



TransGrid

Powering Sydney's Future

Potts Hill to Alexandria transmission cable project

Construction Noise and Vibration Management Plan

August 2020

TransGrid: State Significant Infrastructure - Powering Sydney's Future - Development and operation of a new 330 kV underground cable circuit



CONSTRUCTION NOISE AND VIBRATION MANAGEMENT PLAN (CNVMP)

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Document Approvals:

	Name	Credentials	Signature	Date
Prepared by:	Yang Liu	M Environmental Eng; M Structural Eng. MIEAust MASS		13/08/2020
Reviewed by:	Mark Blake	BE Mechanical MIEAust MASS		13/08/2020
Approved by:	John Klaser (Project Manager)	Cert. Building Cert. Civil Constructon Dip PM		13/08/2020



Construction Noise and Vibration Management Plan
Powering Sydney's Future Project - SSI 8583
Potts Hill to Alexandria Transmission Cable Project



Report Number 10-1779

Taihan Electric Australia Pty Ltd

PREPARED FOR: Taihan Electric Australia Pty Ltd
126 Beaconsfield Street
SILVERWATER NSW 2128

PREPARED BY: VMS Australia Pty Ltd
Unit 1, 41-43 Green Street
BANKSMEADOW NSW 2019
ABN 52 168 418 013

Quality Management

Reference	Status	Date	Prepared	Authorised
10-1779	Final	5 August 2020	Yang Liu	Mark Blake
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Glossary

Term/Acronym	Definition
Acceleration	Acceleration is defined as the rate of change of Velocity of a particle over a period of time and is typically measured in the units of m/sec ² .
Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Amendment Report	The Amendment Report (Powering Sydney's Future: Potts Hill to Alexandria Transmission Cable Project Amendment Report, AECOM dated February 2020) prepared post the EIS being exhibited which describes the design refinements to the Project and identifies any changes to the environmental management and mitigation measures that are proposed to minimise environmental impacts.
AMMM	Additional Mitigation Measures Matrix
Ancillary facility	A temporary facility for construction of the SSI including an office and amenities compound, construction compound, material crushing and screening plant, materials storage compound, maintenance workshop, testing laboratory and material stockpile area.
Annoying Activities	As defined by the Interim Construction Noise Guideline to include: <ul style="list-style-type: none"> • 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
AS 1055	Standards Australia AS1055–1997™ – Description and Measurement of Environmental Noise
AS2187:2006	Australian Standard AS 2187.2-2006: Explosives - Storage and Use - Use of Explosives
AS2436	Standards Australia AS 2436–2010™ – Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites.
AS61672 or AS1259	Standards Australia AS IEC 61672.1–2004™ – Electro Acoustics - Sound Level Meters Specifications Monitoring or Standards Australia AS1259.2-1990™ – Acoustics – Sound Level Meters – Integrating/Averaging as appropriate to the device.
Attenuation	The reduction in the level of sound or vibration.
AVTG	Assessing Vibration – a technical guideline
A-weighting, dBA	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
BS 6472	British Standard (BS 6472–1992) – Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz) dated 1992;

Term/Acronym	Definition
BS 7385	British Standard BS7385: Part 2-1993 - Evaluation and Measurement for Vibration in Buildings Part 2 – Guide to Damage Levels from Ground-borne Vibration, dated 1993.
CCLP	Contractor Community Liaison Plan
CCS	Community Communication Strategy
CEMP	Construction Environmental Management Plan
CMRP	Compliance Monitoring and Reporting Program
CMS	Complaints Management System
CMSS	Construction Managers Site Superintendent
CNVIS	Construction Noise and Vibration Impact Statement
CNVMP	Construction Noise and Vibration Management Plan (CEMP Sub-plan) (this document)
CoA	Conditions of Approval for SSI 8583
Completion of construction	The date upon which construction is completed and all requirements of the Planning Secretary (if any) have been met. If construction is staged, completion of construction is the date upon which construction is completed and all requirements of the Planning Secretary (if any) have been met, in respect of all stages of construction.
Construction	Includes all physical work required to construct the Project, as defined in the CoA
Contractor	Any contractor or subcontractor appointed to the Project
Council	City of Canterbury-Bankstown Inner West Council City of Sydney
COVID-19 Extended Standard Hours	7 am to 6 pm all days
CPIMP	Construction Public Infrastructure Management Plan
CR	Complaints Register
CRT	Community Relations Team
SCRG	Community and Stakeholder Reference Group
DEC	Department of Environment and Conservation (now EPA)
DECC	Department of Environment and Climate Change (now EPA)
DECCW	Department of Environment, Climate Change and Water (now EPA)
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s_1 and s_2 is given by $20 \log_{10} (s_1 / s_2)$. The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is $20\mu\text{Pa}$.
DIN4150:3	German Institute for Standardisation – DIN 4150 (1999-02) Part 3 – Structural Vibration - Effects of Vibration on Structures.
DP&I	NSW Department of Primary Industries (now DPIE)
DPIE	NSW Department of Planning, Industry and Environment
ECM	Environmental Control Measure
EES	The DPIE's Environment, Energy and Science Group

Term/Acronym	Definition
EIS	The Environmental Impact Statement titled Powering Sydney's Future: Potts Hill to Alexandria Transmission Cable Project Environmental Impact Statement, prepared by AECOM Australia Pty Limited, dated October 2019, including the Submissions Report and Amendment Report.
EIS CNVIS	The Construction Noise and Vibration Impact Assessment attached as Appendix E to the EIS.
EMR	Independent Environmental Management Representative appointed by TransGrid
EMMM	Environmental Management Mitigation Measures (Chapter 3 of the Amendment Report)
EMS	Environmental Management System
Environment	Includes all aspects of the surroundings of humans, whether affecting any human as an individual or in his or her social groupings
EP&A Act	Environmental Planning and Assessment Act 1979 (NSW)
EP&A Regulation	Environmental Planning and Assessment Regulation 2000 (NSW)
EPA	NSW Environment Protection Authority
EPL	Environment Protection Licence under the POEO Act
ESM	Environment & Sustainability Manager
Fast/Slow Time Weighting	Averaging times used in sound level meters.
Feasible and reasonable	Consideration of best practice taking into account the benefit of proposed measures and their technological and associated operational application in the NSW and Australian context. Engineering considerations and what is practical to build. Reasonable Feasible relates to relates to the application of judgement in arriving at a decision, taking into account mitigation benefits and cost of mitigation versus benefits provided, community views and nature and extent of potential improvements.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Heavy Vehicle	Has the same meaning as in the <i>Heavy Vehicle National Law</i>
Heritage item	A place, building, work, relic, archaeological site, tree, movable object or precinct of heritage significance that is listed under one or more of the following registers: the State Heritage Register under the Heritage Act 1977 (NSW), a heritage item registered under a Local Environmental Plan under the EP&A Act, the World, National or Commonwealth Heritage lists under the Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth), and an Aboriginal object or Aboriginal place as defined in section 5 of the National Parks and Wildlife Act 1974 (NSW).
Hertz, Hz	The unit of Frequency (or Pitch) of a sound or vibration. One hertz equals one cycle per second.
HNML	Highly Noise Affected Noise Management Level – 75 dB(A) LAeq(15 minute)
ICNG	Interim Construction Noise Guideline (OEH, 2009)
Incident	An occurrence or set of circumstances that causes or threatens to cause material harm and which may or may not be or cause a noncompliance.
Infrastructure Approval	SSI project approval for SSI 8583 granted by the Minister for Planning and Public Spaces on 14 May 2020

Term/Acronym	Definition
Land	Has the same meaning as the definition of the term in section 1.4 of the EP&A Act
Landowner	Has the same meaning as “owner” in the <i>Local Government Act 1993</i> and in relation to a building means the owner of the building
LGA	Local Government Area. Area of administration of Council.
L90,15minute	A noise level index. The noise level exceeded for 90% of the time over a 15-minute period. L90 can be considered to be the “average minimum” noise level and is often used to describe the background noise.
Leq,15minute	A noise level index called the equivalent continuous noise level over a 15-minutes period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
Lmax,T15minute	A noise level index defined as the maximum noise level during a 15-minute period. Lmax is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the ‘fast’ sound level meter response.
Maximise	Implement all reasonable and feasible mitigation measures to achieve the specified outcome
Minimise	Implement all reasonable and feasible mitigation measures to reduce the impacts of the SSI
Minister	NSW Minister for Planning and Public Spaces, or delegate
Minor	Not very large, important or serious
Monitoring Program	Construction Noise and Vibration Monitoring Program
NCA	Noise Catchment Area
Negligible	Small and unimportant, such as to be not worth considering
NML	Project Specific Noise Management Level as derived from the Interim Construction Noise Guideline (2009)
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
NPfI	NSW Noise Policy for Industry (2017)
Non-compliance	An occurrence, set of circumstances or development that is a breach of this approval
NSW Vibration Guideline, the	NSW Department of Environment and Conservation – NSW Environmental Noise Management – Assessing Vibration: a Technical Guideline (the NSW Vibration Guideline), February 2006.
Octave Band	A range of frequencies whose upper limit is twice the frequency of the lower limit.
OEH	Office of Environment and Heritage (now EPA)
OOH	Out of Hours – All periods which are not Standard Construction Hours
OOHW	Out of Hours Works
OOHW Protocol	Out of Hours Work Protocol
POEO Act	Protection of the Environment Operations Act 1997 (NSW)
Planning Secretary	Planning Secretary of the DPIE

Term/Acronym	Definition
PPV	The particles of a medium are displaced from their random motion in the presence of a vibration wave. The greatest instantaneous velocity of a particle during this displacement is called the Peak Particle Velocity (PPV) and is typically measured in the units of mm/s.
Privately-owned land	Land that is not owned by a public agency
Project	Powering Sydney's Future – Potts Hill to Alexandria Transmission Cable Project Construction and operation of a new 330 kilovolt underground transmission cable circuit between the existing Rookwood Road substation in Potts Hill and the Beaconsfield West substation in Alexandria.
Project Area	The area subject to disturbance and/or infrastructure development, as shown on the project layout plans
Proponent	TransGrid
Public infrastructure	Linear and related infrastructure that provides services to the general public, such as roads, railways, water supply, drainage, sewerage, gas and fuel supply, electricity, telecommunications, etc.
RBL	The Rating Background Level for each period is the median value of the Assessment Background Level values for the period over all of the days measured. There is therefore an RBL value for each period (day, evening and night)
Relevant council	The council of the land on which works are to be carried out
Residence	Existing or approved dwelling
Residential zones	As defined by the relevant Local Environment Plan including Zone R1 General Residential, Zone R2 Low Density Residential, Zone R3 Medium Density Residential, Zone R4 high Density Residential
Respite Period	Any period which highly noise intensive works as defined in CoA E5 are not undertaken
RMS	NSW Roads and Maritime Services
RNP	NSW Road Noise Policy (DECCW 2011)
SCEC	Senior Community Engagement Consultant
Sensitive periods	Period of time determined in consultation with affected sensitive receiver
Sensitive receiver	Includes residences, educational institutions (including preschools, schools, universities, TAFE colleges), health care facilities (including nursing homes, hospitals), religious facilities (including churches), child care centres, passive recreation areas (including outdoor grounds used for teaching), active recreation areas (including parks and sports grounds). Receivers that may be considered to be sensitive include commercial premises (including film and television studios, research facilities, entertainment spaces, temporary accommodation such as caravan parks and camping grounds, restaurants, office premises, and retail spaces) and industrial premises, and others as identified by the Secretary
Sound Power	Sound Power is the rate at which sound energy is emitted, reflected, transmitted or received, per unit time. Unlike sound pressure, sound power is neither room-dependent nor distance-dependent.

Term/Acronym	Definition
Sound Power Level (SWL)	The Sound Power Level is the sound power relative to a standard reference pressure of 1pW (20×10^{-12} Watts) on a decibel scale. The SWL of a simple point source may be used to calculate the SPL at a given distance [®] using the following formula: $SPL = SWL - 10 \times \log_{10}(4 \pi \times r^2)$ Note that the above formula is only valid for sound propagation in the free-field (see below).
Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Pressure Level (SPL)	The sound level is the sound pressure relative to a standard reference pressure of 20µPa (20×10^{-6} Pascals) on a decibel scale.
Spoil	All material generated by excavation into the ground
SSI	The State Significant Infrastructure (the Project), as generally described in Schedule 1 of the Infrastructure Approval (SSI 8583)
Standard Construction Hours	7 am to 6 pm Monday to Friday, and 8 am to 1 pm on Saturdays No work Sundays or public holidays
Submissions Report	Powering Sydney's Future: Potts Hill to Alexandria Transmission Cable Project Submissions Report, AECOM dated February 2020. The Submissions Report outlines TransGrid's response to submissions received on the EIS during the public exhibition period, including updates to the environmental management and mitigation measures presented in the EIS.
Sub-plans	Sub Plans to the CEMP requiring the approval the Secretary of the Department of Environment and Planning under Conditions C3 and C7 including traffic and transport, noise and vibration, air quality, vegetation and biodiversity, soil and water, heritage, public infrastructure and waste.
SWMS	Safe Work Method Statement
Taihan	Taihan Electric Australia Pty Ltd, the principal construction contractor responsible for delivering the Project.
TfNSW	Transport for New South Wales
TPIM	Third Party Interface Manager (TPIM), Stakeholder and Community Relations
TransGrid	Proponent of the Project
Underboring	This is a trenchless method for installing cables involving passing the conduits under infrastructure (such as a road or railway corridor) or a watercourse. Underboring could be via thrust boring (also known as micro tunnelling), or horizontal directional drilling.
Vibration Dose, VDV	When assessing intermittent vibration it is necessary to use the vibration dose value (VDV), a cumulative measurement of the vibration level received over an 8-hour or 16-hour period. The VDV formulae uses the RMS Acceleration raised to the fourth power and is known as the Root-mean-quad method. This technique ensures the VDV is more sensitive to the peaks in the acceleration levels. VDV's are typically measured in the units of $m/s^{1.75}$.
VMS	VMS Australia Pty Ltd
WHS Regulation	Work Health and Safety Regulation 2011
Works	All physical activities to construct the Project

1 Introduction

1.1 Purpose

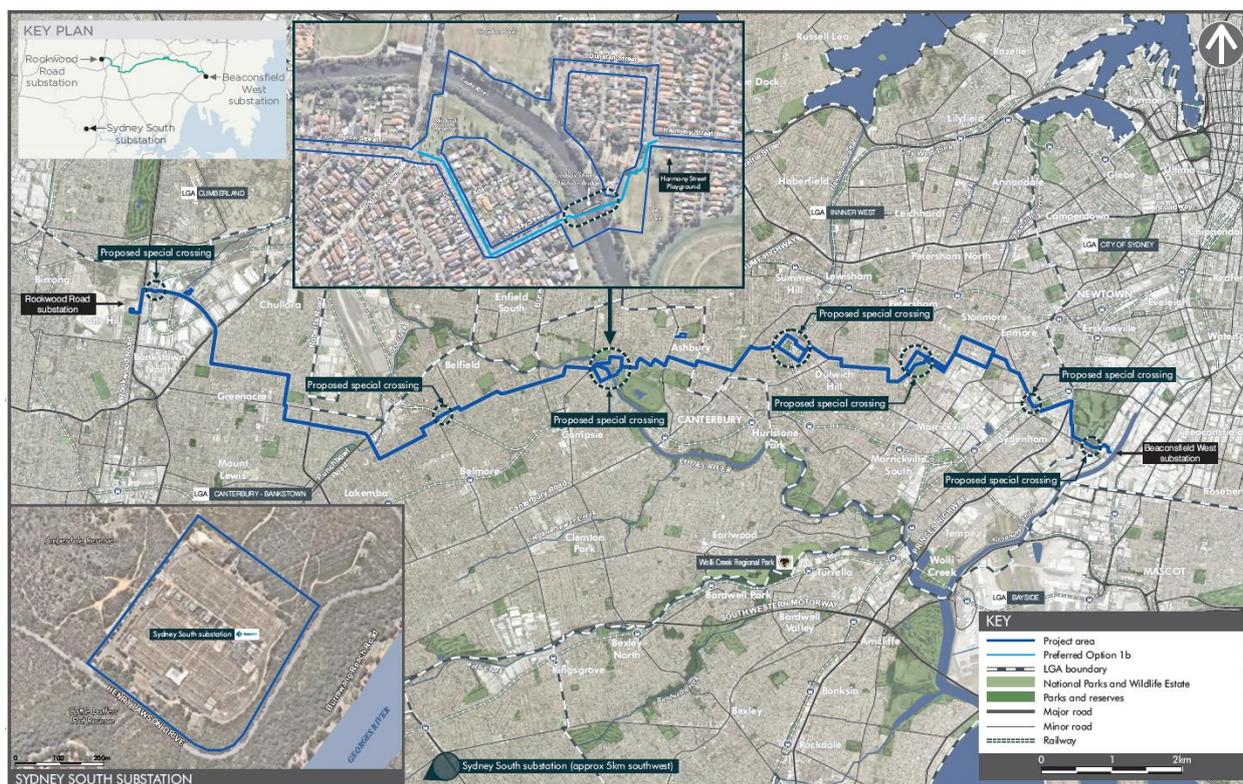
VMS Australia Pty Ltd (VMS) has been engaged by Taihan Electric Australia Pty Ltd (Taihan) to prepare the Construction Noise and Vibration Management Plan (CNVMP) to minimise and mitigate potential impacts from noise and vibration generated during the construction of the Potts Hill to Alexandria Transmission Cable Project (the Project).

This CNVMP has been prepared to address the relevant requirements of the Conditions of Approval (CoA) (Infrastructure Approval SSI 8583) and applicable legislation. Following consultation, with relevant councils, the CNVMP will be submitted to the Planning Secretary of the Department of Planning, Industry and Environment (DPIE), for approval as part of the Construction Environmental Management Plan (CEMP). Submission of the CEMP and Sub-plans is required no later than one month before commencement of Construction. Construction will not commence until the CEMP and sub-plans (including this CNVMP) have been approved.

1.2 Context

The Powering Sydney's Future – Potts Hill to Alexandria Transmission Cable Project (the Project) involves the construction of 330kV underground cables between TransGrid's Rookwood Road substation in Potts Hill and the Beaconsfield West substation in Alexandria. An overview of the Project Area is shown in **Figure 1**.

Figure 1 Project Area Location Plan



Source: Amendment Report.

TransGrid is the Proponent of the Project and Taihan is the appointed Contractor. Garde in turn is the Contractor appointed by Taihan for the Civil Works construction. TransGrid is the Principal Contractor for substation works. Roles and responsibilities may be assigned to sub-contractors or TransGrid.

As part of the Environmental Impact Statement (EIS), a Construction Noise and Vibration Impact Assessment (EIS CNVIS) was prepared to address the Secretary's Environmental Assessment Requirements (SEARs) issued by DPIE. The EIS assessed the predicted noise and vibration impacts during the construction of the Project. The EIS CNVIS is included in the EIS as Appendix E.

The EIS concluded that there would be noise and vibration impacts during construction of the Project and the extent would vary depending on the type of activity in progress and the proximity to sensitive receivers. These impacts will be mitigated through the implementation of the construction noise and vibration mitigation measures provided in this CNVMP.

1.3 Scope and Objectives of the CNVMP

This CNVMP describes how TransGrid and its Contractors will manage and mitigate noise and vibration impacts during construction of the Project. This CNVMP has been prepared for construction purposes.

The key objectives of this CNVMP are to:

- Minimise noise and vibration impacts on surrounding residents and businesses
- Outline the proposed community consultation
- Manage noise management levels, where feasible
- Avoid structural damage to buildings or heritage items
- Assist, establish and maintain cooperative relationships with community members.

This CNVMP has been prepared to address the requirements of the following:

- Conditions of Approval (CoA) for the Project
- Mitigation measures listed in the Environmental Management and Mitigation Measures (EMMM, presented in Chapter 3 of the Amendment Report, *Powering Sydney's Future: Potts Hill to Alexandria Transmission Cable Project Amendment Report*, AECOM, dated February 2020 and Chapter 6 of the Submissions Report, *Powering Sydney's Future: Potts Hill to Alexandria Transmission Cable Project Submissions Report*, AECOM, dated February 2020
- Applicable guidelines and legislation

The Compliance Matrix in **Appendix A** summarises the above compliance requirements and how these have been addressed within the CNVMP.

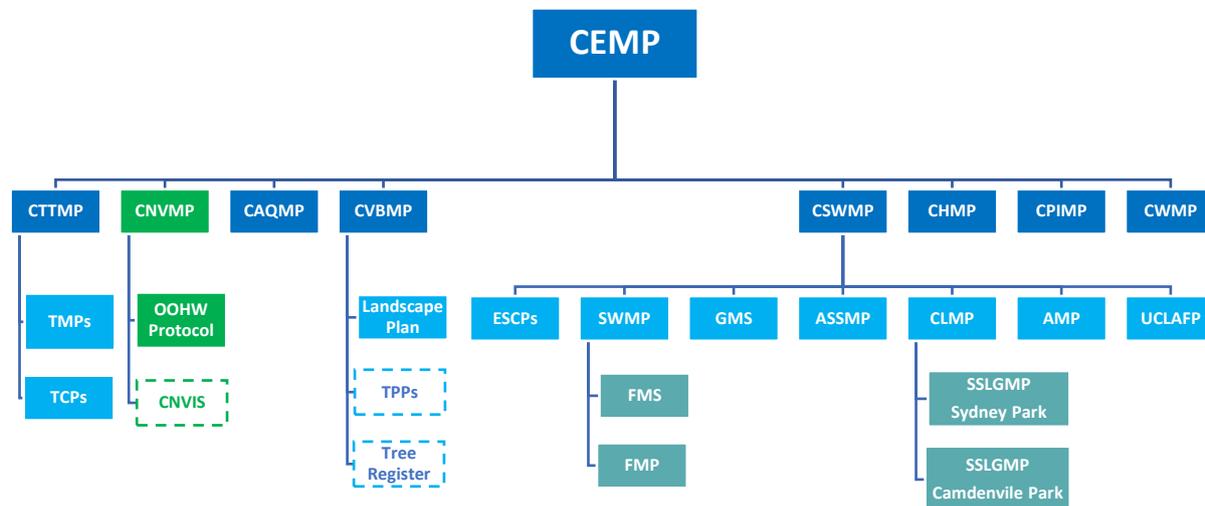
1.4 Project Environmental Management System

The Project's Environmental Management System (EMS) is described in **Figure 2**.

To achieve the intended environmental performance outcomes, TransGrid and its Contractors have established, implemented, maintained and continually improves its EMS.

The EMS consists of environmental plans, including this CNVMP, procedures, protocols and tools as set out below and illustrated in **Figure 2**.

Figure 2 Project Environmental Management System



1.5 Consultation for Preparation of the CNVMP

In accordance with CoA C3 (b), this CNVMP has been developed in consultation with the relevant councils (City of Canterbury-Bankstown, Inner West Council and City of Sydney). In accordance with CoA C4, a copy of the correspondence received from the Councils as result of the consultation is provide in **Appendix E**.

1.6 CNVMP Amendments

Any changes to the CNVMP will be undertaken in accordance with the Construction Environmental Management Plan (CEMP) Section 7.4 (also refer to **Section 13**).

1.7 Planning Secretary Approval

This CNVMP must be approved by the Planning Secretary before commencement of the Project works.

2 Construction Activities and Tasks

The Project scope of works (Project Works) is detailed in the CEMP and is summarised in **Table 1**.

Table 1 Project Scope of Works

Constriction Activity	Location	Duration	Description
Site preparation	Work site	Up to one week	Short term works to clear the project area where required, including implementing traffic management and establishing environmental controls and ancillary facilities
Trenching and excavation	Transmission cable route	Average rate of trenching of 30 metres per day. Each section between the joint bays ay take up to eight weeks to complete	Linear progressive works. May occur at multiple locations along the transmission cable route at one time Steel plates maybe used to temporarily cover trenches
Excavation and construction of joint bays	Transmission cable route, one joint bay every 950 metres (average)	Up to five weeks to establish each joint bay, including excavation	Works to be undertaken at discrete locations along the transmission cable route
Special crossing – Cable bridges	Cable bridge locations as described in Table 2-1 of the EIS	Up to ten weeks (not continuous) for each crossing	Works to be undertaken at up to three discrete locations
Special crossing – Underboring	Underboring locations (originally described in Table 2-1 of the EIS, though augmented (to 14) to minimise impacts).	Up to ten weeks (not continuous) for each crossing	Works to be undertaken at up to five discrete locations
Cable pulling	Transmission cable route, between two adjacent joint bays for one cable pull	Up to one week for each section	Works to be undertaken at discrete locations along the transmission cable route. May occur at multiple locations along the transmission cable route at one time
Construction laydown areas	Camdenville Park (Location as described in Table 2-4 of the EIS)	Duration of the project's construction, estimated to be around 14-16 months	Primarily for construction plant parking, storage of equipment and deliveries, and spoil stockpiling. Stockpiling would occur for around 15 months
Restoration of surfaces	Transmission cable route	Between 3-5 weeks per section	Linear progressive works. May occur at multiple locations along the transmission cable route at one time

Constriction Activity	Location	Duration	Description
Spoil and waste management	Roads surrounding the transmission cable route	Duration of the project's construction, estimated to be around 14-16 months	Trucks would be used to transport spoil during the trenching and conduit installation works, joint bay construction and restoration of surfaces. Trucks would be using both local and arterial roads
Rookwood Road, Beaconsfield West and Sydney South substation upgrade works	Rookwood Road, Beaconsfield West and Sydney South substations	Rookwood Road: 2-4 months Beaconsfield West: 2-4 months Sydney South: 3 months	Upgrade works at substation

Note 1: Night-works would be undertaken at all classified roads (state road reserve), signalised intersections, cable pulling and joining, and industrial areas as described in detail within the CEMP.

