EM will assess the OOHW request and determine:
 - a. If the proposed works are likely to achieve noise levels within RBL + 5 dB(A) or the Noise Management Levels (NMLs) specified in Table 3 of the Interim Construction Noise Guideline (refer to section Table 7 of the NVMP) or if they will occur within the safe working distances for human comfort from vibration (refer to Section 7.5 of the NVMP).
 - b. If a negotiated agreement has been reached with the majority of affected receivers (as per ARTC EPL 3142 condition O9.10), for works within 150 m of residences where the prescribed noise and vibration levels cannot be achieved.
 - c. If the works are for the delivery of materials required outside of standard hours by the NSW Police Force or other authorities for safety reasons.
 - d. Where it is required in an emergency to avoid injury or the loss of life, property and/or to prevent environmental harm.
 - e. If the proposed works are 'justified' OOHW where:
 - i. carrying out those works and activities during standard hours would cause unacceptable risks to one or more of the following:
 1. construction personnel safety
 2. road user and public safety
 3. safety of the operational rail network
 4. safety of workers within the rail corridor
 5. road network operational performance as may be notified from time to time by the TfNSW; or
 - ii. a public utility provider (i.e. electricity, gas, water, sewer or telecommunications) refuse to allow work on an existing service during the standard construction hours; or
 - iii. The Transport for NSW Transport Management Centre (or other road or rail authority) refuse to issue a road occupancy licence or railway possession for work during standard construction hours.
3. If items 2c) and/or 2d) apply, then works will be applied for without a specific noise assessment. An initial noise assessment will be conducted to determine impact and identify any appropriate mitigation measures.
4. If the EM determines, based on initial noise assessment, that the works will generate $L_{Aeq,15min}$ noise levels that will be significantly less than the NML and no vibration impacts are expected, the OOHW approval form will be submitted to the EM and Community Relations Manager for approval. This will include works further than 150 m from receivers. Standard OOHW noise management measures, in accordance with Chapter 8 of the NVMP, will be included in the OOHW approval and noise monitoring undertaken.

5. If there is a risk that the noise levels will exceed the relevant NMLs and/or works may occur within the safe working distances for vibration, a Noise and/or Vibration Impact Assessment will be undertaken as described below to assess compliance with the OOHV NMLs and vibration management levels and assess the relevant mitigation measures and approval process.

Noise and Vibration Impact Assessment

Where there is a risk that the proposed OOHV will exceed RBL + 5 dB(A) and/or works may occur within the safe working distance for vibration, a noise and vibration impact assessment for the works will be undertaken and include the following:

- Details of the nature and scope of each activity and work, including details of times, vehicles, plant and equipment to be used to undertake that activity or work.
- Analysis to justify the scheduling and duration of each activity and work outside the standard construction hours, including taking into account:
 - the predicted impact on noise sensitive receivers of any activities and works undertaken outside the hours; and
 - the preference that high noise impact works be undertaken during the day.
- Analysis to justify use of the selected construction and work methods, plant and equipment compared to alternatives taking into consideration noise and vibration impacts.
- A table showing details of the noise and vibration mitigation measures for each activity and work, including respite periods, proposed to be adopted to minimise noise and vibration impacts on surrounding noise sensitive receivers in each locality.
- A table showing for each activity and work in each noise catchment:
 - the addresses of the most affected noise sensitive receivers;
 - the background noise level for each of the noise sensitive receivers listed in the table;
 - noise management levels as described in Section 4 of the ICNG and Section 5.1.6 of the NVMP;
 - the predicted $L_{Aeq,15min}$ noise level, incorporating any 5 dB correction for particularly annoying activities as listed on page 16 of the ICNG; and
 - an assessment of sleep disturbance as set out in Section 4.3 of the ICNG (DECC, 2009), where works are planned to extend over more than two consecutive nights.
- Details of the specific noise mitigation measures to be adopted in respect of any activity or work predicted to generate noise levels at any noise sensitive receiver exceeding the noise affected $L_{Aeq,15min}$ level of background plus 5 dB outside the standard hours.
- A diagram showing the location of noise and vibration monitoring locations in relation to each of the most affected noise sensitive receivers for each activity and work in each noise catchment.
- Community notification requirements as per the CS and OOHV mitigation measures detailed in Chapter 8 of the NVMP that are dependent on the predicted noise level.
- Details of the approval pathway utilised to ensure the OOHV is compliant with the ARTC EPL 3142.