3 Environmental Requirements

3.1 Legislation

Legislation relevant to noise and vibration management includes:

- Environmental Planning and Assessment Act 1979 (EP&A Act)
- Environmental Planning and Assessment Regulation 2000
- Protection of the Environment Operations Act 1997 (POEO Act)
- Protection of the Environment Operations (Noise Control) Regulation 2008

The EP&A Act establishes a system of environmental planning and assessment of development proposals. The CoA and obligations are incorporated into this CNVMP.

The EPA is responsible for issuing Environment Protection Licences (EPLs) for 'scheduled activities' under POEO Act. TransGrid and its Contractors do not currently hold an EPL for the Project. This CNVMP will be revised in the event that an EPL is obtained for the Project.

Relevant provisions of the above legislation are identified in the register of legal requirements included in Appendix A1 of the CEMP.

This CNVMP addresses applicable requirements within the following documents:

- State Significant Infrastructure Powering Sydney's Future – Potts Hill to Alexandria Transmission Cable Project Conditions of Approval (SSI CoA) (Infrastructure Approval 8583 determined 14 May 2020)
- Environmental Management and Mitigation Measures (EMMM, Chapter 3 of the Amendment Report, dated February 2020)

The Compliance Matrix in **Appendix A** provides a cross-reference to indicate where the CoAs are addressed in this CNVMP or other project or environmental management documents.

3.2 Guidelines and Standards

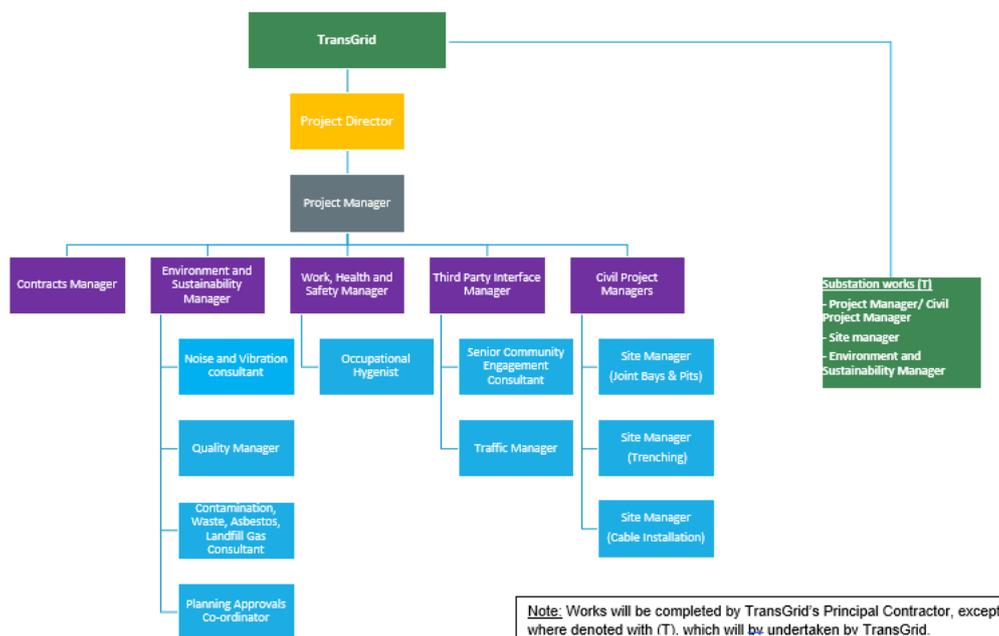
The main guidelines, standards and policy documents relevant to this CNVMP include:

- Interim Construction Noise Guideline (ICNG), Department of Environment and Climate Change (DECC), 2009;
- Assessing Vibration: A Technical Guideline (AVTG), Department of Environment and Conservation (DEC), 2006;
- NSW Road Noise Policy (RNP), Department of Environment, Climate Change and Water (DECCW), 2011;
- Noise Policy for Industry (NPfI), Environment Protection Authority (EPA), 2017;
- German Standard DIN 4150: Part 3 1999 Structural Vibration in Buildings – Effects on Structures, 1999;
- British Standard 6472: Part 1 2008 Evaluation of Human Exposure to Vibration in Buildings (1-80Hz), 2008;
- British Standard 7385: Part 2-1993 Evaluation and measurement of vibration in buildings, 1993;
- Australian Standard AS 2436-2010, Guide to noise and vibration control on construction, demolition and maintenance sites, 2010;
- Australian Standard AS 1055.1-1997 – Acoustics – Description and measurement of environmental noise, Part 1: General procedures, 1997;
- Australian Standard AS/NZs 2107:2000 Acoustics – Recommended design sound levels and reverberation times for building interiors, 2000;
- UK Department for Environment, Food and Rural Affairs (DEFRA) Update of noise database for prediction of noise on construction and open sites, 2006;
- TransGrid Environmental Guidance Note: Construction Noise, HP TRIM No.D2019/02090, Issue Date 8/5/19; and
- State Significant Infrastructure: Standard Conditions of Approval (Linear Infrastructure), September 2018.

4 Roles and Responsibilities

This section provides details on the key roles and responsibilities of TransGrid and its Contractors environmental personnel. The key environmental roles are shown in **Figure 3**.

Figure 3 Project Management Structure



The roles of responsibilities of key personnel with respect Noise and Vibration are described in **Table 2**.

Table 2 Roles and Responsibilities

Role	Responsibilities
Project Director (PD)	<ul style="list-style-type: none"> Act as Contractor’s Representative
Project Manager (PM)	<ul style="list-style-type: none"> Managing the delivery of the Project including overseeing implementation of noise and vibration management measures
Environment & Sustainability Manager (ESM)	<ul style="list-style-type: none"> Oversee the implementation of all noise and vibration management initiatives including inductions, toolbox talks and coordinating TransGrid and its Contractors’ response to noise and vibration complaints Responsible for managing ongoing compliance with the CoA and environmental document requirements Monitoring and reporting on compliance Manage review and continual improvement of this plan
Senior Community Engagement Consultant (SCEC)	<ul style="list-style-type: none"> Manage notifications and consultation for noise and vibration and liaise with the Environment and Sustainability Manager about noise and vibration complaints

Role	Responsibilities
Work, Health and Safety Manager (WHSM)	<ul style="list-style-type: none"> ▪ Monitoring health and safety risks and hazards in the workplace ▪ Advising employees on how to minimise or ultimately avoid risks and hazards in the workplace ▪ First aid / nursing duties ▪ Ensuring the business is legally compliant with all health and safety legislation ▪ Working with and training all employees to manage, monitor and improve the health and safety standards in the workplace ▪ Being responsible for all safety inspections in the workplace (for example, monitoring noise levels in a warehouse) ▪ Assisting with the creation and management of health and safety monitoring systems and policies in the workplace ▪ Managing emergency procedures (such as fire alarm drills) and organising emergency teams such as fire marshals and first aiders ▪ Offering general health and safety advice to all employees
Civil Project Manager (CPM)	<ul style="list-style-type: none"> ▪ Manage the delivery of the construction process, in relation to noise and vibration management in conjunction with the Environment & Sustainability Manager
Site Manager (SM)	<ul style="list-style-type: none"> ▪ Implementation of all noise and vibration management initiatives including inductions, toolbox talks and response to noise and vibration complaints

4.1 Specialist Consultants

VMS Australia Pty Ltd (VMS) has been engaged to undertake comprehensive noise and vibration modelling and assessment of the proposed works, including the preparation of the CNVMP. Throughout construction, the Project noise and vibration consultant may provide specialist advice and services including:

- Preparing Construction Noise and Vibration Impact Statements
- Undertaking noise and vibration monitoring (including review of noise and vibration predictions)
- Assisting in community consultation
- Assisting in liaison with TansGrid, DPIE, EPA and Council on the appropriateness and accuracy of the noise and vibration assessments.

5 Existing Environment

The Project is located across three (3) local government areas (LGAs), including:

- City of Canterbury-Bankstown;
- Inner West; and
- City of Sydney.

It traverses the suburbs of Potts Hill, Yagoona, Chullora, Greenacre, Lakemba, Belmore, Belfield, Campsie, Croydon Park, Ashbury, Ashfield, Dulwich Hill, Marrickville, Newtown, St Peters, Alexandria and Picnic Point.

Within the Project Area, it is surrounded by various sections of dense residential areas. Other sensitive receivers include, places of worship, educational facilities, childcare centres, health care facilities and open areas used for passive or active recreation.

5.1 Sensitive Receivers

Residences, commercial and community facilities (such as churches and open spaces) are located adjacent to and at varying distances from the Project alignment. The Condition of Approval defines sensitive receivers (refer to **Section 7.2**).

The locations of noise sensitive receivers are shown on the Land Use Map presented in **Appendix B**. The sensitive receivers were identified via a ground truthing survey of the building adjacent to the Project Area and via publicly available spatial databases for farther receivers.

Commercial and industrial receivers are generally not considered noise sensitive, however some may comprise specific uses which are considered noise sensitive. For example, childcare centres, aged care and theatres (when in use) are considered noise sensitive receivers. These receivers are also shown on the Land Use Map presented in **Appendix B**.

5.2 Noise Catchment Areas

Seven (7) Noise Catchment Areas (NCAs) representing the existing noise environments have been adopted for the Project. A description of each NCA is provided below in **Table 3** and their locations shown on **Figure 4**.

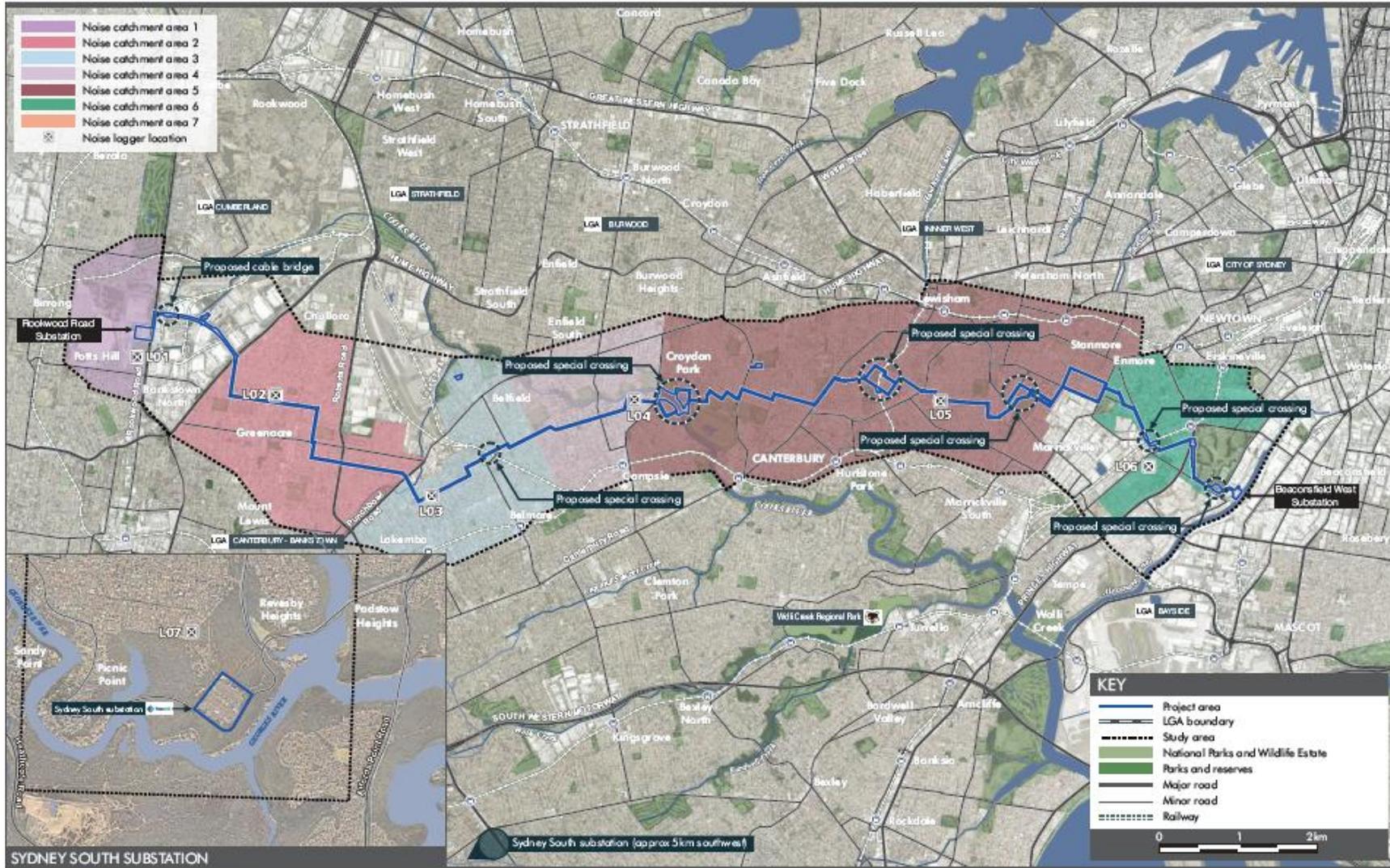
Table 3 Noise Catchment Areas

NCA	Representative Logger	Description
NCA1	L01	Includes mainly low density residential properties within Yagoona, Potts Hill and Regents Park. This NCA is also adjacent to industrial properties within Potts Hill and Chullora.
NCA2	L02	Includes mainly low density residential properties within Greenacre but also includes some high and medium density residential properties. Bordered by industrial properties to the northwest and northeast. Greenacre Town Centre is located in the centre of the NCA and includes Greenacre Area Community Centre. Other non-residential noise sensitive receivers include St John Vianney Catholic Church, St John Vianney Catholic Primary School, Good Shepherd Church, Sydney Full Gospel Church, Greenacre Public School, Banksia Road Public School, Greenacre Montessori Academy Child Care Centre, Playtime Child Care Centre, Tiny Tots Kindergarten, Funtime Child Care Centre, Kindy Academy Child Care Centre, Mickey's World Child Care Centre, Alnoori Muslim School, Al Sadiq College, Liberty Church of Christ, KU Karingal Preschool, Holy Saviour Primary School and Wangee Road Child Care Centre.
NCA3	L03	Includes mainly medium and high density residential properties within Lakemba, Belmore and Belfield. The Enfield Intermodal Terminal is located to the northwest. Other non-residential noise sensitive receivers include St Michael's Catholic Primary School, Belfield Uniting Church, Church of St Michael the Archangel, St Andrews Anglican Church, Lakemba Mosque, Hanaro Presbyterian Church, Saint Therese Catholic Church, St Therese's Catholic Primary School, three Care for Kindies Child Care Centres, Hamden Park Public School, Canterbury Vale School, Colonial Preschool Child Care Centre, Embassy Church, Belmore North Public School and Star Academy Kids Learning Centre

NCA	Representative Logger	Description
NCA4	L04	Includes a mix of low, medium and high density residential properties within Croydon Park and Campsie. Other non-residential noise sensitive receivers include Love of Learning Child Care Centre and Little Learning School Child Care Centre, Oz Education Child Care Centre, Harcourt Public School and Croydon Park Baptist Church.
NCA5	L05	Includes mainly low density residential properties within Campsie, Croydon Park, Ashbury, Canterbury, Ashfield, Hurlstone Park, Dulwich Hill, Lewisham, Marrickville and Stanmore with some medium and high density residential properties. Other non-residential noise sensitive receivers include child care centres, Sydney Private Hospital, Bethel Nursing Home, Ashbury Public School, Summer Hill Aged Care Services Nursing Home, Woodstock Child Care Centre, Summer Hill Public School and St Patrick's Catholic Primary School and Trinity Grammar School, Summer Hill Children's Centre, St Patrick's Catholic Church, Lewisham Public School, Christian Brothers' High School Lewisham, Newington College, Petersham Primary School, Addison Road Early Learning Centre, Learn & Laughter Early Learning Centre, Enmore Road Early Learning Centre, Canaan Presbyterian Church, Petersham Baptist Church and Marrickville Kingdom Hall of Jehovah's Witnesses, St Francis Xavier Catholic School, Canterbury Public School, and Croydon Park Public School.
NCA6	L06	Includes mainly low density residential properties within Enmore, Newtown, Erskineville and St Peters but also includes some medium and high density residential properties. Industrial properties are located to the west and east. Sydney airport is located to the south. Other non-residential noise sensitive receivers include Camdenville Public School, St Pius Catholic Primary School, St Peters Public School, Only About Children Child Care Centre and St Pius Enmore Catholic Church.
NCA7	L07	Includes mainly low density residential properties within Picnic Point, Revesby Heights and Alfords Point.

Note 1: The NCAs and the noise logging was determined and presented in detail within the EIS CNVIS.

Figure 4 Noise Catchment Areas



5.3 Baseline Noise Environment

Long-term background noise monitoring was conducted as part of the EIS noise assessment.

The EIS assessment concluded that the background noise levels for the area is primarily dominated by traffic noise at all locations and is typical of an urban environment.

The detailed results of the noise monitoring were provided in the Construction Noise and Vibration Impact Assessment of the EIS (EIS CNVIS).

A description and location of the Noise Catchment Areas (NCAs) for the Project is provided in **Section 5.2**.

A summary of the background noise monitoring results for each NCA (refer to Table 4-3 of the EIS) is presented in **Table 4**, including the Rating Background Level (RBL) and ambient average noise level (L_{Aeq}) for each period (day, evening and night). The RBLs are to be used when assessing the $L_{Aeq(15\text{ minute})}$ noise levels at residences for a variation to work hours in accordance with CoA E6(d)i (refer to **Section 6.3**).

Further to the RBLs nominated in the EIS, CoA E1 nominates Project-specific Construction NMLs for all sensitive receivers (refer to **Section 7.2**) which will be used when determining noise mitigation measures (refer to **Section 10**).

Table 4 Baseline Noise Levels (dBA)

NCA	Rating Background Level (RBL)			Ambient Average Noise Level (L_{Aeq})		
	Day ¹	Evening ¹	Night ¹	Day ¹	Evening ¹	Night ¹
NCA 1	45	45 ²	39	63	58	52
NCA 2	38	38 ²	35	53	50	45
NCA 3	40	40 ²	38	59	57	53
NCA 4	33	33 ²	32	54	45	44
NCA 5	34	34 ²	30	58	57	48
NCA 6	42	42 ²	35	61	60	56
NCA 7	30 ³	30 ²	30	49	45	40

Note 1: In accordance with the NPfl:

Day is defined as 7:00 am to 6:00 pm, Monday to Saturday and 8:00 am to 6:00 pm Sundays and public holidays.

Evening is defined as 6:00 pm to 10:00 pm, Monday to Sunday and public holidays.

Night is defined as 10:00 pm to 7:00 am, Monday to Saturday and 10:00 pm to 8:00 am Sundays and public holidays.

Note 2: Where measured Evening RBLs are higher than Daytime RBLs, Evening RBLs adjusted to the same as the daytime RBL in accordance with the NPfl.

Note 3: Where the rating background level is found to be less than 30 dB(A), then it is set to 30 dB(A) in accordance with the NPfl.

Whilst the assessment of noise in the EIS did so by measuring Rating Background Levels (RBL's), the Condition of Approval (CoA E1) requires the Project to achieve the prescribed construction Noise Management Levels (NMLs). As such the Project's construction noise management (see **Section 7**) applies, to the extent possible, NMLs units of measurement.

6 Construction Hours

6.1 Approved Construction Hours

The approved construction hours for different construction activities are outlined in CoA E4 and reproduced in **Table 5**.

Table 5 Approved Construction Hours

	Works	Hours
(a)	Linear infrastructure – Site preparation, trenching and excavation, joint bays, restoration of road surfaces, other	Standard construction hours ²
(b)	Substation upgrade works	
(c)	Linear infrastructure – Works in classified road reserves and signalised intersections, cable pulling and jointing	Anytime
(d)	Special crossings – cable bridges and underboring	
(e)	Construction laydown areas	

Note 1: Classified roads in the project area are identified in CoA E29.

Note 2: Standard construction hours are defined in CoA E1 as follows:

Monday to Friday 7am to 6pm

Saturday 8am to 1pm

No work Sundays or public holidays

6.1.1 COVID-19 Extended Standard Hours

COVID-19 Extended Standard Hours only apply while the Ministerial Order is in place.

Due to the unexpected COVID-19 viruses situation, the standard construction hours has been extended in accordance with the *Environmental Planning and Assessment (COVID-19 Development – Construction Work Days) Order 2020 (made on 2 April 2020)* (Development Construction Order) and the *Environmental Planning and Assessment (COVID-19 Development – Infrastructure Construction Work Days) Order 2020 (made on 9 April 2020)* (Infrastructure Construction Order) (COVID-19 Orders) for the limited period (6 months from the date each order was made) as nominated by the Minister of Planning and Public Spaces. The extended construction work days in accordance with the COVID-19 Orders are conditioned as follows for the Project:

- Project Works are permitted on a Saturday, Sunday or public holiday
- Comply with all CoAs other than CoA E4 that restricts the hours of work or operation on a Saturday, Sunday or public holiday
- For work or operation on a Saturday, Sunday or public holiday, comply with the standard weekday construction hours (7am to 6pm) defined in CoA E1
- Not involve the carrying out of rock breaking, rock hammering, sheet piling, pile driving or similar activities during the COVID-19 Extended Standard Hours
- Take all feasible and reasonable measures to minimise noise

Accordingly, the standard construction hours for the COVID-19 special period are summarised in **Table 6**.

Table 6 COVID-19 Extended Standard Hours

	Works	Hours
(a)	Linear infrastructure – Site preparation, trenching and excavation, joint bays, restoration of road surfaces, other	Everyday ² 7am to 6pm
(b)	Substation upgrade works	
(c)	Linear infrastructure – Works in classified road reserves and signalised intersections, cable pulling and jointing	Anytime
(d)	Special crossings – cable bridges and underboring	
(e)	Construction laydown areas	

Note 1: Classified roads in the project area are identified in CoA E29.

Note 2: Only limited construction activities, i.e. no rock breaking, rock hammering, sheet piling, pile driving or similar activities, can be undertaken during the following periods:
Saturday 7am to 8am and 1pm to 6pm
Sundays or public holidays

Recognising the above, the COVID-19 Extended Standard Hours provision in combination with CoA E5, *Highly Noise Intensive Works* would enable such works to be undertaken from 7am to 6pm on Saturdays and Sundays, though requires such works to comply with the COVID-19 Order conditions (vis. Sect 6(2)(c)(ii) and (iii), namely:

(ii) *not involve the carrying out of rock breaking, rock hammering, sheet piling, pile driving or similar activities during the hours of work or operation that would not be permitted but for this Order, and*

(iii) *take all feasible and reasonable measures to minimise noise.*

The CoA's 'DEFINITIONS' clarifies *feasible and reasonable measures* to include taking into account *community views* and being *practical*. Thus whilst such works can be undertaken, these works cannot include those listed in '(ii)' above and must take into account community views expressed through the consultation outlined in the *Community Communications Strategy* (prepared under CoA B2).

6.2 Construction Hours for Highly Noise Intensive Works

Highly noise intensive works is defined in CoA E4 as works which result in the exceedance of the Highly Noise Affected Noise Management Level (HNML) of 75 dBA LAeq(15 minute) at the same noise sensitive receiver.

Appendix B will be used to identify sensitive receivers impacted by highly noise intensive works in exceedance of 75 dBA LAeq(15 minute).

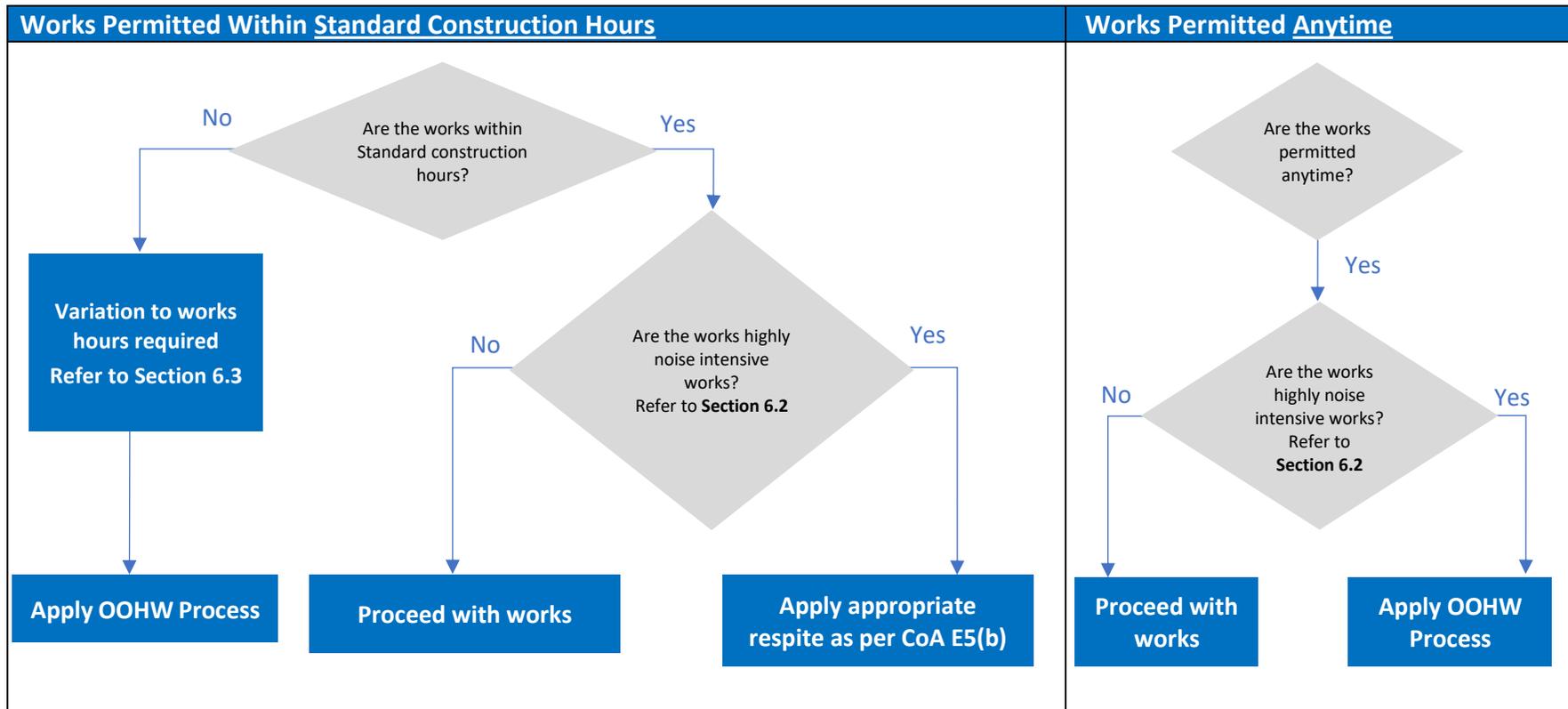
Highly noise intensive work must only be undertaken during Standard Construction Hours or COVID-19 Extended Standard Hours (refer to **Table 6**). Standard Construction Hours are set out in CoA E4 (refer to **Table 5**). For COVID -19 Extended Standard Hours (refer to **Table 6**).

If continuous, then the highly noise intensive works will not exceed three hours, without a minimum respite from these works of not less than one hour between each block ('continuous' includes any period during which there is less than 1 hour respite between ceasing and recommencing any of the highly noise intensive works).

In accordance with CoA E5(b), following each 3 hour block of highly noise intensive works, the works may recommence once a minimum respite from these works of not less than 1 hour between each block has been provided.

Where highly noise intensive works cannot be undertaken during Standard Construction Hours, the review process for proceeding with highly noise intensive works outside of standard construction hours is determined via the process shown in **Figure 5**.

Figure 5 Highly Noise Intensive Works Review Process



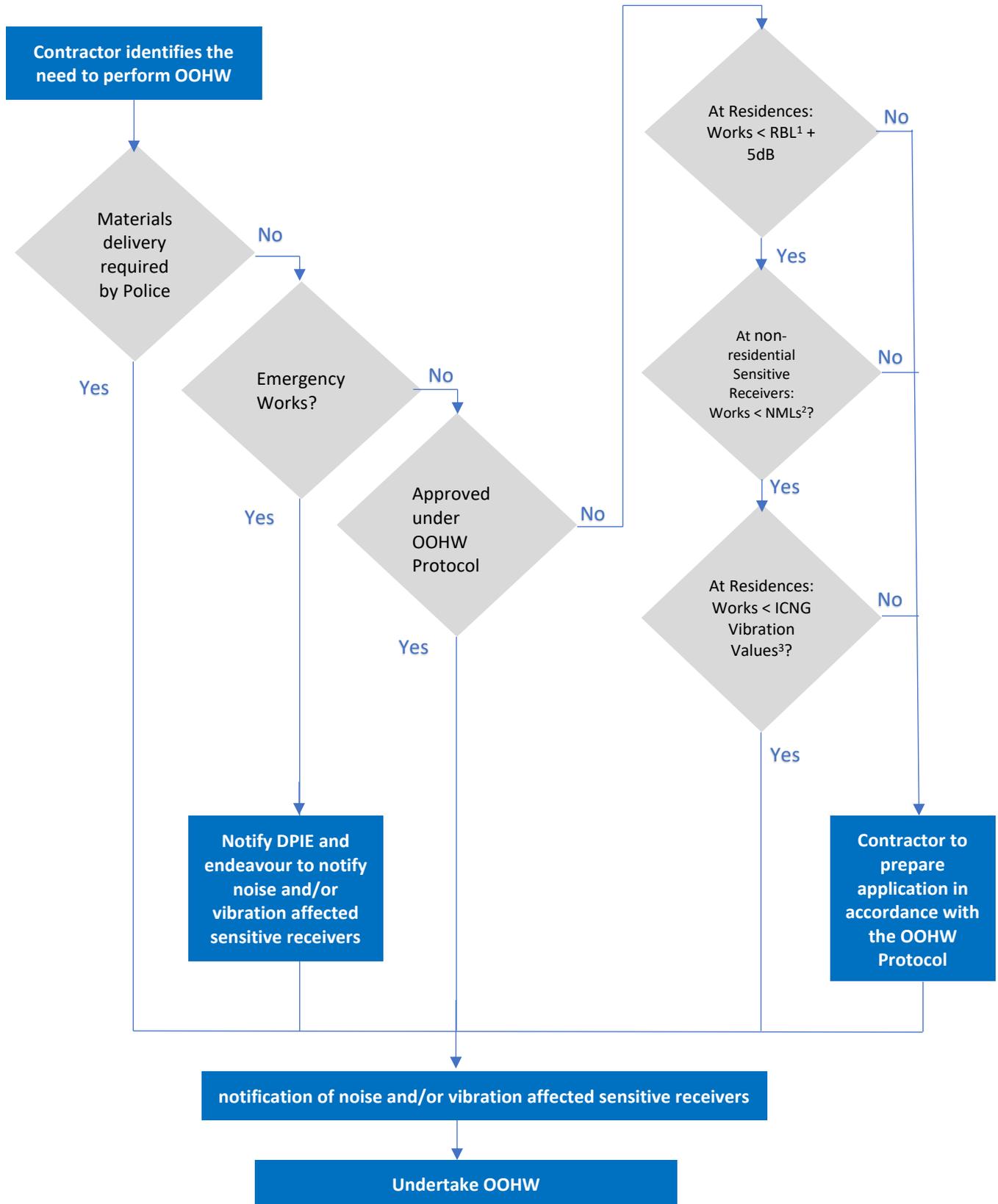
6.3 Variation to Work Hours

In addition to the works which are allowed to be conducted at anytime (refer to **Table 5**), in accordance with CoA E6, works may be undertaken outside the standard hours specified in CoA E4 and CoA E5 in the following circumstances:

- (a) for the delivery of materials required by the NSW Police Force or other 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) works approved under an Out-of-Hours Work Protocol as required by CoA E8; or
- (d) construction that causes LAeq(15 minute) noise levels:
 - (i) no more than 5 dBA above the RBL (refer to **Table 4**) at any residence, and
 - (ii) no more than the NMLs specified in CoA E1 at other sensitive land uses (refer to **Table 7**); . Note, compliance with this condition would also result in compliance with CoA E5 Highly Noise Intrusive Works (refer to **Section 6.2**;
 - (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 AVTG (refer to **Table 18** and **Table 19** or **Table 20** and **Table 21**), and
 - (i) 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 AVTG (refer to **Table 22**).

The Variation to Work Hours process is shown in **Figure 6**.

Figure 6 Variation to Work Hours Process



Note 1: Refer to **Table 4** for RBLs. Note 2: Refer to **Table 7** for NMLs. Note 3: Refer to **Section 8.1** for ICNG vibration values.

6.4 Out of Hours Work Protocol (OOHW Protocol)

All out of hours works not meeting the requirements of CoA E6 (refer to **Section 6.3** and **Figure 6**) will be managed and approved under CoA E8 OOHW Protocol. The OOHW Protocol will be approved by the Planning Secretary before commencement of the works. The OOHW Protocol is attached in **Appendix D**.

7 Construction Noise Management

The three primary noise metrics used to describe construction noise emissions are:

- LA1(1minute) - The typical 'maximum noise level for an event', used in the assessment of potential sleep disturbance during night-time periods. Alternatively, assessment may be conducted using the L_{max} or maximum noise level.
- LAeq(15minute) - The "energy average noise level" evaluated over a 15-minute period. This parameter is used to assess the potential construction noise impacts.
- LA90 - The "background noise level" or "Rating Background Level" (RBL) in the absence of construction activities. This parameter represents the average minimum noise level during the daytime, evening and night-time periods respectively. The LAeq(15minute) construction noise management levels are based on the RBLs.

The subscript "A" indicates that the noise levels are filtered to match normal hearing characteristics (A weighted).

The NSW EPA Interim Construction Noise Guideline (ICNG) requires Project specific Noise Management Levels (NMLs) to be established for noise affected receivers. To reduce the noise impact of construction, a range of standard noise mitigation measures (see **Section 10.2**) will be applied.

To identify the appropriate mitigation measure to apply, a Project-specific Construction Noise and Vibration Impact Statement (CNVIS, refer to **Appendix B** and **Section 9.3**) has been prepared to predict noise levels from the works and identify potential exceedances of the Construction NMLs (nominated in CoA E1, refer to **Table 7**) at the nearby sensitive receivers. In the event construction noise levels are predicted to be above the NMLs, additional noise mitigation measures (refer to **Section 10.3.1**) will be investigated and applied to minimise noise emissions.

Having investigated all feasible and reasonable work practices, if construction noise levels are still predicted to exceed the NMLs then the potential noise impacts would be managed as per **Section 10.3.1** of this CNVMP.

7.1 Construction Noise and Vibration Impact Assessments (CNVISs)

Where required, the Baseline Project specific CNVIS will be used to determine appropriate noise and vibration management and mitigation to be implemented for the Project Works. Refer to **Section 9.3.2** and **Appendix B** for the Baseline CNVIS that will be used for all Project Works, except for High Risk OOHWs (refer to the **Appendix D, OOHW Protocol**) for which a specific OOHW CNVIS would be produced (refer to **Section 9.3.3**).

7.2 Construction Noise Management Levels - Sensitive Receivers

The Condition of Approval defines sensitive receivers to include:

- residences
- educational institutions (including preschools, schools, universities, TAFE colleges)
- health care facilities (including nursing homes, hospitals)
- religious facilities (including churches)

- child care centres
- passive recreation areas (including outdoor grounds used for teaching)
- commercial premises (including film and television studios, research facilities, entertainment spaces, temporary accommodation such as caravan parks and camping grounds, restaurants, office premises, and retail spaces)
- others as identified by the Planning Secretary

Further CoA E1 nominated Project-specific Construction NMLs for all sensitive receivers, which is reproduced in **Table 7**. Note, these Construction NMLs are to be measured externally to the sensitive receiver.

Table 7 CoA E1 Construction Noise Management Levels

Location	Standard Construction Hours	Outside Standard Construction Hours	
	L _{Aeq} (15 min)	L _{Aeq} (15 min)	L _{A1} (1 min)
All sensitive receivers	55	45	65

Notes:

- The Department acknowledges that a considerable number of sensitive receivers are predicted to experience exceedances of these noise management levels as the construction works approach the receivers. CoA E3 requires exceedances to be managed in accordance with this CNVMP.
- Noise is to be measured in accordance with the relevant provisions of the EPA's Interim Construction Noise Guideline.
- Standard construction hours are defined as:
 - Monday to Friday: 7:00am to 6:00pm;
 - Saturday: 8:00am to 1:00pm; and
 - No work Sundays or public holidays.

7.3 Construction Noise Management Levels - Other Receiver Land Uses

For other receiver land uses, not covered by CoA E1 (refer to **Table 7**), the noise management levels recommended in the ICNG are presented **Table 8**.

Table 8 Construction Noise Management Levels for Other Receiver Land Uses

Land Use	NML L _{Aeq} (15minute) Noise Levels
Active recreation areas ¹	65 dBA
Industrial premises ²	75 dBA (when in use)

Note 1: Characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion.

Note 2: Assess at the most affected occupied point on the premises.

7.4 Highly Noise Affected Noise Management Level (HNML)

In accordance with CoA E5 and the ICNG, highly noise intensive works which result in the exceedance of the Highly Noise Affected Noise Management Level (HNML) of 75 dBA L_{Aeq}(15 minute) would require respite and be limited to Standard Construction Hours, except as permitted under CoA E6 (refer to **Section 6.2** and **Section 10.1**).

7.5 Sleep Disturbance

The EIS NIA (refer to Table 5-4 of the EIS NIA) nominated an LA1(1 minute) Sleep Disturbance Screening Level of RBL plus 15 dBA and an LA1(1 minute) Awakening Reaction Level of 65 dBA in accordance with the ICNG. In accordance with the EIS NIA, the Out of Hours Works Construction Noise and Vibration Impact Statement (OOHW CNVIS) (refer to **Section 9.3.3**) would first assess the predicted maximum noise levels against the Sleep Disturbance Screening Level. If the Sleep Disturbance Screening Level is exceeded the maximum noise levels are then compared against the Awakening Reaction Level.

The Infrastructure Approval does not specifically nominate sleep disturbance NMLs, however, CoA E1 (refer to **Table 7**) presents an 65 dBA LA1(1 minute) Construction NML for Outside Standard Construction Hours which can control high noise level short duration events commonly associated with potential sleep disturbance. Experience on similar projects, suggests that the difference between the LA1(1 minute) and LAeq(15 minute) noise level from construction activities is typically less 10 dBA. Consequently, assessing and managing the Project noise emissions against the 45 dBA LAeq(15 minute) Construction NML for Outside Standard Construction Hours would adequately address the LA1(1 minute) Construction NML. Notwithstanding, all night-time noise works will be assessed against the CoA E1 65 dBA LA1(1 minute) Construction NML for Outside Standard Construction Hours.

Refer to **Section C7.5** in **Appendix C** for additional information on sleep disturbance.

Additionally, CoA E6 requires the OOHWs to be limited to no more than 5 dBA above the RBL (in accordance with the ICNG), unless otherwise approved under the OOHW Protocol. Refer to the OOHW Protocol (attached in **Appendix D**) for the processes for the consideration, management and approval of OOHWs.

7.6 Road Traffic Noise

The EIS found that the expected increase in road traffic noise due to the construction works to be less than the 2 dB allowance under the NSW Road Noise Policy (RNP) and does not require assessment. Accordingly, road traffic noise is not considered further in this CNVMP.

7.7 Workplace Health and Safety

It is prudent to consider the potential of noise exposure to construction workers and the public. Refer to **Section C7.7** in **Appendix C** for additional information.

Construction noise can induce hearing loss and typically occurs when individuals are exposed to excessive noise levels for extended periods of time (normally over several months or perhaps years). Alternatively, hearing damage can occur when a person is exposed to very high (peak) noise levels.

In accordance with the WHS Regulation, at no time can noise generated by construction exceed the National Standard for exposure to noise in the occupational environment of an eight-hour equivalent continuous A-weighted sound pressure level of LAeq(8 hour) of 85dBA for any employee working at a location near the Project site.

It is considered highly unlikely that any sensitive receiver, including pedestrians and staff of nearby businesses would be exposed to high noise levels (>85 dBA) for periods long enough to exceed the WHS criteria. Notwithstanding, signage should be posted around construction sites in order to inform the general public of high noise exposure areas.

However, a range of management and mitigation measures are available to ensure compliance with the WHS criteria for workers within and surrounding the site. Such measures may include:

- The use of hoarding and/or temporary noise barriers around the site.
- Rotation of employees to avoid high noise exposure areas for extended periods of time.

- Ensuring employees are given appropriate shift lengths and provided respite between shifts.
- Providing hearing protection to employees where appropriate.
- Providing specific WHS noise training to employers in order to provide awareness and guidance on managing their employees during highly noisy periods.

8 Construction Vibration Management Levels

CoA E2 nominates the following standards and guidelines which the Project is to comply with:

- CoA E2(a) vibration criteria established using the Assessing vibration: a technical guideline (AVTG) (DEC 2006) (for human exposure) (refer to **Section 8.1**);
- CoA E2(b) BS 7385 Part 2-1993 “Evaluation and measurement for vibration in buildings Part 2” as they are “applicable to Australian conditions” (refer to **Section 8.3**);
- CoA E2(c) vibration limits set out in the German Standard DIN 4150-3: Structural Vibration- effects of vibration on structures (for structural damage) (refer to **Section 8.4**); and
- CoA E2(d) minimum working distances to sensitive receivers as outlined in Table 3 of the CoA (refer to **Section 8.1** and **Table 9**).

8.1 CoA Minimum Working Distance

Upon applying the applicable mitigation measures, the minimum working distances to the vibration sensitive receivers are nominated in CoA E2 (Table 3) and reproduced in **Table 9**.

Table 9 CoA E2 Minimum Working Distance

Location	Plant	Description	Minimum Working Distance (m)		
			Cosmetic Damage		Human Comfort
			Residential	Heritage	Residential
All sensitive receivers	Jack Hammer	Hand-held	1	1	1
	Hydraulic Hammer (rock breaker)	300kg – <12t excavator	2	4	7
		900kg – <18t excavator	7	12	23
		1,600kg – <34t excavator	22	34	73
	Piling Rig	Hammer – 12t downforce	15	24	50

Note: The Department acknowledges that sensitive receivers may experience exceedances of these vibration criteria as the construction works approach the receivers. CoA E3 requires exceedances to be managed in accordance with this CNVMP.

The CoA E2 Minimum Working Distance offsets are shown on the maps presented in **Appendix B** (refer to **Section 9.3.2**) for the <12t and <18t excavator with rock breaker attachment.

The modelling in **Appendix B** provides the baseline CNVIS, with conservative levels of vibration to guide the application of the vibration mitigation measures (refer to EMMMs presented in **Table 12**) to localities. Where required, further Project Specific Safe Working Distances (refer to **Section 8.6**) may be developed to enhance the application of both EMMM and any *additional mitigation measure* required by specific sites. Should these Project Specific Safe Working Distances for the actual plant used be developed following commencement of the Project Works, they will then supersede the CoA Minimum Working Distances for corresponding plant.

8.2 Human Comfort Continuous and Impulsive Vibration Criteria

Vibration and its associated effects on people are usually classified as continuous, impulsive or intermittent as follows:

- *Continuous vibration*: machinery, steady road traffic, continuous construction activity such as underground drilling
- *Impulsive vibration*: infrequent activities that create up to three distinct vibration events in an assessment period, e.g. occasional dropping of heavy equipment, occasional loading and unloading
- *Intermittent vibration*: trains, nearby intermittent demolition activity, rock breakers and jack hammers.

Further information as to the applicable vibration criteria for human comfort are provided in **Section C8.1** in **Appendix C**.

Based on the above human comfort criteria, all sensitive receivers located within the 23 m Minimum Working Distance contour presented in **Appendix B** would likely feel vibration from the construction works, during the use of a <18t excavator with rock breaker attachment. The extent of the vibration perception would be reduced to sensitive receivers located within the 7 m Minimum Working Distance contour during the use of a <12t excavator with rock breaker attachment. The potential impacts resulting from the vibration would be mitigated and managed as described in **Section 10** based on the assessment presented in the CNVIS (refer to **Section 9.3.5**) and where required vibration monitoring would be undertaken (refer to **Section 11.7**) to ensure that the construction related vibration levels remain below the level at which damage can occur. Reference will be made to **Appendix B** to identify heritage structures requiring monitoring.

8.3 Cosmetic Damage Vibration Criteria

Structural vibration criteria are designed to minimise the risk of cosmetic surface cracks and are set well below the levels that have the potential to cause damage to the main structure. Structural damage criteria are presented in British Standard (BS) 7385-Part 2:1993 *Evaluation and Measurement for Vibration in Buildings* which have also been referenced and reproduced in AS 2187:2006 as they are applicable to Australian conditions and details are provided in **Section C8.3** in **Appendix C**.

Based on the above Cosmetic Damage Vibration Criteria, all structurally sound heritage structures, residential, commercial and industrial buildings located within the 7 m Minimum Working Distance contour presented in **Appendix B** would be exposed to potential exceedance of the CoA E2 vibration objectives during the use of a <18t excavator with rock breaker attachment. To mitigate this the contractor could reduce the size of the plant to a <12t excavator with rock breaker attachment or develop Project Specific Safe Working Distances for the required plant (refer to **Section 8.1** and **Section 8.6**). The potential impacts resulting from the vibration would be mitigated and managed as described in **Section 10**, including vibration monitoring would be undertaken (refer to **Section 11.7**) to ensure that the construction related vibration levels remain below the level at which damage can occur. Reference will be made to **Appendix B** to identify structures requiring monitoring. In particular, Newington Road, Marrickville has been identified as an area which the surrounding sensitive receivers are within the 7 m Minimum Working Distance for <18t excavator with rock breaker attachment contour. These building will require management and monitoring where works are undertaken with the <18t excavator with rock breaker attachment. TransGrid and its contractors may mitigate the need for further management and monitoring by reducing the Minimum Working Distance to 2m by using a 12t excavator with rock breaker attachment or developing additional Project Specific Safe Working Distances for the required plant (refer to **Section 8.1**).

There are a number of heritage areas which have been identified (refer to **Appendix B** and the Heritage Sub-Plan) and the buildings would be assessed against the cosmetic damage vibration criteria, unless found to be structurally unsound (refer to **Section 8.4**).

Roadways, pavements and heritage pavement, such as that found in the Llewellyn Estate Conservation Area, Juliett Street and Enmore Road, (refer to the Heritage Sub-Plan), are considered to be resistant to vibration induced damage likely to be generated from construction activities. There is no available literature for vibration induced damage to pavement, however, guidance can be sought from German Standard DIN 4150 which nominates a vibration limit of 80 mm/s for clay pipes, which can be conservatively adopted for the pavements. The maximum vibration level from the Project activities is anticipated to be of an order less than 80 mm/s (i.e. <8 mm/s). Accordingly, no vibration limit will be imposed on these assets.

Main control to avoid damage to the heritage pavement will be to not have direct physical impact with the pavement which will be achieved through the erection of physical barriers to delineate the Project activities from the heritage pavement. In addition, a pre-construction dilapidation survey will be conducted of the heritage pavement and additional monitoring will be conducted to confirm impact will be avoided in accordance with CoA E25(b).

8.4 Structural Damage to Structurally Unsound Heritage Buildings Vibration Criteria

BS 7385 notes that a building of historical value should not, unless it is structurally unsound, be assumed to be more sensitive. In the case of heritage listed buildings which are considered to be “structurally unsound”, guidance for structural damage can be derived from the German Standard DIN 4150-3 (2016-12) *Vibrations in Buildings - Part 3: Effects on Structures*. The guideline values for vibration levels for heritage buildings are detailed in **Section C8.4** in **Appendix C**.

All works are to be undertaken to comply with the above recommended vibration criteria. If compliance with the above levels is not being met using approved construction methods, alternative construction methods are to be considered, whilst assessment of the recommended velocity levels are reviewed in consideration of whether there is scope for altering the vibration criteria from the DIN 4150 vibration levels.

Based on the DIN 4150 Vibration Criteria, all structurally unsound heritage structures located within the 12 m Minimum Working Distance contour presented in **Appendix B** would be exposed to potential exceedance of the CoA E2 vibration objectives (refer to **Section 8.1** and **Section 8.6**), particularly during the use of a <18t excavator with rock breaker attachment, and therefore would require additional investigation. The potential impacts resulting from the vibration would be mitigated and managed as described in **Section 10**, including vibration monitoring would be undertaken (refer to **Section 11.7**) to ensure that the construction related vibration levels remain below the level at which damage can occur. Reference will be made to **Appendix B** to identify heritage structures requiring monitoring.

8.5 Buried Utilities Vibration Criteria

Vibration limits for buried utilities may be available from the asset owner. TransGrid and its Contractors will liaise directly with the asset owner (e.g. Sydney Water and Jemena) to confirm if there are any specific vibration limits nominated for the adjoining utilities. The following vibration criteria would also be adopted to control vibration emission to adjoining buried utilities.

The most relevant vibration damage criteria for evaluating the effects of transient vibration on buried pipework is the German Standard DIN 4150 Part 3 -1999 “*Structural Vibration - Part 5.3: Effects on Buried Pipework*” which provides the guideline values and are reproduced in detail in **Section C8.5** in **Appendix C**.

If the above criterion proves overly restrictive, modification of the recommended criterion may be made following a detailed in-situ vibration response trial of the pipeline itself and the surrounding ground.

8.6 Project Specific Safe Working Distances

Plant and activity specific vibration trials will be completed to establish safe working distances for the plant operation and verify vibration emission levels for comparison against the CoA E2 Minimum Working Distances presented in **Table 9**.

The Project Specific Safe Working Distances will be determined for:

- CoA E2(a) - Human comfort
- CoA E2(b) - Industrial, commercial, residential and structurally sound heritage
- CoA E2(c) - structurally unsound heritage

The predicted vibration emissions from the construction works will be reviewed following the vibration trials as detailed in **Section 11.2**.

8.7 Site Vibration Management Levels

Based on the information presented **Section 8.1** to **Section 8.5**, site specific vibration management levels have been nominated to ensure that vibration induced damage does not occur to structures close to the Project Works and that human comfort is kept within an acceptable level (see **Table 10**).