Following completion of the noise and vibration impact assessment, the EM will document the assessment required by this condition in a report, including the OOHV risk factor¹.

1

<p>Low risk activities 1:</p> <ul style="list-style-type: none"> • No sleep disturbance • 1800 - 2200 weekdays • 1300 – 2200 Saturdays • 0800 – 1800 Sunday and Public Holiday nights 	<p>Low risk activities 2:</p> <ul style="list-style-type: none"> • Sleep disturbance risk • 2200 – 0700 weekday nights • 2200 – 0800 Saturday nights • 1800 – 0700 Sunday and Public Holiday nights 	<p>High risk activities:</p> <ul style="list-style-type: none"> • Prolonged work (i.e. >1 week) • Sleep disturbance possible • Impulsive noise and vibration likely (e.g. vibratory rolling or rock breaking)
---	---	---

The assessment will be included as part of the OOHW application for EM and CRM approval. ARTC and the ER will then be provided with the approved OOHW application form for information.

Noise and Vibration Monitoring

The EM will ensure that the following noise and vibration monitoring is undertaken for all OOHW where the NMLs are predicted to be exceeded by at least 10 dB during daytime OOHW or 5 dB for night-time OOHW and/or where vibration levels are predicted to exceed human comfort criteria:

- Undertake attended noise and/or vibration monitoring at representative stages of the activity or work to confirm whether the noise and vibration predictions in its noise and vibration assessment were accurate.
- Where noise monitoring indicates that the activity, work or combination of simultaneous activities or works has caused or is causing noise or vibration levels higher than the predicted levels at any noise sensitive receiver (i.e. increase of greater than 3 dB), mitigation and management measures will be re-evaluated and re-assessed as part of an OOHW application.

Monitoring will also be undertaken at any location where two (2) or more complaints are received about the specific OOHW activity or works on the telephone complaints line.

Community Notification

The Community Relations Manager will notify the community in accordance with the Communication Strategy (CS) and in accordance with the OOHW mitigation measures listed in Chapter 8 of the NVMP. This notification will:

- Be made by targeted letterbox drop, door knock, phone call or email to noise sensitive receivers as detailed in Chapter 8 of the NVMP and the CNVS.
- Be posted on the project website.
- Be made within the timeframes as detailed in Chapter 8 of the NVMP and the ARTC EPL 3142 before commencement of any OOHW and include:
 - a diagram that clearly identifies the location of the proposed OOHW in relation to nearby cross streets and local landmarks or geographical features;
 - details of the timing, nature, scope and duration of the proposed works and activities;
 - detail of why the proposed works and activities are being undertaken outside of standard construction hours;
 - details of the predicted noise and vibration impacts of the works on identified sensitive receivers;
 - details of all proposed mitigation measures, including respite periods and proposed scheduling;
 - details of the types of plant and equipment that will be used to undertake the work;
 - details of how complaints may be made and additional information obtained about the work;
 - contact details in community languages relevant to the locality; and include notification of any upcoming project community meetings / forums.

Negotiation with Stakeholders

Where permitted by ARTC EPL 3142, negotiation may be undertaken with affected residents for OOHW that may have a considerable noise and/or vibration impact on residences. Following the assessment of OOHW, this may be undertaken for those works that:

- Are not required in accordance with Step 2c) and/or 2d) of the Application Process; and
- Occur within 150 m of one or more particular sensitive receivers; and
 - Result in predicted noise levels more than 5 dB above the relevant Night NMLs OR
 - May result in vibration levels in excess of the human comfort vibration management levels.

Negotiation with stakeholders will include:

- A discussion of the reasons that OOHW are proposed and where possible alternatives that would occur if the OOHW could not proceed as planned (e.g. significantly longer duration of works at other times).