Table 10 Nominated Site Vibration Management Levels

Building type	Included Buildings	Site Specific Vibration Management Levels ¹	
		Operator warning level	Operator halt level
Reinforced frame structure	All surrounding industrial and reinforced concrete commercial/residential	20 mm/s PPV	25 mm/s PPV
Unreinforced or light framed structures	All surrounding brick and light framed commercial/residential	5 mm/s PPV	7.5 mm/s PPV
Heritage (structurally sound)	All Structures	5 mm/s PPV	7.5 mm/s PPV
Heritage (structurally unsound)	All Structures	2 mm/s PPV	3 mm/s PPV
Buried Utilities	All	20 mm/s PPV	25 mm/s PPV
Human Response ²	All	0.2 m/s ^{1.75} VDV	0.4 m/s ^{1.75} VDV
Vibration Sensitive Equipment ³	Medical Centre, Hospital	0.013 mm/s PPV	0.018 mm/s PPV

Note 1: An exceedance of the operator warning level does not require activities to cease but will alert the Site Manager to proceed with caution at a reduced force or load.

Note 2: Based on information presented in DECCW's Assessing Vibration: a technical guideline.

Note 3: Based on the Generic Vibration Criteria for Vibration-Sensitive Equipment (SPIE 1991).

9 Construction Methodology - Noise and Vibration Sources

9.1 Construction Activities

Construction activities would typically include the activities presented in **Section 2** and be confined to the Project Area shown in **Figure 1**.

Noise and vibration will be generated from a range of activities associated with the construction works, particularly during excavation activities.

Management of cumulative impacts (activities associated with the project)

Potential for cumulative noise impacts exists when there are two nearby activities associated with the construction of the project being performed. This would be avoided where possible through and managed to reduce potential impacts. Potential cumulative noise impacts from concurrent Project Works to the same sensitive receiver would be managed through project scheduling.

The management of cumulative works associated other nearby projects is discussed in **Section 9.4**.

Trenching: It is anticipated that up to five concurrent trenching crews would be required to undertake the Project Works. Trenching would be managed through project scheduling. Trenching crews would be allocated to separated sections of the alignment and would generally progress in an easterly direction to avoid potential convergence of trenching crews. The noise modelling shows that there if no cumulative noise impact for Standard Construction Hours Project Works separated by more than 400 m and Outside Standard Construction Hours Works separated by more than 200 m.

Joint Bay construction: Joint Bay excavation would typically be undertaken as part of the trenching crew activities and therefore manages any potential cumulative impact.

Special Crossing Works: There is the potential for cumulative noise impacts when trenching approaches the special crossings, however, the cumulative noise level will not increase the noise by more than 3 dB if conducted concurrently. Potential cumulative noise impacts from concurrent Project Works that have the potential to impact the same sensitive receivers will be reviewed and used to inform the appropriate level and allocation of additional mitigation measures based on cumulative noise levels. Special crossings would be managed through project scheduling.

Substations and other ancillary works: similar to the above, potential impacts would be avoided where possible and managed through scheduling.

9.2 Noise and Vibration Sources

9.2.1 Plant and Equipment at Source Noise Control

The proposed plant and equipment to be used during construction are identified in **Table 26** (in **Appendix C**) together with the nominated maximum allowable Sound Power Level (SWL) to manage noise emissions from the Project Works.

The nominated maximum allowable SWLs have been used in preparing the site specific CNVIS (refer to **Appendix B** and **Section 9.3.4**) that will be used to determine what further noise controls (refer to **Section 10.3**) will need to be implemented to minimise the noise impacts.

The plant and equipment Sound Power levels (SWL) auditing procedure is presented in **Section 11.5**.

9.2.2 Sound Power levels Comparison

The overall SWL comparison between the proposed equipment presented in this CNVMP (**Table 26**) against the proposed equipment nominated in the EIS for each construction activity is shown in **Table 11**.

Table 11 Overall SWL Comparison

Activity	Overall SWLs – dB(A)				Comparison	
	CNVMP		EIS		L _{Aeq} (15 minute)	L _{A1} (1 minute)
	L _{Aeq} (15 minute)	L _{A1} (1 minute)	L _{Aeq} (15 minute)	L _{A1} (1 minute)		
Trenching works	122	129	118	126	+4	+3
Joint Bay Installation	122	130	122	130	0	0
Cable Jointing Works	103	109	N/A	N/A	N/A	N/A
Cable Installation	108	116	108	116	0	0
Special crossings - Muir Road Bridge	125	133	118	126	+7	+7
Special crossings - Bedwin Road Bridge	126	133	118	126	+8	+7

Table 11 reveals that the CNVMP SWLs are up to 8 dBA higher than the EIS SWLs, primarily due to the proposed use of larger excavator hammers and intensification of plant and equipment required to deliver the Project than anticipated in the EIS. Accordingly, as a preliminary guide, the noise impacts emissions from the construction works are likely to be up to 8 dBA higher than that presented in the EIS.

The predicted noise emissions from the Project Works have been updated in the Baseline Construction Noise and Vibration Impact Statement (CNVIS) as presented in **Appendix B** (refer to **Section 9.3.2**).

9.2.3 Vibration Generating Plant and Activity

As required, alternatives to rock hammering methods and equipment will be reviewed to minimise impacts on sensitive receivers. The greatest potential for vibration generating activities would be associated with trenching and special crossing works, for which the intensity and duration of vibration is expected to be low. Notwithstanding, TransGrid and its Contractors will consider equipment selection and alternative construction methods and/or mitigation methods, such as rock sawing, for each activity of the Project Works.

The plant and equipment vibration emission auditing procedure is presented in **Section 11.5**.

The predicted vibration emissions from the construction works are presented in **Appendix B** (refer to **Section 9.3.2**).

9.3 Construction Noise and Vibration Impact Statements (CNVISs)

9.3.1 Construction Noise and Vibration Impacts Overview

The following provides an overview of the prediction and management of construction noise for the project. More specific details of the noise levels and the application of mitigation measure are provided in subsequent sections.

This CNVMP has established a *baseline* for the purpose of estimating noise impacts. This *baseline* has modelled noise emissions at the nearest sensitive receivers to the Project Area (as shown on the Land Use Map presented in **Appendix B**). The modelling is in accordance with the ICNG, including adjustments for annoying activities.

This *baseline* (**Appendix B**) is a conservative approach that has applied ‘worst case’ noise levels (in accordance with CoA E1) using, for example, an <18t excavator at the most affected receivers. It also identifies the receivers with noise (NML) exceedances.

A suite of noise environmental control measures (see **Section 10**) will be applied in accordance with this *baseline*. Where, for example, noise levels are predicted to exceed the noise management levels (NMLs, as nominated in CoA E1, refer to **Table 7**), additional management and mitigation measures (AMMM, refer to **Section 10.3.1**) can be applied to the affected sensitive receiver areas.

TransGrid and its contractors propose to use similar types of equipment as detailed in **Table 26** (in **Appendix C**). It is expected noise and vibration produced by the equipment will be consistent with its use on previous projects. The *baseline* noise levels are based on the use this equipment.

However, it is expected that there will be situations where lower noise generating equipment (for example, 12t or smaller excavators) and construction practices can be employed, albeit potentially extending the duration of construction activities. In such situations, a *Construction Noise and Vibration Impact Statement* (CVNIS) can be prepared which specifically models the lower noise generating equipment and practises as well as the characteristics of the specific area (such as the applicable distance attenuation and shielding from existing buildings and structures). Again, the noise environmental controls measures can be applied at the, now, reduced noise levels, to further minimise impacts.

9.3.2 Baseline Construction Noise and Vibration Impact Statement (Baseline CNVIS)

The Baseline CNVIS is presented in **Appendix B**. TransGrid and its Contractors will refer to the Noise Affected Zones presented in **Appendix B** which shows the estimated extent of noise emission levels from the use of a rock breaker planned to be used during the works (refer to **Table 26**). The Noise Affected Zones have been conservatively estimated to represent the worst-case noise emissions over the Project Area. Where appropriate, such as High Risk OOHWs, an OOHW CNVIS (refer to **Section 9.3.3**) will be prepared to include noise predictions based on the specific plant and equipment (for example, substitution with smaller equipment) to be used on the Project and the location of the required activities (for example, rock breakers would only be used in areas requiring rock excavation or breaking of concrete pavement). Accordingly, the extent of the Noise Affected Zones is expected to decrease with the production of the OOHW CNVIS (refer to **Section 9.3.3**).

The Noise Affected Zones correspond to the approximate offset distance within which the CoA E1 Construction NMLs (refer to **Table 7**) are likely to be exceeded.

The following Noise Affected Zones are presented in **Appendix B**:

- 45 dBA Noise Affected Zone - Outside Standard Construction Hours NML (OOHW NML)
- 55 dBA Noise Affected Zone - Standard Construction Hours NML (Standard NML), 10 dB above OOHW NML
- 65 dBA Noise Affected Zone - 10 dB above Standard NML, 20 dB above OOHW NML
- 75 dBA Noise Affected Zone - 20 dB above Standard NML, 30 dB above OOHW NML, Highly Noise Affected
- 85 dBA Noise Affected Zone - 30 dB above Standard NML, Potential of Work Health and Safety exposure

Appendix B also shows the Minimum Working Distances nominated in CoA E2 for the control of vibration emissions from the Project (refer to **Section 8**).

The following Minimum Working Distances are presented in **Appendix B**:

- 2 m Minimum Working Distances - Residential Cosmetic Damage limit for Rock breaker on <12t Excavator
- 4 m Minimum Working Distances - Heritage Cosmetic Damage limit for Rock breaker on <12t Excavator
- 7 m Minimum Working Distances - Residential Cosmetic Damage limit for Rock breaker on <18t Excavator
- 12 m Minimum Working Distances - Heritage Cosmetic Damage limit for Rock breaker on <18t Excavator
- 23 m Minimum Working Distances - Residential Human Comfort limit for Rock breaker on <18t Excavator

Based on measured vibration levels of rock breakers on other projects, the Minimum Working Distances nominated in CoA E2 would result in received vibration levels which are significantly lower than the vibration limits nominated in CoA E2. Accordingly, the extent of the Safe Working Distances (refer to **Section 8.6**) is expected to be less than the Minimum Working Distances nominated in CoA E2.

9.3.3 Out of Hours Works Construction Noise and Vibration Impact Statement (OOHW CNVIS)

The Baseline CNVIS presented in **Appendix B** will be used to identify the sensitive receivers where the CoA E1 Construction NMLs (refer to **Section 7.2**) and CoA E2 vibration (refer to **Section 8.1** and **Section 8.6**) objectives are likely to be exceeded to determine the required mitigation measures (refer to **Section 10**), where noise and vibration monitoring would be undertaken during the OOHWs (refer to **Section 11**) and provide input to the community and other stakeholders communication in accordance with CoA B1 and CoA B2 Community Communication Strategy (CCS). A specific OOHW CNVIS will be prepared for High Risk OOHWs (refer to the **Appendix D, OOHW Protocol**).

The specific OOHW CNVIS would be prepared prior to OOHWs commencing. High risk OOHW Applications (refer to the **Appendix D, OOHW Protocol**) will be submitted for review 4 weeks before the scheduled start date of the OOHW. However, work can commence upon the Secretary's approval.

For Project Works not requiring a specific OOHW CNVIS, potentially impacted sensitive receivers will be identified as being within the CoA E1 Construction NML Noise Affection Zones (refer to **Section 7.2**) and CoA E2 Minimum Working Distance offsets presented in **Appendix B**.

9.3.4 Construction Noise Impacts

The specific OOHW CNVIS would include predictive modelling of noise emissions at the nearest sensitive receivers to the Project Area (as shown on the Land Use Map presented in **Appendix B**). The noise modelling will be in accordance with the ICNG, including a 5 dB penalty adjustment for Annoying Activities (refer to Glossary). The noise predictions would take into account that construction noise will vary depending on the position of construction works within each critical work area and the duration of specific noise generating activities. The approach would include identifying 'worst case' noise levels at the most affected receivers adjacent to the Project Area as well as identification of receivers with NML exceedances. Where noise levels are predicted to exceed the NMLs as nominated in CoA E1 (refer to **Table 7**), the OOHW CNVIS would recommend additional management and mitigation measures (AMMM, refer to **Section 10.3.1**) for affected sensitive receivers. For Project Works not assessed under the specific OOHW CNVIS, reference will be made to the Baseline CNVIS in **Appendix B** to identify receivers within each AMMM Noise Affected Zone.

TransGrid and its contractors propose to use similar types of equipment as detailed in **Table 26** (in **Appendix C**) and expects noise and vibration produced by the works to be consistent with previous projects. Predicted noise levels are to be based on the above equipment noise levels, distance attenuation and shielding from existing building and structures where applicable.

9.3.5 Construction Vibration Impacts

The Baseline CNVIS presented in **Appendix B** includes the pertinent Minimum Working Distance offsets nominated in CoA E2 (refer to **Section 8.1**) which will be used determine equipment selection to manage the vibration emissions from the Project Works.

9.3.6 Dilapidation Surveys

The vibration monitoring procedure (refer to **Section 11**) is to be reviewed in accordance with the Pre-construction Dilapidation Report to ensure adequate monitoring to surrounding public infrastructure and buildings.

Public Infrastructure

Refer Construction Public Infrastructure Management Plan (CPIMP) Section 4.2.

Buildings

In accordance with EMMM NV14 and depending on the selected plant and equipment, pre-construction dilapidation reports will be undertaken for the following items using the CoA E2 Table 3 minimum working distances for cosmetic damage (refer to **Section 8.1**):

1. listed heritage items - minimum working distance for heritage; and
2. buildings within Heritage Conservation Areas (HCAs) that are not heritage listed - minimum working distance for residential

The dilapidation survey will document the condition of these buildings before construction commences and after construction is complete to confirm no impact as a result of the project construction. Building dilapidation surveys will be scheduled in consultation with property owners.

Refer to **Appendix B** for maps identifying minimum working distances as well as heritage buildings and HCAs.

9.4 Cumulative Works (external projects)

Where it has been identified that construction works from other projects are scheduled to be undertaken in the vicinity of the Project Area, TransGrid and its Contractors will consult with proponents of the other projects and take reasonable steps to coordinate works to minimise cumulative impacts of noise and vibration and maximise respite for affected sensitive receivers.

The steps taken to identify cumulative impacts include:

- At each 6 week look ahead scheduled with Councils, Taihan will provide an outline of its programmed work and collaborate with Councils to identify any nearby or adjacent planned works from projects external to PSF;
- A check will be made at Community and Stakeholder Reference Group (CSRG) that above action is identifying cumulative (external or internal) impacts; and
- Potential PSF (Internal) impacts (converging/nearby concurrent activities) will be assessed through construction programming and steps taken to avoid unnecessary exceedances. Refer to **Section 9.1** for more information.

10 Mitigation Measures

The EIS CNVIS identified the potential noise and vibration impacts to the surrounding sensitive receivers resulting from the construction works. The Amendment Report, prepared post the EIS being exhibited, describes the design refinements to the Project and identifies any changes to the environmental management and mitigation measures that are proposed to minimise environmental impacts that will be adopted for the Project and forms part of the CoA. Mitigation includes, controlling noise emissions from the Project, in order of priority, at the source, the transmission path and at the receiver. Supplementary controls will also be considered, if appropriate, primarily via temporary noise barrier around the perimeter of works to control high noise intrusion works, particularly from stationary OOHWs. No at receiver controls are anticipated. Notwithstanding the implementation of these mitigation controls, some noise and vibration disturbance is still anticipated. Accordingly, there will be a significant reliance on the management of potential impacts on receivers, with a particular emphasis on consultation and respite management. Details are provided in the sections below.

10.1 Community Consultation and Respite

A staged process has been identified for determining Out of Hours Works (OOHW) and the appropriate respite periods for the community at affected locations, namely:

Stage 1: Determine Presence of Sensitive Receivers:

Sensitive receivers have been defined in the Condition of Approval 'Definitions', vis:

Includes residences, educational institutions (including preschools, schools, universities, TAFE colleges), health care facilities (including nursing homes, hospitals), religious facilities (including churches), child care centres, passive recreation areas (including outdoor grounds used for teaching), commercial premises (including film and television studios, research facilities, entertainment spaces, temporary accommodation such as caravan parks and camping grounds, restaurants, office premises, and retail spaces), and others as identified by the Planning Secretary.

To determine if a sensitive receiver falls within a noise affected zones, refer to **Appendix B** Baseline Construction Noise and Vibration Impact Assessment (CNVIS) for worst case (i.e. 'conservative') scenario of generated construction noise.

If a sensitive receiver is located within 45 dBA to 85 dBA lines, the process proceeds to Stage 2, i.e. consultation.

If no sensitive receivers are present, then OOHW can proceed up to six consecutive nights in accordance with CoA E1 and CoA E6.

Stage 2: Consultation with Affected Sensitive Receivers:

Sensitive receivers within the green line (55 dBA) identified in **Appendix B** Baseline Construction Noise and Vibration Impact Assessment (CNVIS) and within 90 m radius of the OOHW will be consulted to identify appropriate respite periods and scheduling of OOHW.

Having determined which sensitive receivers are likely to be impacted by OOHW, it is necessary (under CoA E8) to consult with the affected community at each location. An overarching Community Communication Strategy (CCS, CoA B2) outlines how such community consultation is to be undertaken, for example, includes: information regarding current site construction activities, schedules and milestones at each construction location and procedures for the community to provide feedback for the proponent to respond to this feedback and mediate any disputes. The outcome of consultation is required to be provided to the Planning Secretary.

Further to this consultation, sensitive receivers within the blue line (45 dBA) and within 160 m radius of the OOHW will receive specific notifications prior to works commencing.

Stage 3: Baseline OOHW Respite

Where the above consultation process with sensitive receivers does not result in agreement, the Baseline OOHW Respite will apply so as not to result in noise levels exceeding the specified (CoA E1) at the same noise sensitive receivers on more than:

- i. Two (2) consecutive evenings and nights per week; and
- ii. Three (3) evenings and nights per week; and
- iii. Ten (10) evenings and nights per month.

Site specific construction techniques that minimise noise and vibration levels would be investigated and implemented where possible. However, where it is found that high noise impact activity is required, negotiation will be undertaken with the surrounding sensitive receivers to ensure respite during specific times, particularly during sensitive periods (refer to **Section 10.1.1**, **Section 10.1.2** and **Section 12**).

During 'Standard Construction Hours', the CoA (E5) and EMMM NV5, requires that if works, at the same receiver, which, if continuous and results in:

- the exceedance of the Highly Noise Affected Noise Management Level (HNML) of 75 dBA LAeq(15minute) or
- within the minimum working distances nominated in CoA E2 (refer to **Table 9**) for vibration intensive works the same noise sensitive receivers, that

the works should not exceed three hours each, with a minimum respite period of one hour between each block.

For the purposes of this CNVMP, 'continuously' includes any period during which there is less than one (1) hour respite between ceasing and recommencing any of the vibration intensive or high noise generating equipment.

For OOHW respite periods refer to the OOHW Protocol (**Appendix D**).

10.1.1 Protocol for Scheduling of Noise Generating Works in Vicinity of Potentially Affected Community

In accordance with CoA E10(c), TransGrid and its Contractors will implement a protocol for scheduling of noise generating works 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) outside sensitive periods as far as reasonable and feasible.

The outcomes of the community consultation (described above) will identify respite periods and the scheduling of the OOHW which will be provided to the ESM and PM (refer to **Section 12**). The affected community's preference for alternative hours and/or durations will be considered when confirming the schedule.

10.1.2 Protocol for Identification, Notification and Management that Exceed NMLs and Vibration Criteria

In accordance with CoA E10(d), TransGrid and its Contractors will implement a protocol for the identification, notification and management of works that exceed the noise management levels and/or vibration criteria, including provision for specialist heritage advice for any works that exceed the vibration criteria for cosmetic damage at heritage items (refer to **Section 7** and **Section 12**).

10.2 Standard Noise and Vibration Environmental Control Measures

Standard noise and vibration Environmental Control Measures (ECMs) to minimise noise and vibration related impacts during construction activities are applied in order to ensure the noise and vibration performance outcomes, identified in the EIS CNVIS, will be achieved. The ECMs are included in **Table 12**.

These ECMs will each alter the noise being produced in a different way. For example, the installation of localised noise barriers will be suitable for smaller or stationary items such as generators, whereas an equivalent reduction in noise would not be produced from trucks arriving and departing site. Similarly, respite periods may be required for certain activities. This might mean that underboring works can continue OOHs, however the excavation may be scheduled for standard daytime hours, plus possible respite period.

Table 12 Noise and Vibration Environmental Control Measures

ECM ID	Management and Mitigation Measures	Responsibility	Timing	EMMM / CoA Reference
Pre-construction				
ECM-NV01	<p>A CNVMP will be developed as part of the CEMP for the project and will include reasonable and feasible safeguards to manage the noise emissions from construction and manage any complaints which may be received. The CNVMP will include the following:</p> <ul style="list-style-type: none"> • identification of nearby residences and other sensitive land uses; • description of approved hours of work; • description and identification of all construction activities, including construction work sites, equipment and duration; • description of work practices (generic and specific) which will be applied to minimise noise and vibration; • a complaints handling process; • noise and vibration monitoring procedures; • overview of community consultation/notification required (see NV2); and • the Out-of-hours Protocol developed for the project. 	Project Director (PD)	Pre-construction	NV1 / E10

ECM ID	Management and Mitigation Measures	Responsibility	Timing	EMMM / CoA Reference
ECM-NV02	<p>Where feasible and reasonable, construction will be carried out during standard construction hours. However, given that some works will be required to be undertaken outside of standard construction hours, an 'Out-of-hours Protocol' will be prepared as part of the CNVMP.</p> <p>This will evaluate the potential noise impacts of specific out-of-hours works and recommend appropriate mitigations measures such as:</p> <ul style="list-style-type: none"> • community consultation with highly noise affected receivers; • procedures to determine negotiated outcomes in consultation with affected receivers (e.g. not scheduling construction during sensitive periods such as exams where construction is in the vicinity of schools); • specific mitigation measures such as respite periods; and • a monitoring program. 	Project Manager (PM)	Pre-construction	NV4 / E8, E9
ECM-NV03	Dilapidation/Condition Surveys of the surrounding public infrastructure (roads and footpaths) and required properties in accordance with CoA E31(a) (refer to Section 9.3.6)	Project Manager (PM)	Pre-construction	- / E32(a)
ECM-NV04	Register of Noise Sensitive Receivers including name and category of receiver.	Noise and Vibration Consultant	Pre-construction	- / -
ECM-NV05	Location of site access and egress and load out areas are to consider noise sensitive receivers and where feasible and reasonable to minimise reversing movements within the site. Also refer to ECM-NV17.	PM	Pre-construction	NV10 / -
General Construction				
ECM-NV06	<p>Equipment selection will consider potential noise and vibration impacts and quieter equipment and/or construction methods will be used where feasible and reasonable. Plant and equipment will:</p> <ul style="list-style-type: none"> • have an operating sound power level of no more than those listed in the Construction Noise and Vibration Impact Assessment in Appendix E of the EIS; • be maintained and operated in an efficient manner, in accordance with manufacturer's specifications, to reduce the potential for adverse noise and vibration impacts; • be fitted with non-tonal reversing beepers (or an equivalent mechanism); • be throttled down or shut down when not in use; • minimise noise through: 	PM	Pre-subcontractor engagement ongoing	NV9 / -

ECM ID	Management and Mitigation Measures	Responsibility	Timing	EMMM / CoA Reference
	<ul style="list-style-type: none"> - use of residential grade mufflers; - use of damped hammers such as “City” Model Rammer Hammers; and - silencing air parking brakes. <p>High noise generating plant will:</p> <ul style="list-style-type: none"> • be located so that the offset distance between the plant and adjacent sensitive receivers is maximised as far as possible; and • be directed away from sensitive receivers, where possible to do so. 			
ECM-NV07	<p>All project personnel, contractors and subcontractors will undergo an environmental induction. The induction will at least include:</p> <ul style="list-style-type: none"> • all project specific and relevant standard noise and vibration mitigation measures; • relevant licence and approval conditions; • permissible hours of work; • any limitations on high noise generating activities (e.g. use of jack hammering, rock breaking, piling rigs and diamond saws); • locations of nearest sensitive receivers; • construction employee parking areas; • designated loading/unloading areas and procedures; • site opening/closing times (including deliveries); • behavioural practices such as limiting the use of loud stereos/radios on-site and not dropping materials from height or metal items; • public complaints handling procedures; and • environmental incident management procedures. 	Project Director (PD), Civil Project Manager (CPM)	Ongoing	NV3 / -
ECM-NV08	<p>Residents and other sensitive receivers impacted by noise and/or vibration from the proposed works which is expected to exceed the NML and/or vibration criteria will be notified at least seven days prior to the commencement of the particular activity. The information provided to the residents and other sensitive receivers impacted will include:</p> <ul style="list-style-type: none"> • programmed times and locations of construction work; • the hours of proposed works; • construction noise and vibration impact predictions; and • construction noise and vibration mitigation measures to be implemented. 	CPM	Ongoing	NV2 / -

ECM ID	Management and Mitigation Measures	Responsibility	Timing	EMMM / CoA Reference
ECM-NV09	Where feasible and reasonable, construction will be carried out during standard construction hours. Where required to be completed outside of standard construction hours, in proximity to sensitive receivers, works generating high noise and/or vibration levels (including the use of rock breakers and diamond saws) will be scheduled during less sensitive time periods.	CPM	Ongoing	NV7 / E1
ECM-NV10	Respite periods during standard construction hours, will be identified in consultation with affected receivers. Respite options will be considered when sensitive receivers are within the minimum working distances for vibration intensive works or are highly noise affected receivers (experiencing noise levels above 75 dB(A)). Respite options will include consideration of amendments to work schedules. Vibration intensive or high noise generating equipment will be used in continuous blocks, not exceeding three hours each, with a minimum respite period of one hour between each block.	CPM	Ongoing	NV5 / E5
ECM-NV11	Night works, where applicable, should be programmed to minimise the number of consecutive nights work impacting the same residential receivers	CPM	Ongoing	- / -
ECM-NV12	The need to consider respite periods will be triggered where the LAeq(15min) noise levels exceed 75 dB(A) at the same receiver after midnight for more than three consecutive nights. Where this level is exceeded, respite periods will be considered in accordance with the Out-of-hours Protocol (refer to NV4). Respite for OOHW will also be determined in accordance with CoA E9.	CPM	Ongoing	NV6 / E5, E8(c)
ECM-NV13	Complaints management will be outlined in the Complaints Management System (CMS).	Senior Community Engagement Consultant (SCEC) PD	As received	- / -
ECM-NV14	A noise monitoring program will be implemented for the duration of the works in accordance with the CNVMP and will focus on the use of high noise generating plant (e.g. jack hammering, rock breaking, piling rigs and diamond saws) and works outside of standard construction hours.	CPM SCEC	Ongoing/As required	NV8 / E10(e)

ECM ID	Management and Mitigation Measures	Responsibility	Timing	EMMM / CoA Reference
ECM-NV15	<p>If vibration intensive equipment is to be used within the minimum working distances for cosmetic damage, then it is recommended that a different construction method with lower source vibration levels is used where feasible and reasonable.</p> <p>Where work within the minimum working distances for cosmetic damage is planned to occur:</p> <ul style="list-style-type: none"> attended vibration measurements will be undertaken at the work site when work commences, to determine site specific minimum working distances. As a precaution, where practicable, these measurements will be made at distances outside the minimum working distances to ensure no structural damage occurs and will provide detailed information regarding the transmission of vibration to allow site specific safe working distances to be determined; and for listed heritage items and houses within Heritage Conservation Areas (HCAs), building conditions surveys will be undertaken. The survey will document the structural condition of these buildings/structures before construction commences and after construction is complete to identify any impacts on historical buildings/structures as a result of the project construction. Building condition surveys will be scheduled in consultation with property owners. <p>Vibration intensive work will not proceed within the minimum working distances (recommended or site specific) unless a permanent vibration monitoring system is installed to warn operators when vibration levels are approaching the peak particle velocity objectives as outlined in DIN 4150.</p> <p>For work scheduled to occur near a building, within the minimum working distance for human comfort but outside the minimum working distance for cosmetic damage, the affected receivers will be notified.</p>	CPM SCEC	Ongoing/As required	NV14 / -
ECM-NV16	Minimise structure-borne noise to neighbouring buildings such as separating connection prior to hammering by means of saw cutting.	PM	As required	- / -

ECM ID	Management and Mitigation Measures	Responsibility	Timing	EMMM / CoA Reference
ECM-NV17	<p>Potential noise impacts from construction vehicles will be minimised through the following:</p> <ul style="list-style-type: none"> • traffic flow, parking and loading/unloading areas will be planned to minimise reversing movements within the work sites and at construction laydown areas; • loading and unloading of materials/deliveries will occur as far as possible from sensitive receivers; • shielding loading/unloading areas if close to sensitive receivers, where feasible (i.e. breaking the line of site between the area and the receiver); • fitting delivery vehicles with straps rather than chains for unloading, wherever possible; • selecting construction laydown area access points and roads as far away as possible from sensitive receivers; • locating delivery and haulage routes away from sensitive receivers, where possible; • scheduling deliveries during less sensitive times, where possible; • limiting the speed of vehicles; • restricting the use of engine compression brakes; and • maximising the storage capacity of construction laydown areas to reduce the need for truck movements during sensitive times (between midnight and 7:00 am). 	CMSS	Ongoing	NV10 / -
ECM-NV18	<p>The use of road plates will be minimised, where possible. Where required to be used, the plates will be installed in a manner that minimises the potential for displacement by traffic loading and minimises any height difference with the adjacent road surface in order to reduce the potential for impact noise generation from tyres traversing the plates.</p>	CMSS	Ongoing	NV11 / -
ECM-NV19	<p>Low noise emitting plant and equipment (such as those with built-in shielding and mufflers) will be used wherever possible. Noise generating plant at work sites (such as compressors and generators) will be directed away from and situated furthest away from sensitive receivers, where practicable. Machinery that is not in use will be switched off.</p>	CMSS	Ongoing	NV12 / -
ECM-NV20	<p>Structures will be used to shield residential receivers from noise such as use of hoarding/noise curtains, where practicable, at construction laydown areas and special crossing work sites.</p>	CMSS	As required	NV13 / -

ECM ID	Management and Mitigation Measures	Responsibility	Timing	EMMM / CoA Reference
ECM-NV21	Installation of localised temporary noise barriers around noisy areas where noise monitoring indicates that the existing measures are not adequate to meet noise goals.	CMSS	As required	- / -
ECM-NV22	Modifications or alterations to plant and equipment i.e. consider use of alternative excavator attachments.	CMSS	As required	- / -
ECM-NV23	Equipment which is used intermittently is to be shut down when not in use.	CMSS	As required	- / -
ECM-NV24	Avoiding the coincidence of noisy plant working simultaneously close together and adjacent to sensitive receivers to result in reduced overall noise emissions	CMSS	As required	- / -
ECM-NV25	Alternate construction method or other negotiated outcomes with the affected community.	SCEC CMSS	As required	- / -
Plant and Equipment				
ECM-NV26	Where feasible and reasonable noise intensive construction activities, including rock/concrete hammering, shall be undertaken during less sensitive daytime periods.	CMSS	Ongoing	- / -
ECM-NV27	Air brake silencers are to be correctly installed and fully operational for any heavy vehicle that access the Project Area.	CM, CMSS	Ongoing	- / -
ECM-NV28	Regular maintenance on plant and equipment to include compliance checks on plant noise emissions against the maximum plant SWLs presented in Table 26 . Service and performance records are reviewed as per Incoming Plant Inspection Checklist.	CMSS	Ongoing	- / -
ECM-NV29	All plant and equipment are to be maintained in good order and in accordance with manufacturer's recommendations. Plant or equipment causing excessive noise are to be modified or if required removed from site.	CM, CMSS	Ongoing	- / -
Post Construction				
ECM-NV30	A post-construction Dilapidation/Condition survey will be carried out with the agreement of the property owner/occupier on the surrounding infrastructure (including footpath and roads) and buildings in accordance with CoA E32(b) for all items that that were the subject of the Pre-construction Dilapidation Report (refer to CoA E32(a)). Reports are to be submitted to the Principal's Representative for review as per the contract.	CM	Post-construction	- / E32(b)

10.3 Implementation of Further Environmental Control Measures

A range of ECMs have been recommended to reduce and control potential construction noise impacts.

Applicable mitigation measures will be applied during the construction planning and site establishment phases of the Project, and in the development of the CNVIS (refer to **Appendix B** and **Section 9.3**). This will include the investigation and the selection of alternative methods for construction activities that affect sensitive receivers. Equipment selection will be undertaken during the development of the CNVIS, based on the predicted noise levels, additional plant equipment will be selected for use wherever practicable.

The construction noise mitigation measures are recommended to minimise potential for disturbance at receivers, preserve the acoustic amenity of the surrounding environment and aim to control noise levels within the construction NMLs.

10.3.1 Additional Mitigation Measures

Additional noise mitigation measures to be explored in the CNVIS (refer to **Section 9.3**) in the event of predicted exceedances of the NMLs (particularly during OOHWs). The Baseline CNVIS (refer to **Appendix B**) identifies the level of noise impact which triggers consideration of each additional mitigation measure (reproduced in **Table 13** and **Table 14**).

The potential additional mitigation measures are summarised below, with discussion of their potential applicability to the Project Works. The Baseline CNVIS presents the modelling of impacts of the residual noise, after noise reduction measures are determined, the following additional noise mitigation measures, below, will be considered. During the planning of the works the Community Relations Team (CRT) will liaise with the Project team for the implementation of the selected measures. The objective of these additional noise mitigation measures is to engage, inform and provide Project-specific messages to the community, recognising that advanced warning of potential disruptions can assist in reducing the impact.

- **Periodic Notifications** - Periodic notifications include regular newsletters, letterbox drops or advertisements in local papers to provide an overview of current and upcoming works and other topics of interest.
- **Website** - The Project website would form a resource for members of the community to seek further information, including noise and vibration management plans and current and upcoming construction activities.
- **Project Info-line and Construction Response Line** – The CRT will operate a 1800 community information line. The number provides a dedicated 24-hour contact point for any complaints regarding construction works and for any Project enquiries. All complaints and enquiries will be responded to in accordance with the Contractor Community Liaison Plan (CCLP).
- **Email Distribution List** - An email distribution list would be used to disseminate Project information to interested stakeholders.
- **Signage** - Signage on construction sites would be provided to notify stakeholders of Project details and Project emergency or enquiry information.
- **Specific Notifications (SN)** - Specific notifications would be letterbox dropped or hand distributed to the nearby residences and other sensitive receivers no later than seven days ahead of construction activities that are likely to exceed the noise objectives. This form of communication is used to support periodic notifications, or to advertise unscheduled works.
- **Phone Calls (PC)** - Phone calls may be made to identified/affected stakeholders within seven days of proposed work. For these works considering the large numbers of receivers, phone calls are not likely to be considered a reasonable mitigation measure in all cases, but could be used to inform specific receivers if requested (after notification of the works as above).

- **Individual Briefings (IB)** - Individual briefings may be used to inform stakeholders about the impacts of high noise activities and mitigation measures that will be implemented. The Stakeholder and Community Relations Manager would visit identified stakeholders at least 48 hours ahead of potentially disturbing construction activities. For these works considering the large numbers of potentially affected receivers, individual briefings may not be considered a reasonable mitigation measure in all cases, but could be used for specific receivers if requested (after notification of the works as above).

If it is not convenient for stakeholder to be available for an individual briefing a phone call (PC) will be offered to provide the briefing.

- **Monitoring (M)** - Regular noise monitoring during construction at sensitive receivers during critical periods would be used to identify and assist in managing high risk noise events. Monitoring of noise would also be undertaken in response to complaints. All noise monitoring would be carried out in accordance with the required standards and procedures.
- **Project Specific Respite Offer (RO)** - Residents subjected to lengthy periods of noise or vibration may be eligible for a Project specific respite offer. The purpose of such an offer is to provide residents with respite from an ongoing impact. An example of a respite offer might be pre-purchased movie tickets. The provision of this measure would be determined on a case-by-case basis.

Table 13 Additional Mitigation Measures Matrix (AMMM) - Airborne Construction Noise

Time Period		Mitigation Measures Predicted LAeq(15minute) Noise Level Above Construction NMLs ¹			
		0 to 10 dB	10 to 20 dB	20 to 30 dB	> 30 dB
Standard	Mon-Fri (7.00 am - 6.00 pm)	-	-	M, SN	M, SN
	Sat (8.00 am - 1.00 pm)				
	Sun/Pub Hol (Nil)				
		0 to 5 dB	5 to 15 dB	15 to 25 dB	> 25 dB
OOHW	Mon-Fri (6.00 pm - 10.00 pm)	SN	SN	M, SN	M, IB or PC, RO, SN
	Sat (1.00 pm - 10.00 pm)				
	Sun/Pub Hol (8.00 am - 6.00 pm)				
		0 to 5 dB	5 to 15 dB	15 to 25 dB	> 25 dB
OOHW	Mon-Fri (10.00 pm - 7.00 am)	SN	M, SN	M, IB, PC, SN	M, IB, PC, RO, SN
	Sat (10.00 pm – 8.00 am)				
	Sun/Pub Hol (6.00 pm – 7.00 am)				

Note 1: Refer to **Table 7** for NMLs.

Note 2: Additional Mitigation Measure terms (e.g. “SN”) described in **Section 10.3.1**.

Reference will be made to **Appendix B** to identify receivers within each AMMM Mitigation Measures category by identifying the corresponding Noise Affected Zone (in **Appendix B**) for each NML (refer to CoA E1 Construction NMLs **Section 7.2, Table 7**).

Table 14 AMMM - Ground-borne Vibration

Time Period		Mitigation Measures Vibration Intensive Operated closer than Minimum Working Distance for Human Comfort ¹
Standard	Mon-Fri (7.00 am - 6.00 pm)	M, SN, RP
	Sat (8.00 am - 1.00 pm)	
	Sun/Pub Hol (Nil)	
OOHW	Mon-Fri (6.00 pm - 10.00 pm)	M, IB or PC, RO, SN
	Sat (1.00 pm - 10.00 pm)	
	Sun/Pub Hol (8.00 am - 6.00 pm)	
OOHW	Mon-Fri (10.00 pm - 7.00 am)	M, IB or PC, SN
	Sat (10.00 pm - 8.00 am)	
	Sun/Pub Hol (6.00 pm - 7.00 am)	

Note 1: Refer to **Table 9** for minimum working distances. Minimum working distances to be replaced by Project Specific Safe Working Distances based on plant and activity specific vibration trials (refer to **Section 8.6**).

Note 2: Additional Mitigation Measure terms (e.g. "SN") described in **Section 10.3.1**.

11 Noise and Vibration Monitoring

11.1 Compliance Monitoring and Reporting Program

As required by CoA A14, Compliance reports in accordance with the Department's *Compliance Reporting Requirements (DPE, 2018)* will be carried out. Further, DPIE must be notified of construction commencement at least one (1) month prior.

11.2 Details of All Monitoring of the Project to be Undertaken

Management and control of noise and vibration impacts shall be monitored and assessed as described below.

Operator-attended noise and vibration measurements will be undertaken within a period of 14 days from the commencement of each construction activity at the nearest noise and vibration sensitive receivers in order to confirm that the noise and vibration levels in the adjacent sensitive receivers are consistent with the applicable CNVIS (refer to **Appendix B** and **Section 9.3**). The measured noise and vibration levels would be assessed against the CoA E1 Construction NMLs (refer to **Section 7.2**) and CoA E2 vibration objectives (refer to **Section 8.1**). Operator-attended noise measurements would be repeated at a minimum interval of every month for each construction activity in order to ensure ongoing compliance.

Operator-attended vibration surveys will be undertaken to determine site specific minimum working distances from each construction activity at each work site when work commences. The Operator-attended vibration surveys would also be conducted for all initial works being undertaken closer than the CoA Minimum Working Distance (refer to **Table 9**) to ensure that the construction activity does not cause structural or cosmetic damage to the nearby buildings.

Real-time continuous noise and vibration monitoring would be implemented for highly intrusive construction works at nominated representative receivers or at the most affected receiver, where high noise or vibration impacts have been predicted in the CNVIS (refer to **Appendix B** and **Section 9.3**), or in response to complaints.

11.3 Location of Monitoring

The CNVIS (refer to **Appendix B** and **Section 9.3**) identifies specific sensitive receivers that require noise and vibration monitoring due the predicted high level of potential impacts. In particular, the CNVIS identifies all heritage structures that require vibration monitoring.

11.4 Frequency of Monitoring to be Undertaken

Table 15 presents the noise and vibration monitoring program for the construction works.

Noise measurements will be undertaken consistent with the procedures documented in *AS 1055.1-1997 Acoustics - Description and Measurement of Environmental Noise - General Procedures*.

Vibration measurements will be undertaken in accordance with the procedures documented in the OEH's *Assessing Vibration - a technical guideline (2006), BS 7385: Part 2-1993 Evaluation and measurement of vibration in buildings* and *DIN 4150:Part 3-1999 Structural Vibration - Effects of Vibration on Structures*.

Table 15 Noise and Vibration Monitoring Program

Type	Location	Timing/Frequency	Purpose
Operator-attended Noise	The nearest noise sensitive receivers	Within 14 days from the commencement of each construction activity. Monthly.	Verify CNVIS noise prediction. Verify compliance.
Operator-attended Vibration	All heritage listed area/structure	Within 14 days from the commencement of vibration generating activity. Monthly.	Establish safe working distances for vibration intensive equipment. Verify compliance.
Real-time Continuous Noise and Vibration	The nearest noise sensitive receivers	Within 14 days from the commencement of highly intrusive construction works.	Ensure ongoing compliance and provide real-time data to TransGrid and its Contractors.
"Roving" Real-time Continuous Noise and Vibration	Roving monitor to be rotated between affected receivers as predicted in the CNVIS. Where there are multiple receivers in different localities with high noise or vibration impacts predicted, multiple monitors may be required. Specific receivers for ongoing complaints management.	Predicted high noise or vibration impacts. In response to complaints or concern for ongoing management.	Ensure ongoing compliance and provide real-time data to TransGrid and its Contractors.
Operator-attended Noise and/or Vibration)	At complainant or representative location	In response to complaints or as required	To quantify noise and/or vibration emissions relating to complaints.

11.5 Plant and Equipment Noise Auditing

Internal compliance auditing of plant and equipment noise emissions would be undertaken via operator-attended measurements of a representative selection of plant and equipment used on-site are to be undertaken. The representative items of equipment are to be regularly monitored to confirm that the operating noise levels of all noise intensive plant items comply with the recommended SWLs (LAeq) presented in **Table 26**.

11.6 Noise Monitoring

Noise monitoring would be undertaken as required as per the Noise and Vibration Monitoring Program presented in **Table 15** or as instructed by the ESM or representative. The initial noise monitoring would measure airborne and ground-borne noise to assess whether construction activities exceed predictions in the CNVIS. Determination would be made if the existing noise controls on site are adequate or whether changes are required for proceeding works.

Monitoring undertaken on private property is to be followed in accordance with the CNVIS (refer to **Appendix B** and **Section 9.3**), including notification if agreement from the property owner/occupier is not granted.

Noise monitoring is to occur within the Noise Affection Zones identified in **Appendix B** or other identified monitoring location.

11.6.1 Parameters of the Project to be Monitored

All noise monitoring will be recorded over 15 minute sample intervals. Every 15 minutes, the data is to be processed statistically and stored in memory. The minimum noise metrics to be stored in memory and reported are the following A-weighted noise levels: L1, L90, Leq and Lmax.

11.6.2 Reporting of Monitoring Results

All noise monitoring will record the following information as a minimum:

- The precise monitoring location.
- Name of the person undertaking monitoring (in the case of attended monitoring) and site manager.
- Details of the instrument used for the measurement including make, model, serial number and last calibration date.
- Date and time of test.
- Weather condition during test, including air temperature, wind speed, wind direction and details of rain/wet conditions if applicable.
- Plant and equipment operating at the time of measurement (in the case of attended monitoring).
- Measured 15 minute noise level(s) at the monitoring location, including LAeq, Lmax and LA90 statistical parameters.

11.6.3 Procedures to Identify and Implement Additional Mitigation Measures Where Results of Monitoring are Unsatisfactory

Where monitored noise levels are found to be above predictions or noise goals (higher of CoA E1 Construction NMLs (refer to **Section 7.2**) or CNVIS predicted noise levels (refer to **Appendix B** and **Section 9.3**)) are exceeded, the following actions will be undertaken:

- Confirm that monitored levels are not being impacted by other noise sources;
- Implement other feasible and reasonable measures which may include reducing plant size, modify time of works, changing operational settings (such as turning off the vibratory function of the machine), and utilising alternate construction methodology or a combination of these;
- Review work practices to ensure compliance with the CNVMP and Interim Construction Noise Guideline (ICNG);
- Confirm if the exceedance is due to an uncharacteristically loud piece of equipment;
- Identify if equipment can be swapped out for another piece of equipment or alternative equipment or plant;
- Confirm if the exceedance is due to an uncharacteristically vibratory piece of equipment;
- Confirm that the modelling reflects the actual activity being undertaken; and
- Ensure that learning's from the above are fed back into the noise modelling assessment process (refer to **Section 9**).

Previously recorded non-conformances will also be considered during the planning of further Project Works.

11.7 Vibration Monitoring

Vibration monitoring is to be undertaken in accordance with the Noise and Vibration Monitoring Program presented in **Table 15** to assess the vibration impacts on the adjacent buildings and occupants. Continuous vibration monitoring will be undertaken at vibration sensitive receivers, particularly heritage items, identified in the CNVIS (refer to **Appendix B**) as being within the Project Specific Safe Working Distances.

If ongoing vibration monitoring is required peak vibration levels are recorded and trigger an audible/visual alarm and/or SMS Alert corresponding to both "Operator Warning Level" and "Operator Halt Level" set according to Nominated Site Vibration Management Levels presented in **Table 10**.

Monitoring can also be undertaken at various stages of construction to determine the effect in alterations to the construction methodology, or as proximity of the works approaches adjacent receivers, or if deemed appropriate and after consultation with the various stakeholders.

In response to vibration complaints additional monitoring may be undertaken to investigate and assess the extent and source of vibration exceedances and to apply mitigation measures preventing the complaint from reoccurring. In particular, if complaints are received from sensitive receivers which are closer to the works than the CoA E2 Minimum Working Distance (refer to **Table 9**) then either operator-attended and/or continuous unattended vibration monitoring would be undertaken in order to adequately manage the complainant's concerns. The CoA E2 Minimum Working Distance offsets are shown on the maps presented in **Appendix B** for the <12t and <18t excavator with rock breaker attachment. Receivers located further than the CoA E2 Minimum Working Distance would generally not require vibration monitoring, even in response to complaint.

11.7.1 Parameters of the Project to be Monitored

All vibration monitoring will be recorded over a minimum 15 minute sample interval. For every sample, the data is to be processed statistically and stored in memory. The minimum vibration metrics to be stored in memory and reported are the following vibration levels: Vibration Dose Value VDV, RMS, Peak Particle Velocity (PPV) and Frequency (Hz).

11.7.2 Reporting of Monitoring Results

All vibration monitoring will record the following information as a minimum:

- The precise monitoring location.
- Name of the person undertaking monitoring (in the case of attended monitoring) and site manager.
- Details of the instrument used for the measurement including make, model, serial number and last calibration date.
- Date and time of test.
- Plant and equipment operating at the time of measurement (in the case of attended monitoring).
- Measured vibration level(s) at the monitoring location, including the Peak Particle Velocity (PPV), the dominant frequency of vibration (in Hz).

11.7.3 Procedures to Identify and Implement Additional Mitigation Measures Where Results of Monitoring are Unsatisfactory

Where monitored vibration levels are found to be above predictions or vibration goals (higher of CoA E2 Construction Vibration Management Levels (refer to **Section 8.7**) or Baseline CNVIS predicted vibration levels (refer to **Appendix B** and **Section 9.3.2**)) are exceeded, the following actions will be undertaken:

- Confirm that monitored levels are not being impacted by other vibration sources;
- Implement other feasible and reasonable measures which may include reducing plant size, modify time of works, changing operational settings (such as turning off the vibratory function of the machine), and utilizing alternate construction methodology or a combination of these;
- Review work practices to ensure compliance with the CNVMP and Interim Construction Noise Guideline (ICNG);
- Confirm if the exceedance is due to an uncharacteristically high vibration generating piece of equipment;
- Identify if equipment can be swapped out for another piece of equipment or alternative equipment or plant;
- Confirm that the modelling reflects the actual activity being undertaken; and
- Ensure that learning's from the above are fed back into the vibration modelling assessment process (refer to **Section 9**).

Previously recorded non-conformances will also be considered during the planning of further Project Works.

11.8 Reporting

The noise and vibration compliance monitoring reports will be prepared in accordance with *Compliance Reporting Requirements (DPE, 2018)* throughout the construction of the Project.

The noise and vibration compliance monitoring reports will be submitted to the Project Director (PD) , Project Manager (PM), Environment & Sustainability Manager (ESM), Civil Project Managers (CPMs) and Site Managers (SMs) with noise and/or vibration monitoring results and details of affected sensitive receivers within one week of being undertaken or at weekly intervals for continuous monitoring. In the case of noise exceedances, details of the plant or operations causing the exceedances along with corrective action and the status of its implementation are to be supplied.

Compliance reports will be submitted to the Planning Secretary in accordance with the Compliance Monitoring and Reporting Program (CMRP) prepared in accordance with CoA 14, CoA 15 and CoA 16.

11.9 Inspections

An activity log will be used on site to keep an accurate record of construction activities on a daily basis. If required, the activity log will be used to correlate on-site activities with measured noise and vibration levels and/or complaints. The acoustic consultant may periodically review the proposed monitoring program with the aim to reduce or increase the monitoring depending on monitoring results and community feedback received.

The Construction Managers Site Superintendent (CMSS), Environment & Sustainability Manager (ESM) or nominated representative is to conduct regular site inspections, observing any instances of excessively noisy machinery or key activities that are associated with the works. Noise or vibration records are to be reviewed for potential issues arising from works. Results from the inspection are then to be recorded on an environmental checklist.

12 Communication, Community Consultation and Reporting

TransGrid and its Contractors' objective is to establish and maintain effective consultation and communication throughout the life of the project in accordance with CoA B2 *Community Communication Strategy (CCS)*. Community consultation will assist in managing impacts from noisier operations and alleviating community concerns thereby minimising complaints. The CCS includes the following consultation:

- Periodic notification of construction activities
- Specific works notification prior to disruptive or noisy activities, including notification of planned activity:
 - In accordance with **Table 14**.
 - In accordance with **Table 13**.
 - When undertaking works applicable to CoA E6 (refer to **Section 6.3**).
- Home and business plans to be carried out in advance of work in the locations impacted by out of hours work. These will identify specific community and business requirements and sensitive time periods (refer to **Section 10.1** Community Consultation and Respite, for further details).
- Consultation will be carried out as per CoA E9 to identify appropriate respite periods for the OOHW in consultation with the community and noise sensitive receivers at each affected location for a period of no less than two months.
- Notification procedure for emergency works to DPIE and noise and/or vibration affected sensitive receivers of the likely impact and duration of those works.