- A discussion of noise and vibration mitigation and management measures proposed for the works, and alternatives proposed by the stakeholders.
- A discussion of potential scheduling that could be undertaken considering the particular needs of the stakeholders.
- Documentation of the outcomes of the negotiation and submission to relevant authorities.

If agreement is not received for the proposed OOHW with the majority of affected stakeholders, then the EM will consult with relevant approval authorities regarding the works to obtain approval and feedback on the implemented management measures. If approval for these works is not received from the approval authority and agreement has not been reached with the potentially affected stakeholders, the works will not proceed until the proposal has been suitably altered to obtain stakeholder and/or authority approval.

If agreement is not received for the proposed OOHW with the majority of affected stakeholders, then the EM will determine if there is a suitable alternative approval pathway to ensure the works are compliant with the ARTC EPL 3142 which may include seeking further approval from the EPA.

Complaints

Any complaints received as a result of the OOHW are to be managed in accordance with the Communication Strategy. On receipt of two or more complaints regarding OOHW in a particular area, the works will cease until noise monitoring can be undertaken to confirm compliance with the predicted noise levels. If compliant, the works will recommence.

If the noise monitoring determines noise levels greater than predicted, the construction process will be reviewed and additional noise mitigation measures will be implemented where reasonable and feasible prior to works recommencing.

Record Keeping

All OOHWs applications are recorded electronically and documented with a unique identification number. Each application is entered into the OOHW database and tracked accordingly.

All noise monitoring results will be recorded using "Noise Monitoring Field Sheet" and data entered into the noise monitoring database.

ATTACHMENT 1 – OUT OF HOURS WORK REQUEST FORM

CABRAMATTA LOOP PROJECT– FULTON HOGAN	
Out of Hours Request No:	
Application Date:	
Name of Person Requesting Work:	
Justification, why work outside of standard hours is required? <i>Include any alternatives considered</i>	

CONTACT DETAILS	Name	Mobile number	Email
Engineer:			
Environmental Manager:	Shannon Chisholm	0400 459 769	shannon.chisholm@fultonhogan.com.au
Contractor’s 24 Hour Contact:			
ARTC Project Manager:			
ARTC Environment Officer			

OUT OF HOURS WORK DETAILS	
Location:	
Description of the Work:	
Proposed Dates / Duration:	
Start Time of Works (each day):	
Finish Time of Works (each day):	
OOHW Period Classification:	

OOHW Period 1, and/or OOHW Period 2						
Plant and Equipment to be Used: <i>List all plant and noise generating equipment / activities to be used</i> <i>Where plant is not used for entire OOHW period, note when it will be used</i>	Plant	Qty	SWL	Plant	Qty	SWL
Map Attached showing worksites and nearest noise sensitive receivers	<input type="checkbox"/> Yes					
Name of Foremen Supervising Work:						
Subcontractor Details (if applicable):						
Details on any concurrent OOHW being undertaken in same Precinct:						

NOISE AND VIBRATION	
Distance from works to nearest sensitive receivers:	
Are there any shielding features (barriers / buildings) between works and receivers that can be used to reduce noise levels?	
Could the works generate audible noise or perceptible vibration at the nearest sensitive receivers? <i>Describe plant / equipment / activities that may generate audible noise or perceptible vibration</i>	
Noise assessment completed	<input type="checkbox"/> No? Complete Noise assessment <input type="checkbox"/> Yes? Proceed
Preliminary vibration assessment <i>If unsure, vibration report should be prepared</i>	<input type="checkbox"/> Works occurring outside safe working distance for human comfort <input type="checkbox"/> Works occurring inside safe working distance for human comfort (VIBRATION REPORT REQUIRED)