- Implementation of the Complaints Management System to manage noise and vibration complaints and enquiries will be as per the Complaints Management Procedure outlined in Contractor Community Liaison Plan. The complaints management procedure flow chart is provided in **Section 12.2**.
- TransGrid has established a quarterly Community and Stakeholder Reference Group (CSRG), at each meeting TransGrid and its Contractors will provide a summary of current and upcoming work, issues and provide an update on complaints and actions taken.
- TransGrid and its Contractors will regularly meet with councils to discuss works within their LGA and current or emerging issues.

TransGrid and its Contractors will be responsible for the overall management and coordination of stakeholder community liaison and ensuring notifications and consultation are provided within adequate periods. TransGrid will be responsible for managing escalated community and stakeholder issues relating to noise and vibration and will take the lead on overall project communications (including periodic newsletters, web and media).

All community consultation is to be in accordance with the Community Communication Strategy (CCS) prepared in accordance with CoA B1 to CoA B3.

12.1 Communication and Reporting

Table 16 presents the reporting and communication summary requirements during the Project.

Table 16 Reporting and Communication Summary Requirements

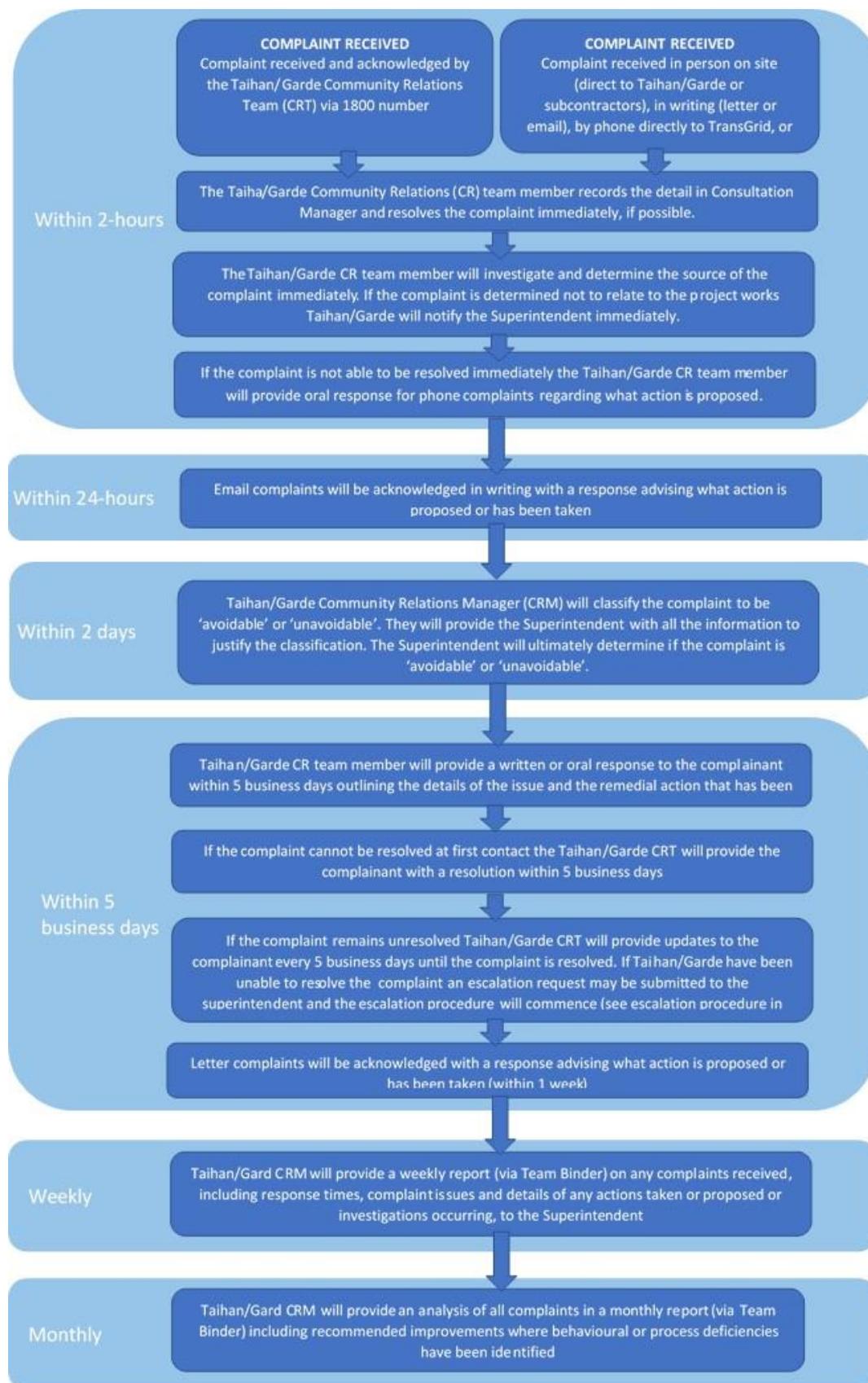
Reporting & Communication	Frequency	Responsibility	Report To
Daily Prestart Meetings	Daily	Site Managers (SM)	Place on Noticeboard Civil Project Manager (CPM) Environment & Sustainability Manager (ESM)
Toolbox Meeting	As required	CPM	Project Manager (PM) ESM
Monitoring Reports	As occurs	ESM	Project Director (PD)

12.2 Noise Complaints and Community Consultation

A Complaints Management System (CMS) prepared in accordance with CoA B4-B6 will be developed before the commencement of any construction works. All complaints handling is to be in accordance with the CMS. Complaints and response actions are documented in the Complaints Register maintained in accordance with CoA B7 and CoA B8. The CMSS is to promptly refer all noise and vibration complaints to the CRT.

All noise and vibration complaints will be handled as per the Complaints Management Procedure flowchart depicted in **Figure 7**.

Figure 7 Complaints Management Procedure Flowchart



13 Review of CNVMP

13.1 Continuous Improvement

Continuous improvement of this CNVMP will be achieved by the ongoing evaluation of environmental management performance against environmental policies, objectives and targets to identifying opportunities for improvement.

The continuous improvement process will be designed to:

- Identify areas of opportunity for improvement of environmental management and performance
- Determine the cause or causes of non-conformances and deficiencies
- Develop and implement a plan of corrective and preventative action to address any nonconformances and deficiencies
- Verify the effectiveness of the corrective and preventative actions
- Document any changes in procedures resulting from process improvement
- Make comparisons with objectives and targets.

13.2 CNVMP Update and Amendment

Refer CEMP Section 8.4.

Appendix A

Compliance Matrices Conditions of Approval and Environmental Management Mitigation Measures

A1 Infrastructure Approval SSI 8583 – Conditions of Approval

The CoA relevant to this CNVMP are listed **Table A1**. A cross reference is also included to indicate where the CoA is addressed in this CNVMP or other Project documents.

Table A1 Compliance Matrix – Minister’s Conditions of Approval

CoA Requirement	Reference	How addressed						
CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN								
<p>C3. The following CEMP Sub-plans must be prepared in consultation with the relevant government agencies identified for each CEMP Sub-plan in Table 1.</p> <p>Table 1 – CEMP Sub-plans</p> <table border="1" style="margin-left: 40px;"> <thead> <tr> <th style="background-color: #cccccc;"></th> <th style="background-color: #cccccc;">Required CEMP sub- plan</th> <th style="background-color: #cccccc;">Relevant government agencies to be consulted for each CEMP sub-plan</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">(b)</td> <td>Noise and vibration</td> <td>EPA Relevant Council(s)</td> </tr> </tbody> </table>		Required CEMP sub- plan	Relevant government agencies to be consulted for each CEMP sub-plan	(b)	Noise and vibration	EPA Relevant Council(s)	This CNVMP	All stakeholders identified in the CoA were consulted. Evidence of consultation is summarised in Appendix E
	Required CEMP sub- plan	Relevant government agencies to be consulted for each CEMP sub-plan						
(b)	Noise and vibration	EPA Relevant Council(s)						
<p>C4. 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.</p>	Appendix E	Information requested by agencies is summarised in Appendix E						

Appendix A

Compliance Matrices

Conditions of Approval and

Environmental Management Mitigation Measures

CoA Requirement	Reference	How addressed
<p>C7. <i>The CEMP and CEMP Sub-plans required under this approval must be prepared by suitably qualified and experienced persons in accordance with relevant guidelines, and include where relevant:</i></p> <p>(a) <i>a summary of relevant background or baseline data;</i></p> <p>(b) <i>details of:</i></p> <p style="padding-left: 20px;">(i) <i>the relevant statutory requirements (including any relevant approval, licence or lease conditions);</i></p> <p style="padding-left: 20px;">(ii) <i>any relevant limits or performance measures and criteria; and</i></p> <p style="padding-left: 20px;">(iii) <i>the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the CSSI or any management measures;</i></p> <p>(c) <i>any relevant commitments or recommendations identified in the EIS;</i></p> <p>(d) <i>a description of the measures to be implemented to comply with the relevant statutory requirements, limits, or performance measures and criteria</i></p> <p>(e) <i>a program to monitor and report on the:</i></p> <p style="padding-left: 20px;">(i) <i>impacts and environmental performance of the SSI; and</i></p> <p style="padding-left: 20px;">(ii) <i>effectiveness of the management measures set out pursuant to paragraph (d);</i></p> <p>(f) <i>a contingency plan to manage any unpredicted impacts and their consequences and to ensure that ongoing impacts reduce to levels below relevant impact assessment criteria as quickly as possible;</i></p> <p>(g) <i>a program to investigate and implement ways to improve the environmental performance of the SSI over time;</i></p> <p>(h) <i>a protocol for managing and reporting any:</i></p> <p style="padding-left: 20px;">(i) <i>incident, non-compliance or exceedance of any impact assessment criterion and performance criterion;</i></p> <p style="padding-left: 20px;">(ii) <i>complaint; or</i></p> <p style="padding-left: 20px;">(iii) <i>failure to comply with other statutory requirements; and</i></p> <p>(i) <i>a description of the roles and environmental responsibilities for relevant employees, as well as training and awareness; and</i></p> <p style="padding-left: 20px;">(j) <i>protocol for periodic review of the plan.</i></p>	<p>Section 5.3</p> <p>Section 3</p> <p>Section 7 & 8</p> <p>Section 8 & 9</p> <p>Table A2: EMMM</p> <p>Section 10</p> <p>Section 11</p> <p>Sections 11.6.3 and 11.7.3</p> <p>Section 11 (11.6.3 and 11.7.3)</p> <p>Sections 11.6.3 and 11.7.3</p> <p>Section 11</p> <p>A system for Incident/complaint management is set out in Community liaison plans (CCLP) which link to 12.2, 11.7, 11.4, 11.8 and 'Responsibilities' (Table 2)</p> <p>Section 13</p>	<p>The CNVMP has been prepared to meet the requirements of the Infrastructure Approval, including details noise and vibration limits, management and mitigation measures to reduce potential impacts, a monitoring program to assess the performance of the Project and to assist in the management and rectification of impacts, a process for informing and negotiating with the community and handling complaints, and assigns responsibilities for implementing the CNVMP.</p>
NOISE AND VIBRATION		

Appendix A

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Conditions of Approval and Environmental Management Mitigation Measures

CoA Requirement	Reference	How addressed											
Construction Noise and Vibration Management Levels													
<p>E1 The Proponent must implement reasonable and feasible mitigation measures with the aim of achieving the construction noise management levels in Table 2.</p> <p>Table 2 – Construction noise management levels</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2" style="background-color: #D3D3D3;">Location</th> <th style="background-color: #D3D3D3;">Standard Construction Hours</th> <th colspan="2" style="background-color: #D3D3D3;">Outside Standard Construction Hours</th> </tr> <tr> <th style="background-color: #D3D3D3;">L_{Aeq}(15 min)</th> <th style="background-color: #D3D3D3;">L_{Aeq}(15 min)</th> <th style="background-color: #D3D3D3;">L_{A1}(1 min)</th> </tr> </thead> <tbody> <tr> <td>All sensitive receivers</td> <td style="text-align: center;">55</td> <td style="text-align: center;">45</td> <td style="text-align: center;">65</td> </tr> </tbody> </table> <p>Notes:</p> <ul style="list-style-type: none"> • The Department acknowledges that a considerable number of sensitive receivers are predicted to experience exceedances of these noise management levels as the construction works approach the receivers. Condition E3 requires exceedances to be managed in accordance with the Noise and Vibration CEMP Sub-Plan. • Noise is to be measured in accordance with the relevant provisions of the EPA's Interim Construction Noise Guideline. • Standard construction hours are defined as: <ul style="list-style-type: none"> ○ Monday to Friday: 7.00am to 6:00pm; ○ Saturday: 8:00am to 1:00pm; and ○ No work Sundays or public holidays. 	Location	Standard Construction Hours	Outside Standard Construction Hours		L _{Aeq} (15 min)	L _{Aeq} (15 min)	L _{A1} (1 min)	All sensitive receivers	55	45	65	<p>Table 7</p> <p>Section 9</p> <p>Section 10</p>	<p>Standard mitigation measures will be implemented across the Project to reduce noise emissions as far as practically possible.</p> <p>Where noise levels are still above the NMLs, additional mitigation measures will be implemented to help manage the potential noise impacts.</p>
Location		Standard Construction Hours	Outside Standard Construction Hours										
	L _{Aeq} (15 min)	L _{Aeq} (15 min)	L _{A1} (1 min)										
All sensitive receivers	55	45	65										

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Conditions of Approval and

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CoA Requirement	Reference	How addressed																																			
<p>E2 The Project-specific construction vibration limits has been outlined in Section E2 of the CoA in accordance with the following standards:</p> <p>(a) Assessing vibration: a technical guideline (DEC, 2006) (for human exposure);</p> <p>(b) BS 7385 Part 2-1993 “Evaluation and measurement for vibration in buildings Part 2” as they are “applicable to Australian conditions”; and</p> <p>(c) German Standard DIN 4150-3: Structural Vibration- effects of vibration on structures (for structural damage).</p> <p>With all the reasonable and feasible mitigation measures, the minimum working distances to the vibration sensitive receivers have been determined in CoA E2 and is represented in Table 3.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="3" style="background-color: #D3D3D3;">Location</th> <th rowspan="3" style="background-color: #D3D3D3;">Plant</th> <th rowspan="3" style="background-color: #D3D3D3;">Description</th> <th colspan="3" style="background-color: #D3D3D3;">Minimum Working Distance (m)</th> </tr> <tr> <th colspan="2" style="background-color: #D3D3D3;">Cosmetic Damage</th> <th style="background-color: #D3D3D3;">Human Comfort</th> </tr> <tr> <th style="background-color: #D3D3D3;">Residential</th> <th style="background-color: #D3D3D3;">Heritage</th> <th style="background-color: #D3D3D3;">Residential</th> </tr> </thead> <tbody> <tr> <td rowspan="5" style="vertical-align: top;">All sensitive receivers</td> <td>Jack Hammer</td> <td>Hand-held</td> <td style="text-align: center;">1</td> <td style="text-align: center;">1</td> <td style="text-align: center;">1</td> </tr> <tr> <td rowspan="4" style="vertical-align: top;">Hydraulic Hammer (rock breaker) Piling Rig</td> <td>300kg – <12t excavator</td> <td style="text-align: center;">2</td> <td style="text-align: center;">4</td> <td style="text-align: center;">7</td> </tr> <tr> <td>900kg – <18t excavator</td> <td style="text-align: center;">7</td> <td style="text-align: center;">12</td> <td style="text-align: center;">23</td> </tr> <tr> <td>1,600kg – <34t excavator</td> <td style="text-align: center;">22</td> <td style="text-align: center;">34</td> <td style="text-align: center;">73</td> </tr> <tr> <td>Hammer – 12t downforce</td> <td style="text-align: center;">15</td> <td style="text-align: center;">24</td> <td style="text-align: center;">50</td> </tr> </tbody> </table> <p>Note: The Department acknowledges that sensitive receivers may experience exceedances of these vibration criteria as the construction works approach the receivers. Condition E3 requires exceedances to be managed in accordance with the Noise and Vibration CEMP Sub-Plan.</p>	Location	Plant	Description	Minimum Working Distance (m)			Cosmetic Damage		Human Comfort	Residential	Heritage	Residential	All sensitive receivers	Jack Hammer	Hand-held	1	1	1	Hydraulic Hammer (rock breaker) Piling Rig	300kg – <12t excavator	2	4	7	900kg – <18t excavator	7	12	23	1,600kg – <34t excavator	22	34	73	Hammer – 12t downforce	15	24	50	<p>Section 8.1</p>	<p>Where possible, vibration generating plant will be used further than the Minimum Working Distances. Where this is not achievable, Safe Working Distances will be determined for specific plant and the vibration levels will be confirmed via monitoring. Where there is a potential risk of exceeding the vibration damage limits, the activity will be continuously with real-time feed back to the operators to ensure that damage does not occur.</p>
Location				Plant	Description	Minimum Working Distance (m)																															
						Cosmetic Damage		Human Comfort																													
	Residential	Heritage	Residential																																		
All sensitive receivers	Jack Hammer	Hand-held	1	1	1																																
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		Hammer – 12t downforce	15	24	50																																

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Conditions of Approval and Environmental Management Mitigation Measures

CoA Requirement	Reference	How addressed															
<p>E3 Any works 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>	This CNVMP	Mitigation measures include community consultation and respite, Standard Noise and Vibration Environmental Control Measures, Implementation of Further Environmental Control Measures, Additional Mitigation Measures and monitoring.															
Construction Hours																	
<p>E4 Works must only be undertaken during the hours identified in Table 4.</p> <p>Table 4 – Construction Hours</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 5%;"></th> <th style="width: 70%;">Works</th> <th style="width: 25%;">Hours</th> </tr> </thead> <tbody> <tr> <td>(a)</td> <td>Linear infrastructure – Site preparation, trenching and excavation, joint bays, restoration of road surfaces, other</td> <td rowspan="2">Standard construction hours</td> </tr> <tr> <td>(b)</td> <td>Substation upgrade works</td> </tr> <tr> <td>(c)</td> <td>Linear infrastructure – Works in classified road reserves and signalised intersections, cable pulling and jointing</td> <td rowspan="3">Anytime</td> </tr> <tr> <td>(d)</td> <td>Special crossings – cable bridges and underboring</td> </tr> <tr> <td>(e)</td> <td>Construction laydown areas</td> </tr> </tbody> </table> <p>Note: Classified roads in the project area are identified in Condition E28.</p>		Works	Hours	(a)	Linear infrastructure – Site preparation, trenching and excavation, joint bays, restoration of road surfaces, other	Standard construction hours	(b)	Substation upgrade works	(c)	Linear infrastructure – Works in classified road reserves and signalised intersections, cable pulling and jointing	Anytime	(d)	Special crossings – cable bridges and underboring	(e)	Construction laydown areas	Section 6	Works would be undertaken during Standard Construction Hours were possible and low impact works undertaken anytime. Where noise works are undertaken Outside Standard Construction Hours additional mitigation measures will implemented.
	Works	Hours															
(a)	Linear infrastructure – Site preparation, trenching and excavation, joint bays, restoration of road surfaces, other	Standard construction hours															
(b)	Substation upgrade works																
(c)	Linear infrastructure – Works in classified road reserves and signalised intersections, cable pulling and jointing	Anytime															
(d)	Special crossings – cable bridges and underboring																
(e)	Construction laydown areas																

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CoA Requirement	Reference	How addressed
Highly Noise Intensive Works		
<p>E5 Despite Condition E4, highly noise intensive works that result in noise levels at sensitive receivers exceeding 75 dB(A) LAeq(15 minute) at the same receiver must only be undertaken:</p> <p>(a) during standard construction hours; and</p> <p>(b) if continuously, then not exceeding three (3) hours, with a minimum respite from these works of not less than one (1) hour between each block.</p> <p>For the purposes of this condition, 'continuously' includes any period during which there is less than one (1) hour respite between ceasing and recommencing any of the work.</p>	Section 6.2	Highly noise intensive works would be undertaken for continuous periods not greater than 3 hours, followed by minimum 1 hour respite period.

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Conditions of Approval and Environmental Management Mitigation Measures

CoA Requirement	Reference	How addressed
Variation to Work Hours		
<p>E6 Construction works may be carried out outside of standard hours under CoA E4. Under CoA E6, works may be undertaken outside the hours specified in CoA E4 in the following circumstances:</p> <ul style="list-style-type: none"> (a) for the delivery of materials required by the NSW Police Force or other 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) works approved under an Out-of-Hours Work Protocol as required by Condition E8; or (d) construction that causes LAeq(15 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 Interim Construction Noise Guideline (DECC, 2009), and (ii) no more than the noise management levels specified in Condition E1 at other sensitive land uses; (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). 	<p>Section 6.3 Refer to OOHW Protocol</p>	<p>Works can be undertaken outside of standard hours without additional approval, such as low noise and vibration impact activities, material deliveries as required by police or other authority, in case of emergency or previously approved OOH works. All other works will require approval under the Out-of-Hours Work Protocol.</p>
<p>E7 On becoming aware of the need for emergency works in accordance with Condition E6(b), the Proponent must notify the Department of the reasons for such work. The Proponent must use best endeavours to notify all noise and/or vibration affected sensitive receivers of the likely impact and duration of those works.</p>	<p>Section 6.3 Section 12 Refer to CCS</p>	<p>DPIE and the community would be notified appropriately in the event of an emergency</p>

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CoA Requirement	Reference	How addressed
Out-of-Hour Work Protocol		
<p>E8 An Out-of-Hours Work Protocol must be prepared to identify a process for the consideration, management and approval of works which are outside the hours defined in Conditions E4 and E5. The Protocol must be approved by the Planning Secretary before commencement of the works. The Protocol must:</p> <ul style="list-style-type: none"> (a) be prepared in consultation with the EPA and relevant council(s); (b) provide a process for the consideration of out-of-hours works against the relevant noise and vibration criteria, including the determination of low and high-risk activities; (c) provide a process for the identification of mitigation measures for residual impacts, including respite periods in consultation with the community at each affected location, consistent with the requirements of Condition E9; (d) provide a process for the identification of out-of-hours works undertaken by third parties in the vicinity of the project area, and coordination of out-of-hours works with these third parties to achieve respite periods in locations where receivers may be affected by concurrent construction works; (e) identify an approval process that considers the risk of activities, proposed mitigation, management, and coordination, including where: <ul style="list-style-type: none"> (i) low risk activities can be undertaken without the approval of the Planning Secretary; and (ii) high risk activities that are approved by the Planning Secretary; and (f) identify Department, EPA, relevant council and community notification arrangements for approved out-of-hours work. 	<p>Refer to OOHW Protocol (Appendix D)</p>	<p>The OOHW Protocol details the justifications, application, management and approvals process that will be followed for all unapproved OOHW which are likely to impact the community. Low risk activities will be approved internally and high risk activities will require approval by DPIE.</p>
<p>E9 In order to undertake out-of-hours work, the Proponent must identify appropriate respite periods for the OOHW in consultation with the community at each affected location on a regular basis. This consultation must include (but not be limited to) providing the community with:</p> <ul style="list-style-type: none"> (a) a schedule of likely out-of-hours work for a period no less than two (2) months; (b) the potential works, location and duration; (c) the noise characteristics and likely noise levels of the works; and (d) likely mitigation and management measures. <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 Planning Secretary.</p>	<p>Section 10 Refer to OOHW Protocol (Appendix D)</p>	<p>A Community Out of Hours Consultation process will be followed to inform the community and identify respite periods.</p>

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CoA Requirement	Reference	How addressed
Noise and Vibration CEMP Sub-Plan		
<p>E10. The Noise and Vibration CEMP Sub-Plan required under Condition C3 must include a:</p> <ul style="list-style-type: none"> (a) description of the reasonable and feasible measures that would be implemented to minimise noise and vibration impacts of the SSI; (b) detailed description of the noise and vibration management system for the SSI; (c) protocol for scheduling of noise generating works 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) outside sensitive periods as far as reasonable and feasible; (d) protocol for the identification, notification and management of works that exceed the noise management levels and/or vibration criteria, including provision for specialist heritage advice for any works that exceed the vibration criteria for cosmetic damage at heritage items; and (e) monitoring program that evaluates and reports on the effectiveness of the noise and vibration management system. 	<p>This CNVMP</p> <p>Section 10</p> <p>Section 1.3</p> <p>Section 10.1 Section 10.1.1</p> <p>Section 10.1 Section 10.1.2</p> <p>Sections 11.6.3 and 11.7.3</p>	<p>Mitigation measures include community consultation and respite, Standard, Further and Additional Noise and Vibration Environmental Control Measures. The CNVMP form part of the CEMP. Preference is given to activities undertaken during less sensitive periods (Standard Construction Hours) through imposing more restrictive noise limits and more onerous approvals process, community negotiation and notification during sensitive periods (Outside Standard Construction Hours). A CNVIS will be prepared to predict the noise and vibration emissions from the</p>

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Compliance Matrices Conditions of Approval and Environmental Management Mitigation Measures

CoA Requirement	Reference	How addressed
		construction activities and identify any exceedances of the noise and vibration criteria and the corresponding management and notification requirements.

A2 Environmental Management and Mitigation Measures

In addition to the CoAs presented above, the Environmental Management and Mitigation Measures (EMMMs) must be complied with during the development of the Project. The EMMMs requirements which are relevant to this CNVMP are presented in **Table A2**.

Table A2 Compliance Matrix - Updated Environmental Management and Mitigation Measures Requirements

Management and Mitigation Measures	ID	Measure	Reference
CNVMP	NV1	<p>A CNVMP will be developed as part of the CEMP for the project and will include reasonable and feasible safeguards to manage the noise emissions from construction and manage any complaints which may be received. The CNVMP will include the following:</p> <ul style="list-style-type: none"> • identification of nearby residences and other sensitive land uses; • description of approved hours of work; • description and identification of all construction activities, including construction work sites, equipment and duration; • description of work practices (generic and specific) which will be applied to minimise noise and vibration; • a complaints handling process; • noise and vibration monitoring procedures; • overview of community consultation/notification required (see NV2); and • the Out-of-hours Protocol developed for the project. 	<p>This CNVMP</p> <p>Section 5.1 Appendix B Section 6 Section 2</p> <p>Section 10</p> <p>Section 12.2 Section 11 Section 12</p> <p>Refer to "OOHW Protocol"</p>

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Management and Mitigation Measures	ID	Measure	Reference
Community consultation/ notification	NV2	<p>Residents and other sensitive receivers impacted by noise and/or vibration from the proposed works which is expected to exceed the NML (as defined in Table 5-2 and Table 5-3 of Appendix E of the EIS) and/or vibration criteria (as summarised in Table 5-6 and Table 5-7 of Appendix E of the EIS) will be notified at least seven days prior to the commencement of the particular activity.</p> <p>The information provided to the residents and other sensitive receivers impacted will include:</p> <ul style="list-style-type: none"> • programmed times and locations of construction work; • the hours of proposed works; • construction noise and vibration impact predictions; and • construction noise and vibration mitigation measures to be implemented. <p>Community consultation regarding construction noise and vibration is further detailed in the CCF in Appendix C of the EIS.</p>	<p>Section 12 and Section 9 of “OOHW Protocol” Appendix B</p>
Site inductions	NV3	<p>All project personnel, contractors and subcontractors will undergo an environmental induction. The induction will at least include:</p> <ul style="list-style-type: none"> • all project specific and relevant standard noise and vibration mitigation measures; • relevant licence and approval conditions; • permissible hours of work; • any limitations on high noise generating activities (e.g. use of jack hammering, rock breaking, piling rigs and diamond saws); • locations of nearest sensitive receivers; • construction employee parking areas; • designated loading/unloading areas and procedures; • site opening/closing times (including deliveries); • behavioural practices such as limiting the use of loud stereos/radios on-site and not dropping materials from height or metal items; • public complaints handling procedures; and • environmental incident management procedures. 	<p>Section 4 Section 10.2 Section 12.1</p>

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Compliance Matrices Conditions of Approval and Environmental Management Mitigation Measures

Management and Mitigation Measures	ID	Measure	Reference
Out-of-hours protocol	NV4	<p>Where feasible and reasonable, construction will be carried out during standard construction hours. However, given that some works will be required to be undertaken outside of standard construction hours, an 'Out-of-hours Protocol' will be prepared as part of the CNVMP.</p> <p>This will evaluate the potential noise impacts of specific out-of-hours works and recommend appropriate mitigations measures such as:</p> <ul style="list-style-type: none"> • community consultation with highly noise affected receivers; • procedures to determine negotiated outcomes in consultation with affected receivers (e.g. construction scheduling during sensitive periods such as exams where construction is in the vicinity of schools); • specific mitigation measures such as respite periods; and • a monitoring program. 	Refer to "OOHW Protocol"
Respite periods for works during standard construction hours	NV5	<p>Respite periods during standard construction hours, will be identified in consultation with affected receivers.</p> <p>Respite options will be considered when sensitive receivers are within the minimum working distances for vibration intensive works or are highly noise affected receivers (experiencing noise levels above 75 dB(A)).</p> <p>Respite options will include consideration of amendments to work schedules.</p> <p>Vibration intensive or high noise generating equipment will be used in continuous blocks, not exceeding three hours each, with a minimum respite period of one hour between each block.</p>	Section 6.2 Section 10.1
Respite periods for works outside of standard construction hours	NV6	<p>The need to consider respite periods will be triggered where the $L_{Aeq(15min)}$ noise levels exceed 75 dB(A) at the same receiver after midnight for more than three consecutive nights. Where this level is exceeded, respite periods will be considered in accordance with the Out-of-hours Protocol (refer to NV4).</p> <p>Respite for OOHW also will be determined in accordance with CoA E9.</p>	Refer to "OOHW Protocol"
Construction hours and scheduling	NV7	<p>Where feasible and reasonable, construction will be carried out during standard construction hours.</p> <p>Where required to be completed outside of standard construction hours, in proximity to sensitive receivers, works generating high noise and/or vibration levels (including the use of rock breakers and diamond saws) will be scheduled during less sensitive time periods.</p>	Section 6

Appendix A

Compliance Matrices Conditions of Approval and Environmental Management Mitigation Measures

Management and Mitigation Measures	ID	Measure	Reference
Noise monitoring	NV8	A noise monitoring program will be implemented for the duration of the works in accordance with the CNVMP and will focus on the use of high noise generating plant (e.g. jack hammering, rock breaking, piling rigs and diamond saws) and works outside of standard construction hours.	Section 11.4 Section 11.6
Equipment selection and placement	NV9	<p>Equipment selection will consider potential noise and vibration impacts and quieter equipment and/or construction methods will be used where feasible and reasonable. Plant and equipment will:</p> <ul style="list-style-type: none"> • have an operating sound power level of no more than those listed in the Construction Noise and Vibration Impact Assessment in Appendix E of the EIS; • be maintained and operated in an efficient manner, in accordance with manufacturer’s specifications, to reduce the potential for adverse noise and vibration impacts; • be fitted with non-tonal reversing beepers (or an equivalent mechanism); • be throttled down or shut down when not in use; • minimise noise through: <ul style="list-style-type: none"> - use of residential grade mufflers; - use of damped hammers such as “City” Model Rammer Hammers; and - silencing air parking brakes. <p>High noise generating plant will:</p> <ul style="list-style-type: none"> • be located so that the offset distance between the plant and adjacent sensitive receivers is maximised as far as possible; and • be directed away from sensitive receivers, where possible to do so. 	Section 9.2 Section 9.2.2 Section 9.2.1 Section 11.5 Section 10.2 Section 10.3 Section 10.2 Section 10.3 Section 10.3

Appendix A

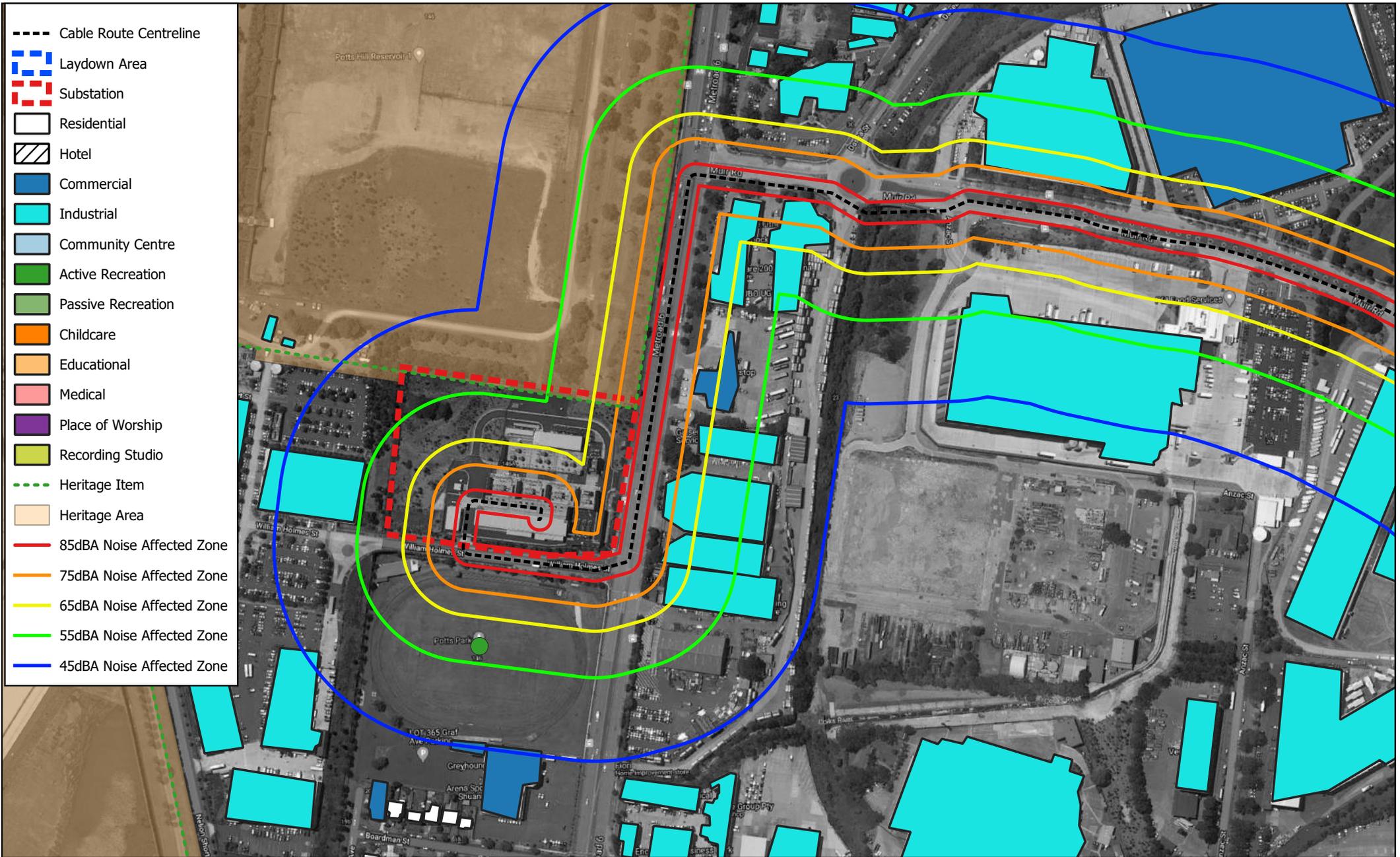
Compliance Matrices

Conditions of Approval and Environmental Management Mitigation Measures

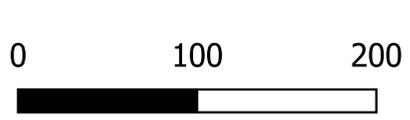
Management and Mitigation Measures	ID	Measure	Reference
Construction traffic	NV10	<p>Potential noise impacts from construction vehicles will be minimised through the following:</p> <ul style="list-style-type: none"> • traffic flow, parking and loading/unloading areas will be planned to minimise reversing movements within the work sites and at construction laydown areas; • loading and unloading of materials/deliveries will occur as far as possible from sensitive receivers; • shielding loading/unloading areas if close to sensitive receivers, where feasible (i.e. breaking the line of site between the area and the receiver); • fitting delivery vehicles with straps rather than chains for unloading, wherever possible; • selecting construction laydown area access points and roads as far away as possible from sensitive receivers; • locating delivery and haulage routes away from sensitive receivers, where possible; • scheduling deliveries during less sensitive times, where possible; 	<p>Section 7.6 Section 10.2</p>
Steel road plates	NV11	<p>The use of road plates will be minimised, where possible. Where required to be used, the plates will be installed in a manner that minimises the potential for displacement by traffic loading and minimises any height difference with the adjacent road surface in order to reduce the potential for impact noise generation from tyres traversing the plates.</p>	<p>Section 10.2</p>
Stationary noise sources	NV12	<p>Low noise emitting plant and equipment (such as those with built-in shielding and mufflers) will be used wherever possible. Noise generating plant at work sites (such as compressors and generators) will be directed away from and situated furthest away from sensitive receivers, where practicable. Machinery that is not in use will be switched off.</p>	<p>Section 10.2</p>
Shield sensitive receivers	NV13	<p>Structures will be used to shield residential receivers from noise such as use of hoarding/noise curtains, where practicable, at construction laydown areas and special crossing work sites.</p>	<p>Section 10.2</p>

The following map presents the following key information:

- Cable route alignment
- Noise sensitive receivers
- Heritage areas and heritage items
- **Baseline Vibration Impact Assessment** - Selected Minimum Working Distances for a excavator with rock breaker attachment as per CoA E2
 - 2 m Minimum Working Distances for <12t excavator - Residential Cosmetic Damage limit
 - 4 m Minimum Working Distances for <12t excavator - Heritage Cosmetic Damage limit
 - 7 m Minimum Working Distances for <18t excavator - Residential Cosmetic Damage limit
 - 12 m Minimum Working Distances for <18t excavator - Heritage Cosmetic Damage limit
 - 23 m Minimum Working Distances for <18t excavator - Residential Human Comfort limit
- **Baseline Noise Impact Assessment** - Estimated extent of noise emission levels from the use of a <18t excavator with rock breaker. The Noise Affection Zones correspond to the approximate offset distance within which the CoA E1 Construction NMLs (refer to **Table 7**) are likely to be exceeded, shown in 10 dB increments corresponding the AMMM Mitigation Measures category ranges (refer to **Table 13**).
 - 45 dBA Noise Affected Zone - Outside Standard Construction Hours NML (OOHW NML)
 - 55 dBA Noise Affected Zone - Standard Construction Hours NML (Standard NML), 10 dB above OOHW NML
 - 65 dBA Noise Affected Zone - 10 dB above Standard NML, 20 dB above OOHW NML
 - 75 dBA Noise Affected Zone - 20 dB above Standard NML, 30 dB above OOHW NML, Highly Noise Affected
 - 85 dBA Noise Affected Zone - 30 dB above Standard NML, Potential of Work Health and Safety exposure



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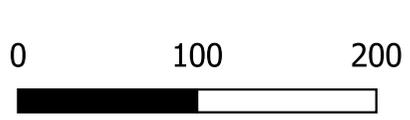


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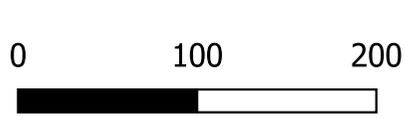


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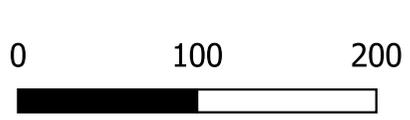


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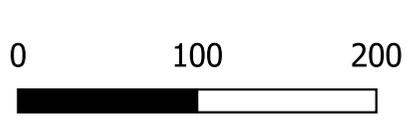


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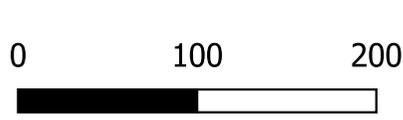
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- Cable Route Centreline
- Laydown Area
- Substation
- Residential
- Hotel
- Commercial
- Industrial
- Community Centre
- Active Recreation
- Passive Recreation
- Childcare
- Educational
- Medical
- Place of Worship
- Recording Studio
- - - Heritage Item
- Heritage Area
- 85dBA Noise Affected Zone
- 75dBA Noise Affected Zone
- 65dBA Noise Affected Zone
- 55dBA Noise Affected Zone
- 45dBA Noise Affected Zone

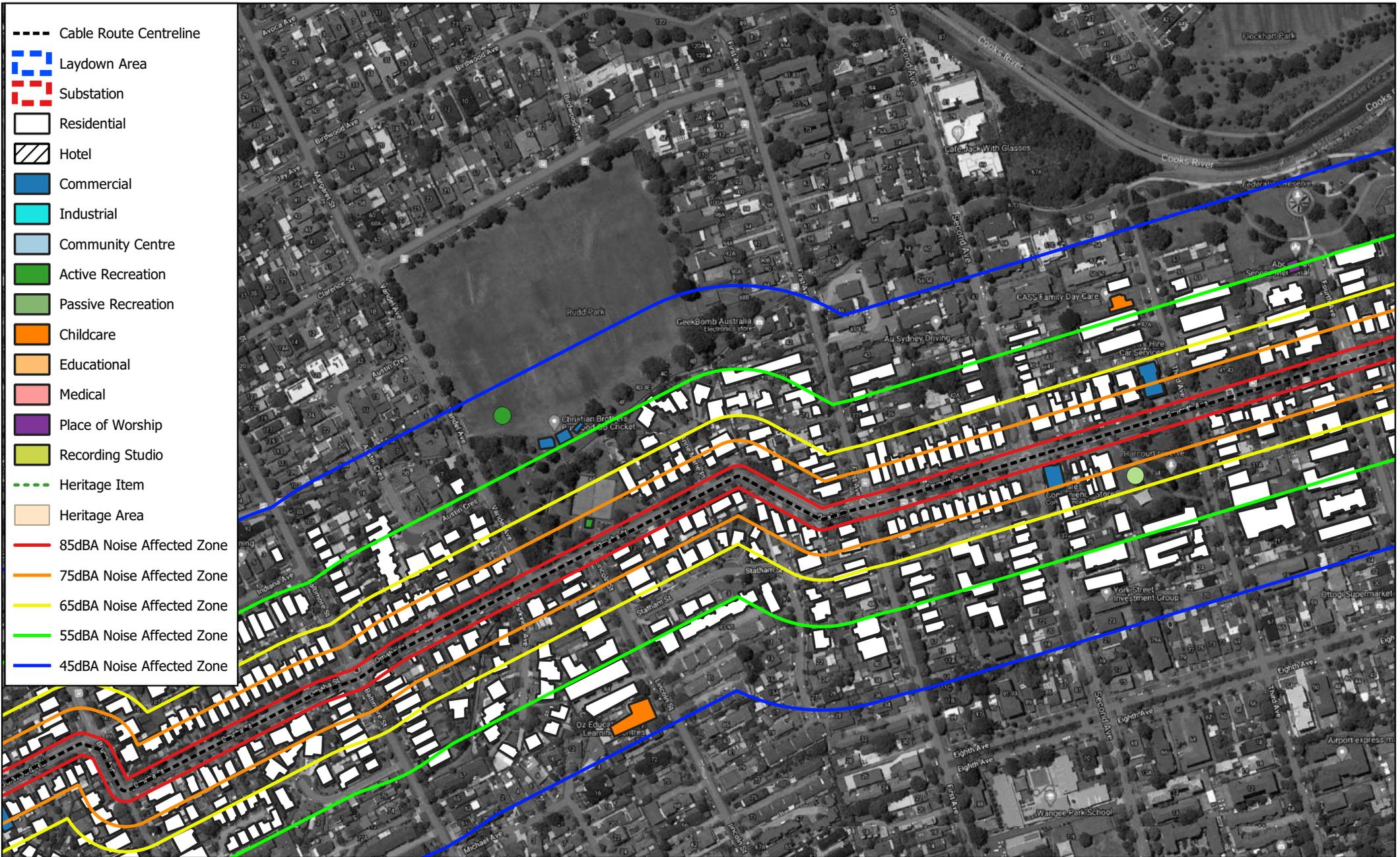
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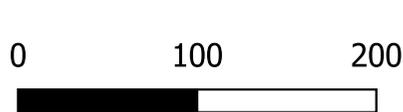
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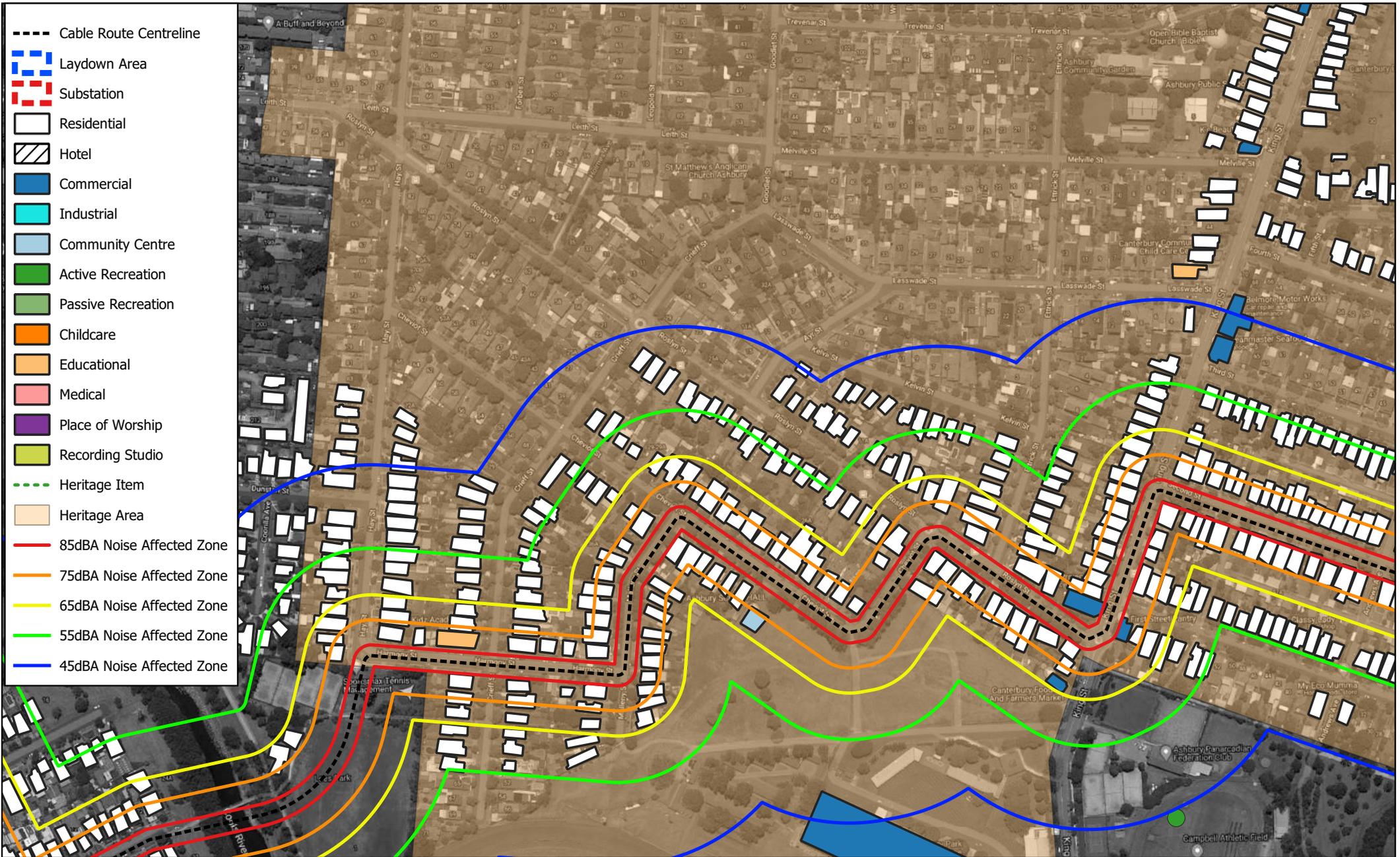


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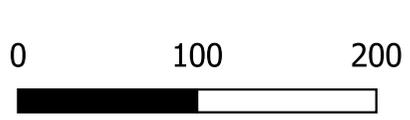


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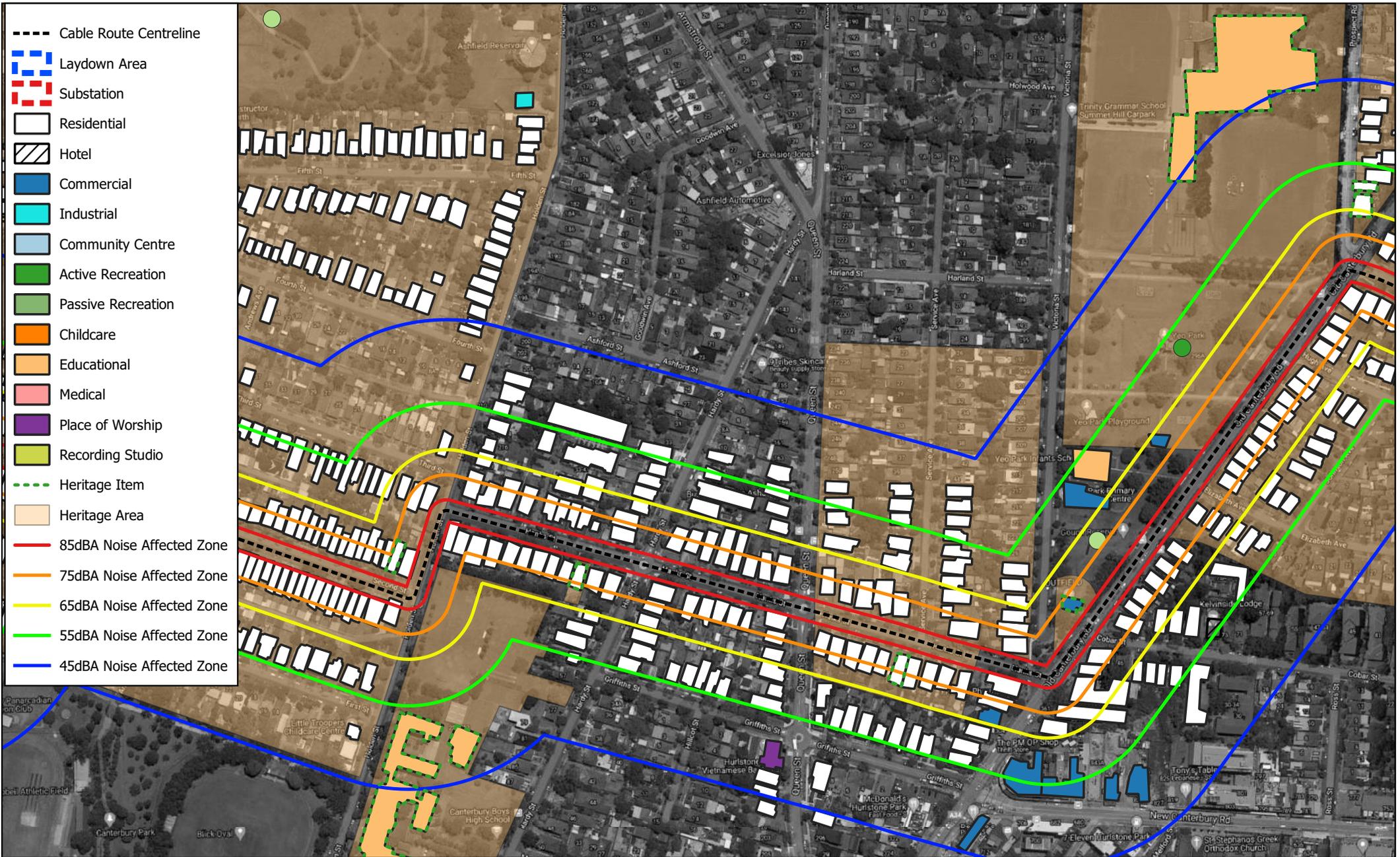
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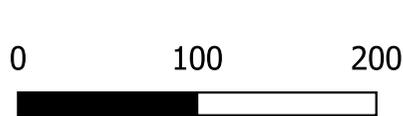