<p>Noise and/or Vibration report attached</p> <p><i>Check all that apply</i></p>	<p><input type="checkbox"/> Noise</p> <p><input type="checkbox"/> Vibration</p> <p><input type="checkbox"/> Not required</p>
<p>Programming measures to be implemented</p> <p><i>Detail work programming that will be adopted to minimise impacts on particular receivers</i></p>	
<p>Noise mitigation measures to be implemented</p> <p><i>Refer to NVMP and provide specific measures for equipment to be used</i></p>	
<p>Vibration mitigation measures to be implemented</p> <p><i>Refer to NVMP and provide specific measures for equipment to be used</i></p>	
<p>Noise and vibration monitoring to be undertaken?</p> <p><i>Provide details of location and frequency</i></p>	
<p>OTHER CONSIDERATIONS</p>	
<p>Identify other potential impacts of the works:</p>	<p><input type="checkbox"/> Dust</p> <p><input type="checkbox"/> Lighting</p> <p><input type="checkbox"/> Pedestrian access</p> <p><input type="checkbox"/> Other (specify)</p> <p><input type="checkbox"/> Public transport <i>e.g. schedule changes</i></p> <p><input type="checkbox"/> Parking</p> <p><input type="checkbox"/> Property access</p>

Describe mitigation measures to be implemented to address these potential impacts	
What lighting is to be provided for night work?	
Does the work team comprise a minimum of two persons?	

CONSULTATION & NOTIFICATION STRATEGY	
Detail consultation and notification strategy for works <i>Ensure strategy is in accordance with CS and NVMP requirements</i>	
Is negotiation required with affected receivers? <i>Refer to situations under which this is required in OOHW Protocol</i>	<input type="checkbox"/> Yes (Attach negotiation summary) <input type="checkbox"/> No
Are ARTC and the ER aware of these works and will they be provided with a copy of this application if approved?	<input type="checkbox"/> Yes, proceed. <input type="checkbox"/> No, communicate OOHW to ARTC and the ER.

APPROVALS PATHWAY - Select either ARTC EPL 3142 or CoA	
<input type="checkbox"/> APPROVAL UNDER ARTC EPL 3142	
<input type="checkbox"/> O9.8 a) The licensee may undertake construction activities outside of the hours specified in Condition O9.7: <ul style="list-style-type: none"> i) to provide safe and reliable services or a safe working environment; or ii) for emergency works; or ii) for the delivery of oversized plant or structures that require special arrangements or authorisation to be lawfully transported along public roads. b) If emergency works outside of the hours specified in Condition O9.7 are to be undertaken in proximity to noise sensitive receivers the licensee must, on becoming aware of the need to undertake the emergency works, notify the EPA’s Environment Line as soon as practicable and submit a report to the EPA by 2pm on the next business day after the emergency works commenced that describes:	

- i) the cause, time and duration of the emergency;
- ii) action taken by or on behalf of the licensee in relation to the emergency; and
- iii) details of any measures taken or proposed to be taken by the licensee to prevent or mitigate against a recurrence of the emergency.

c) Condition O9.8b) does not apply where, for an existing construction project, an approval within the meaning of Division 5.1 of the Environmental Planning and Assessment Act 1979 (the EP&A Act) has been granted in relation to an activity the subject of environmental assessment under Division 5.1 of the EP&A Act prior to the date of issue of this licence;

d) For emergency works undertaken under this condition, the licensee is not required to comply with Condition O9.13.

O9.9

(a) The licensee may undertake construction activities outside of the hours specified in Condition O9.7, if the activities do not exceed:

- i) 5dBA (LAeq, 15min) above the day, evening and night relevant rating background levels, as determined at the nearest noise sensitive receiver as assessed by acoustic investigation, and
- ii) 15dBA (LA1, 1min or LAmax) above the relevant rating background level at night, as determined at the nearest noise sensitive receiver as assessed by acoustic investigation;

(b) The results of any acoustic investigation undertaken in relation to Conditions O9.9(a)(i) and O9.9(a)(ii) must be provided by the licensee when requested by an authorised officer of the EPA.

(c) An acoustic investigation referred to in Conditions O9.9(a)(i) and O9.9 (a)(ii) is not required if there are no noise sensitive receivers impacted by the activities.

O9.10

The licensee may undertake construction activities outside of the hours specified in Condition O9.7 if agreement between the licensee and potentially affected noise sensitive receivers, termed the 'local community', has been reached. Any agreement(s) between the licensee and the local community must be recorded in writing and a copy of the agreement(s) kept at the premises by the licensee for the duration of the works and provided to the EPA at any time during or following the works, on request.

O9.11

With regard to construction activities, any high noise impact generating works must only be undertaken:

- a) Between 08:00am – 06:00pm Monday to Friday;
- b) Between 08:00am – 01:00pm Saturday; and
- c) in continuous blocks of no more than 3 hours, with at least a 1 hour respite between each block of work generating high noise impact, where the location of the work is likely to impact the same noise sensitive receivers. For the purposes of this condition, 'continuous' includes any period during which there is less than a 1 hour respite between ceasing and recommencing any of the work that is the subject of this condition, or
- d) at any other time where there are no noise sensitive receivers identified under Condition O9.12(a) or agreement has been reached with the local community in accordance with Condition O9.10.
- e) Conditions O9.11a) and b) do not apply where, for an existing construction project, an approval within the meaning of Division 5.1 of the EP&A Act has been granted in relation to an activity the subject of environmental assessment under Division 5.1 of the EP&A Act prior to the date of issue of this licence.

Note: Condition E3 provides the hours for high noise impact generating works for existing construction projects referred to in Condition O9.11e).

Alternative approval from EPA – provide details

APPROVAL UNDER CoA

E11

Notwithstanding Conditions E10 and E15, work may be undertaken outside the hours specified in the following circumstances:

- (a) for the delivery of materials required by the NSW Police Force or other appropriate authority for safety reasons; or
- (b) where it is required in an emergency to avoid injury or the loss of life, to avoid damage or loss of property or to prevent environmental harm; or
- (c) where different construction hours are permitted or required under an EPL in force in respect of the CSSI; or
- (d) work approved under an Out-of-Hours Work Protocol for work not subject to an EPL as required by Condition E16; or
- (e) construction that causes LAeq(15 minute) noise levels:
 - (i) no more than 5 dB(A) above the rating background level at any residence in accordance with the Interim Construction Noise Guideline (DECC, 2009), and
 - (ii) no more than the ‘Noise affected’ noise management levels specified in Table 3 of the Interim Construction Noise Guideline (DECC, 2009) at other sensitive land uses, and
 - (iii) continuous or impulsive vibration values, measured at the most affected residence are no more than the maximum values for human exposure to vibration, specified in Table 2.2 of Assessing Vibration: a technical guideline (DEC, 2006), and
 - (iv) intermittent vibration values measured at the most affected residence are no more than the maximum values for human exposure to vibration, specified in Table 2.4 of Assessing Vibration: a technical guideline (DEC, 2006);or
- (f) negotiated agreements with directly affected residents

E12

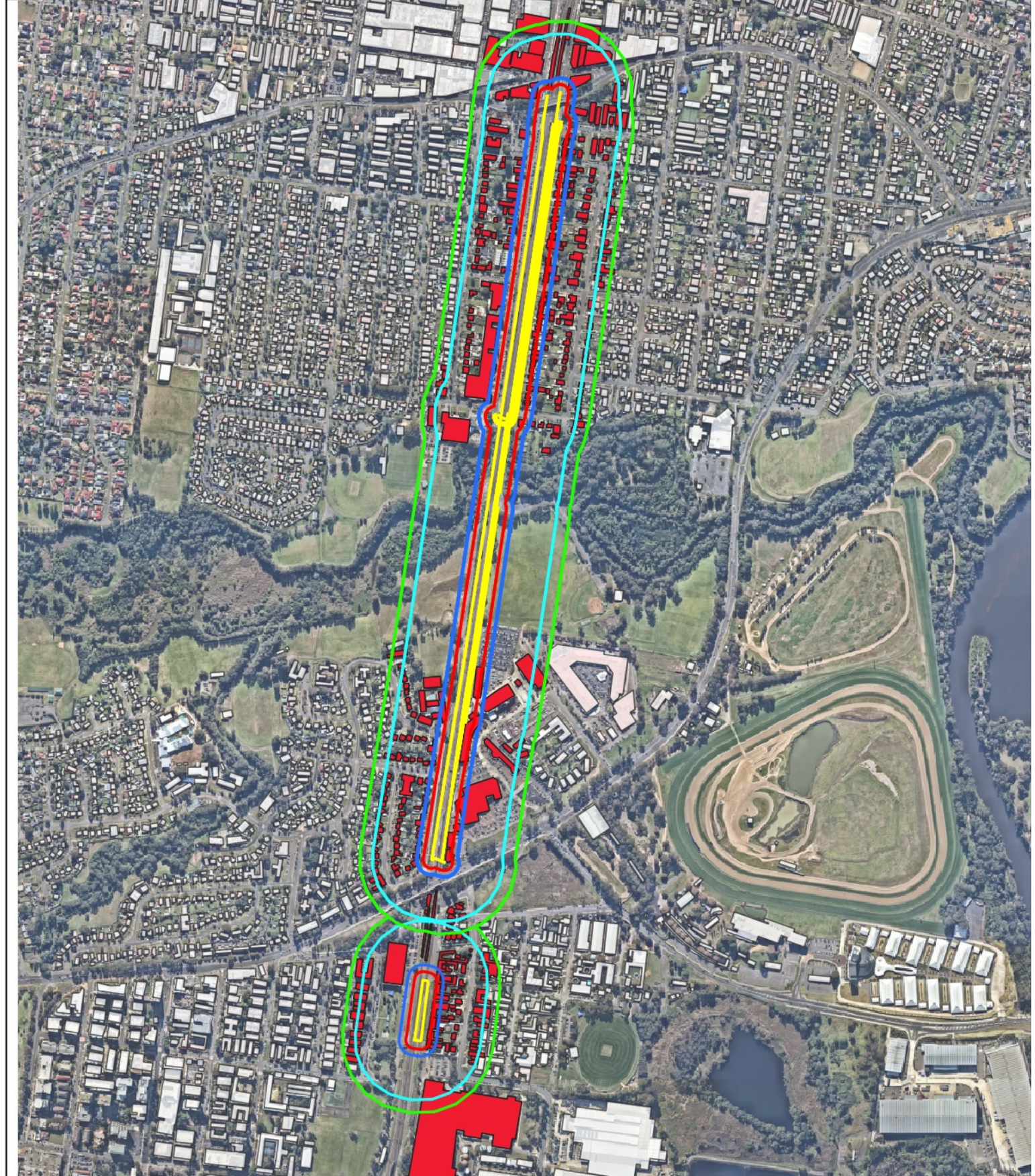
On becoming aware of the need for emergency work in accordance with Condition E11(b), the Proponent must notify the ER of the need for that work. The Proponent must use best endeavours to notify all noise and/or vibration affected sensitive land uses of the likely impact and duration of those works.

CONTRACTOR APPROVALS

ENVIRONMENTAL MANAGER	NAME:	DATE:
	SIGNATURE:	

COMMUNITY RELATIONS MANAGER	NAME: _____ DATE: _____ SIGNATURE: _____
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Appendix D: Vibration Impact Map



CABRAMATTA LOOP

Figure A14

Vibration impact zones (15t vibratory roller)

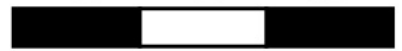
PROJECT NUMBER	S210520
DRAWN BY	MS
CHECKED BY	AP
DATE ISSUED	July 2021
CLIENT	Fulton Hogan
PREDICTION METHOD	n/a
CALIBRATION FACTOR	n/a
GROUND ABSORPTION	n/a
RECEIVER HEIGHT	n/a
ROAD SURFACE	n/a
IMAGERY	NEARMAP
PAGE SIZE	A3

Legend

- Vibration impact zone
- 20m (Standard structure)
- 36m (Heritage structure)
- 140m Human comfort (Day)
- 170m Human comfort (Night)
- Impacted receivers
- Buildings



200 400 600 m



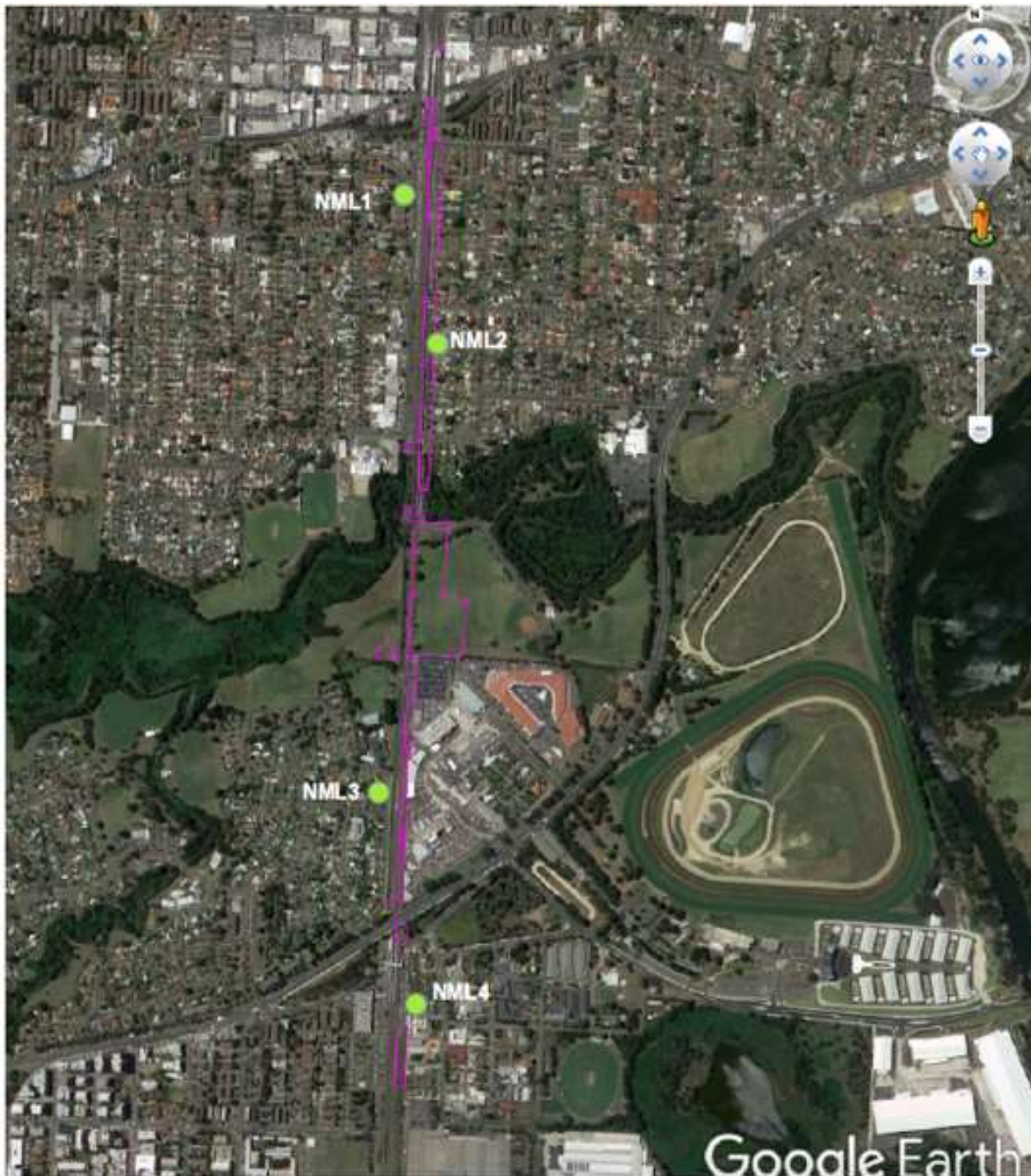
Map Projection AGD 1966 ISG 56 1

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Appendix E: Monthly Attended Noise Monitoring Location

Appendix E: Monthly Attended Noise Monitoring Location



CABRAMATTA LOOP
Figure A15

Monthly noise monitoring locations

Legend

- Monitoring locations
- Buildings

PROJECT NUMBER	S2 10/520
DRAWN BY	MB
CHEKED BY	AP
DATE ISSUED	July 2021
CLIENT	Fulton Hogan
PREDICTION METHOD	n/a
CALIBRATION FACTOR	n/a
GROUND ABSORPTION	n/a
RECEIVER HEIGHT	n/a
ROAD SURFACE	n/a
IMAGERY	NEARMAP
PAGE SIZE	A3

200 400 600 m



Map Projection AGD 1986 / SRS 56 1

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