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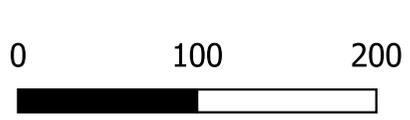


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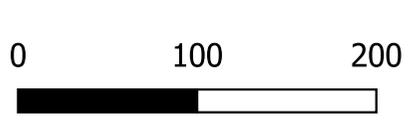


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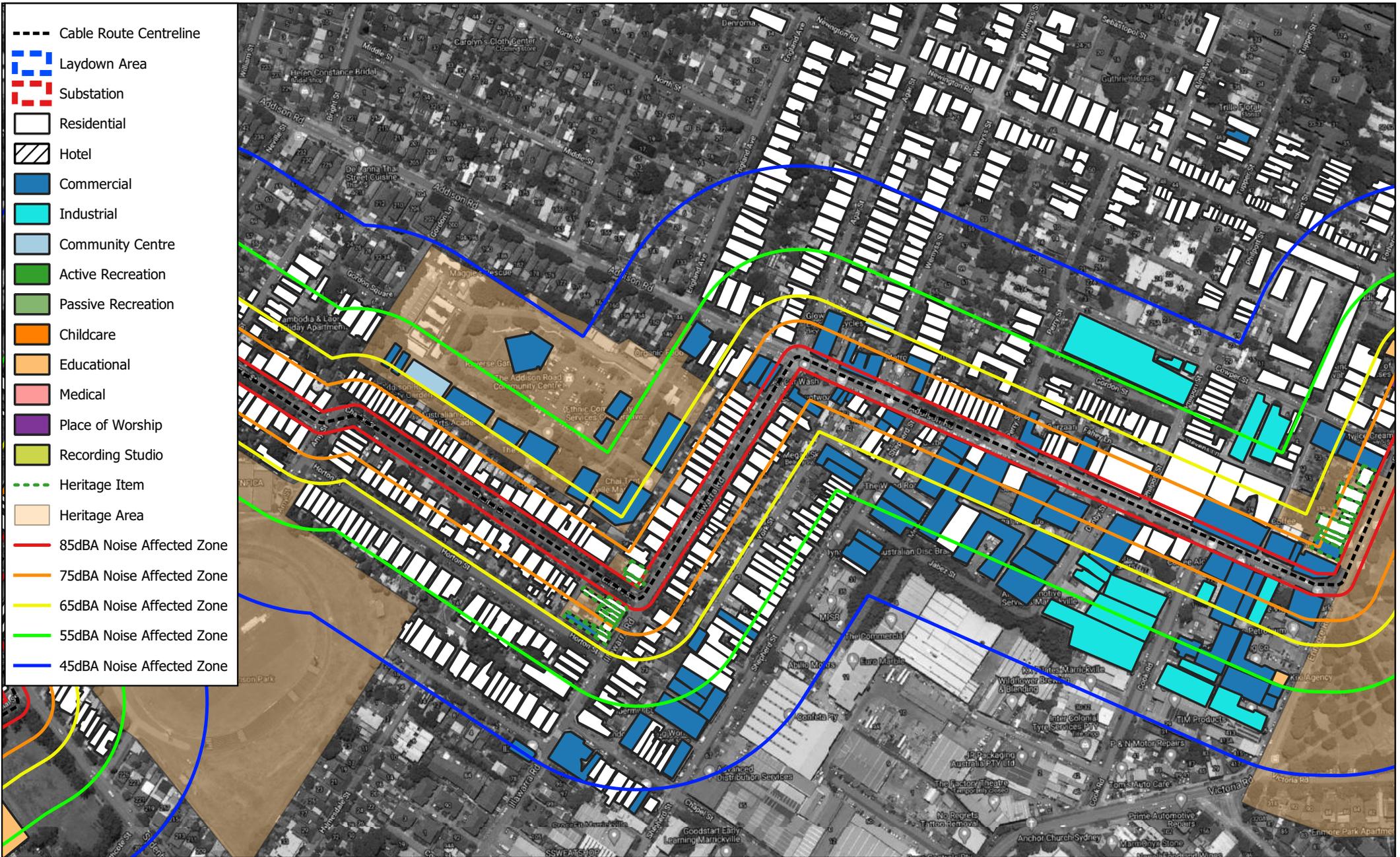


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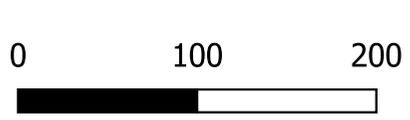


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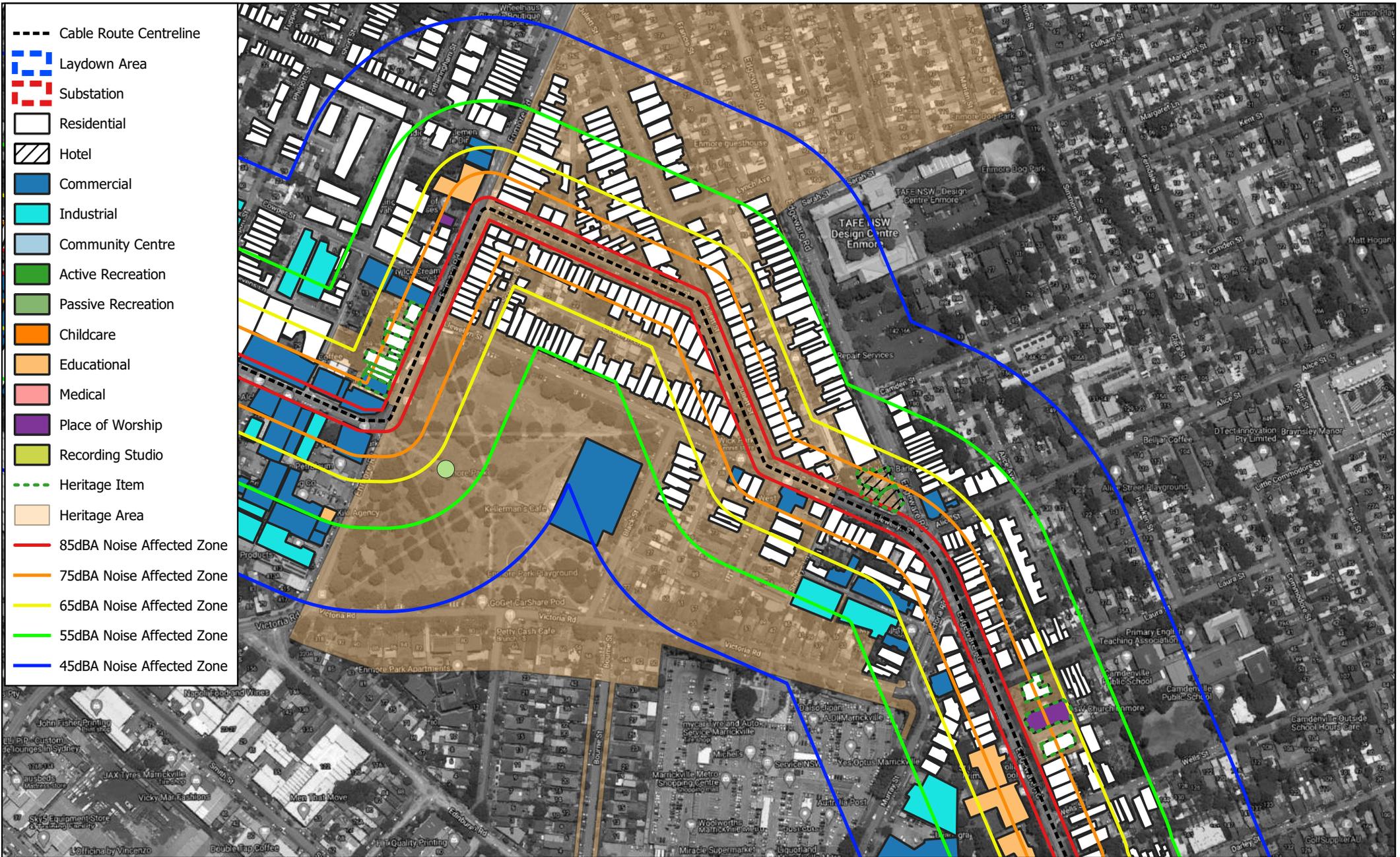


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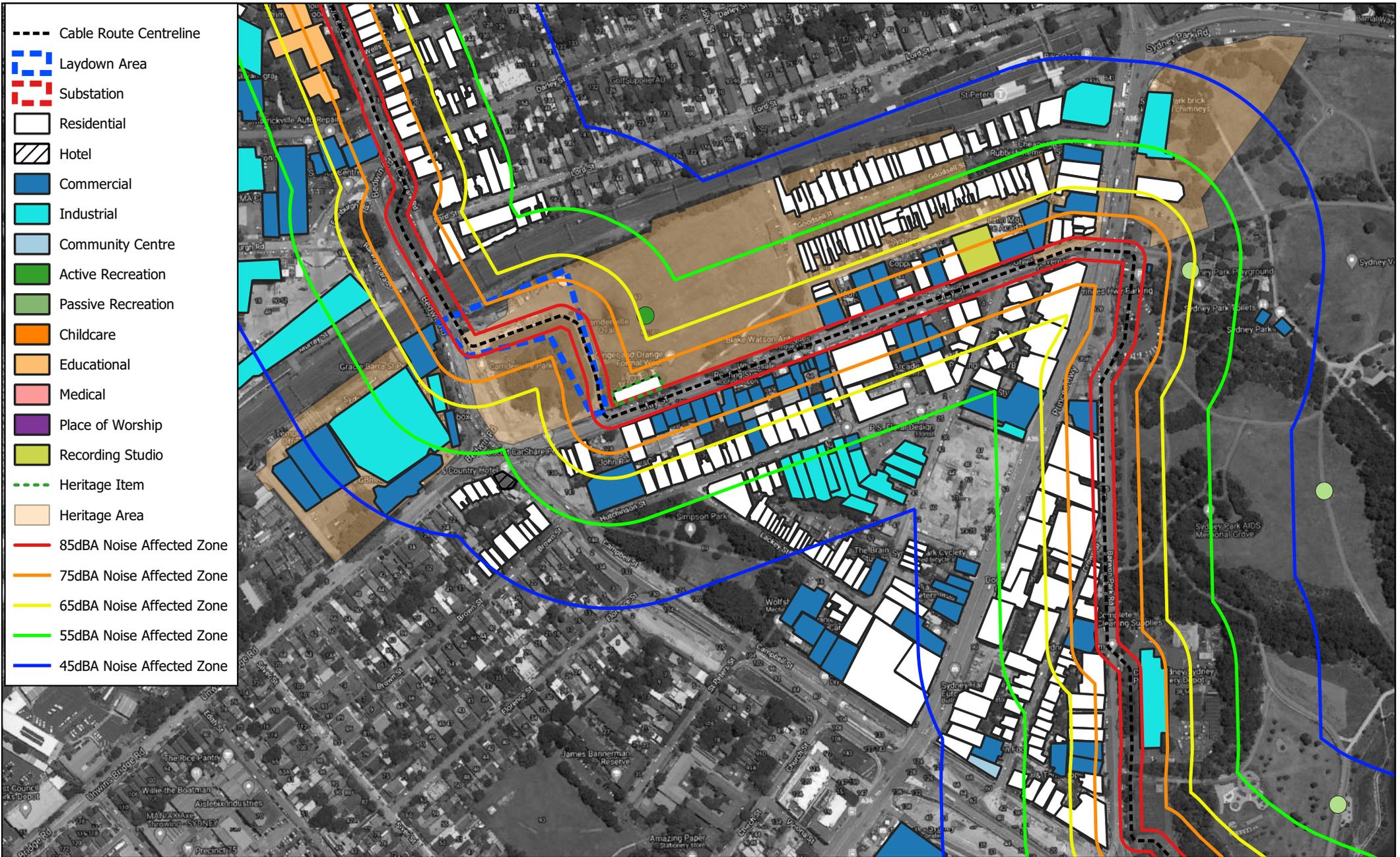


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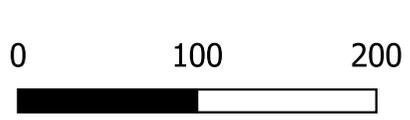


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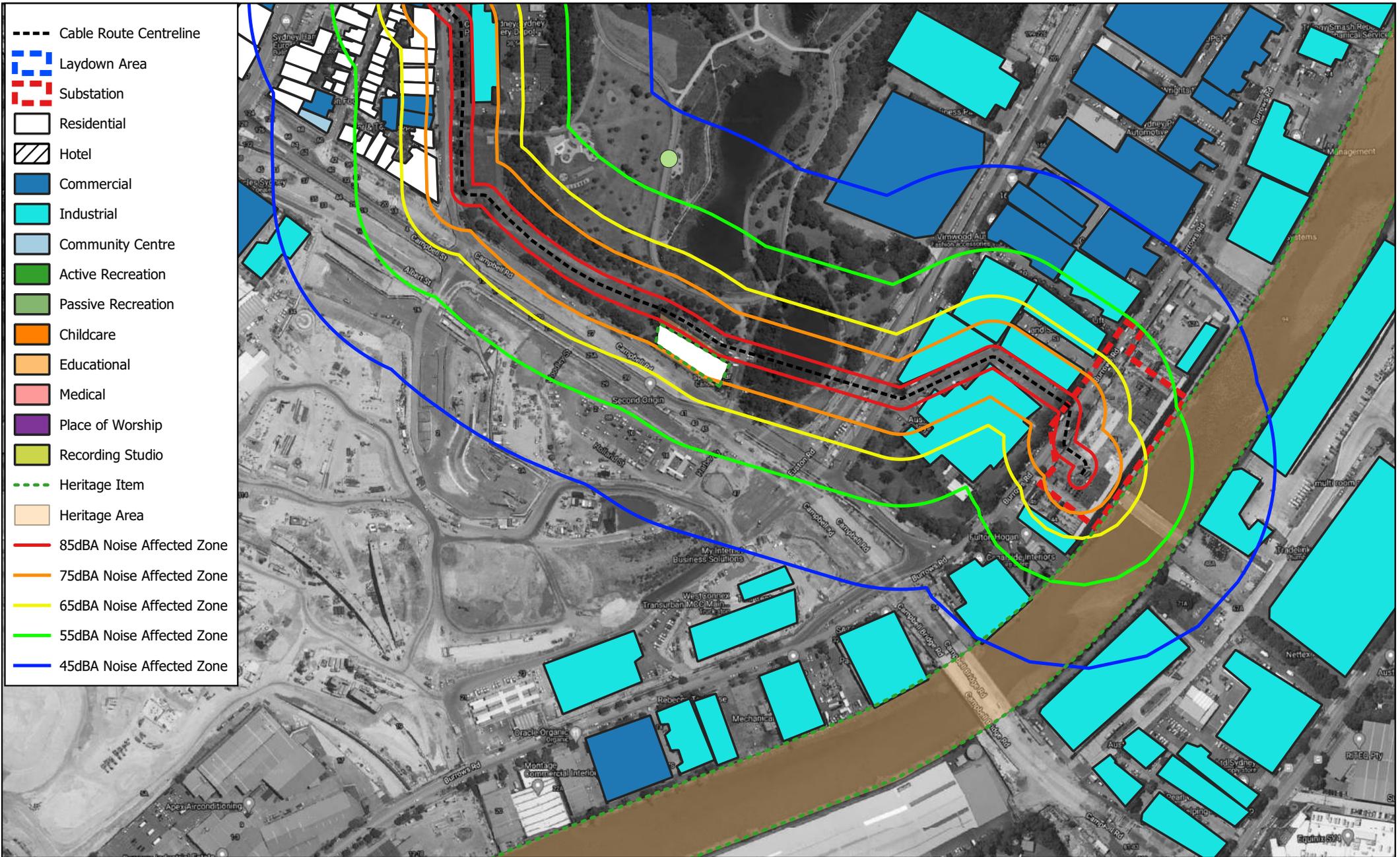


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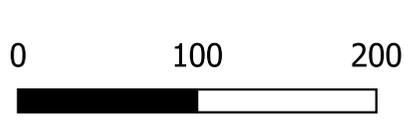


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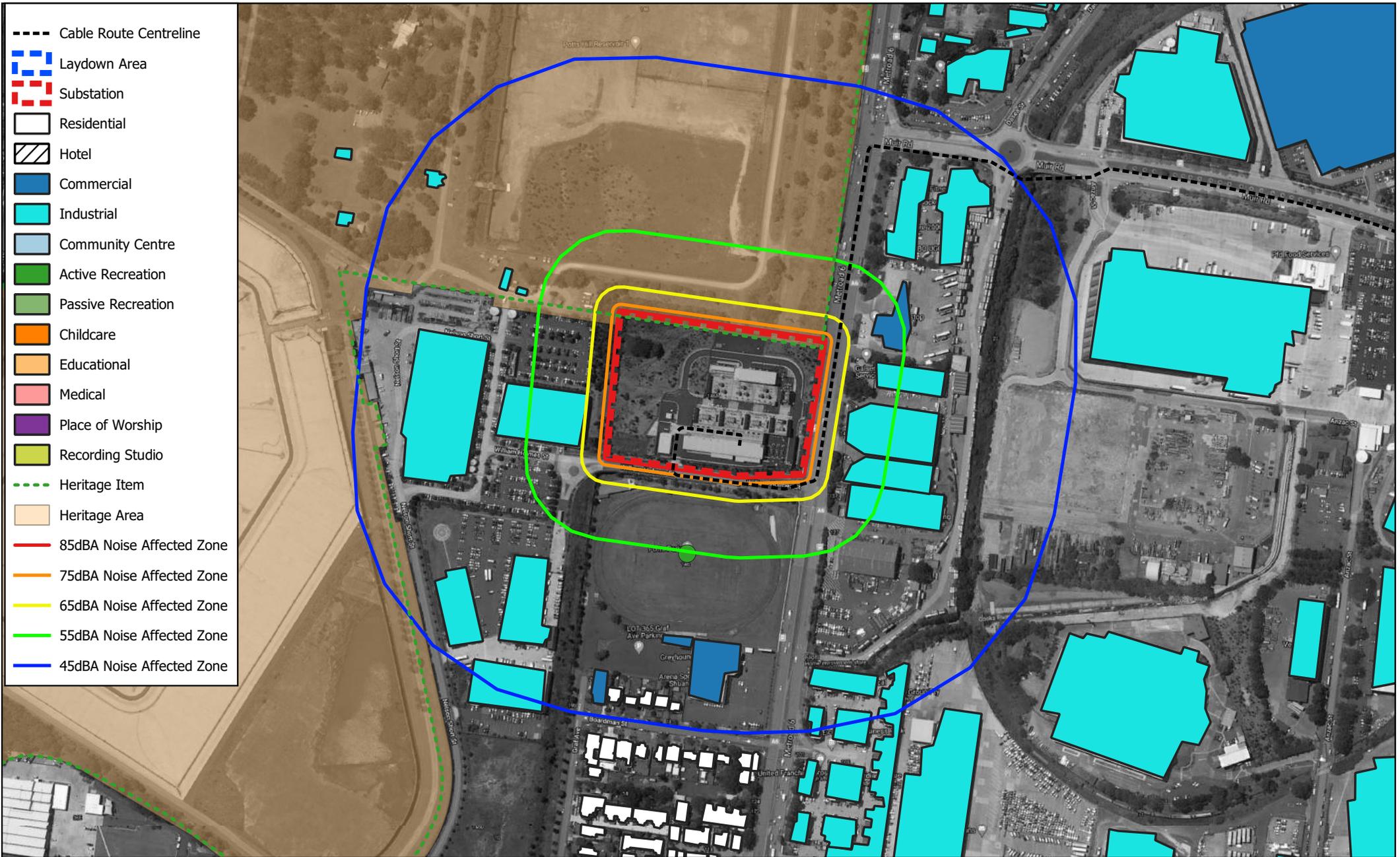


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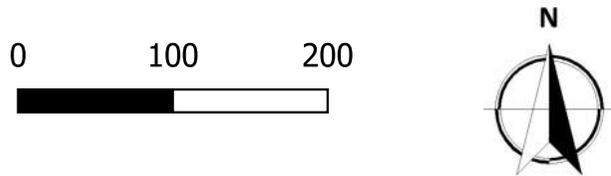


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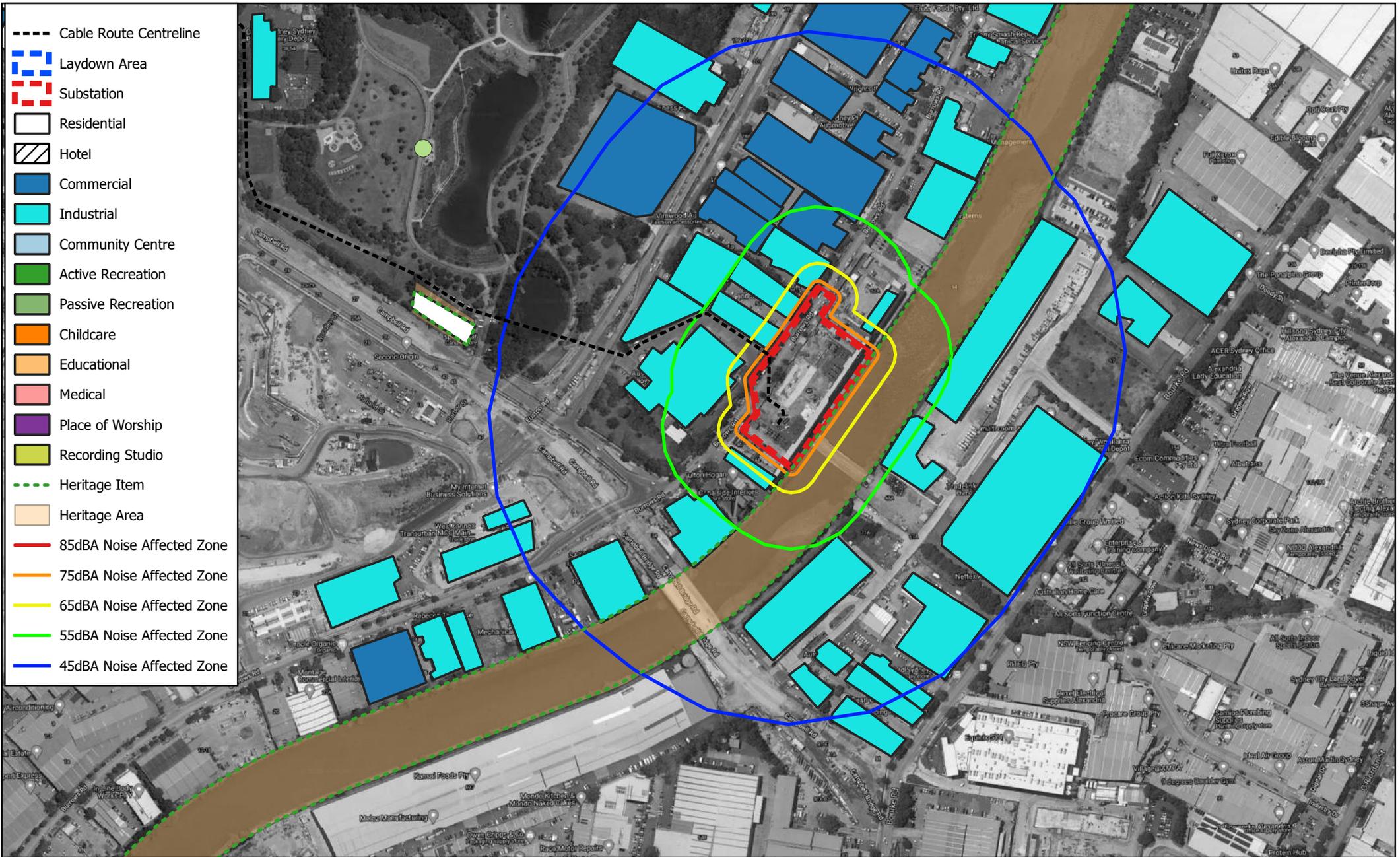


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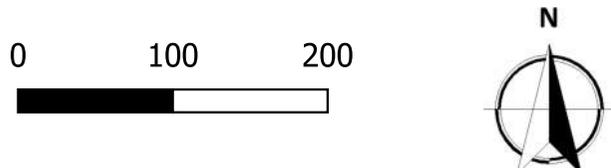


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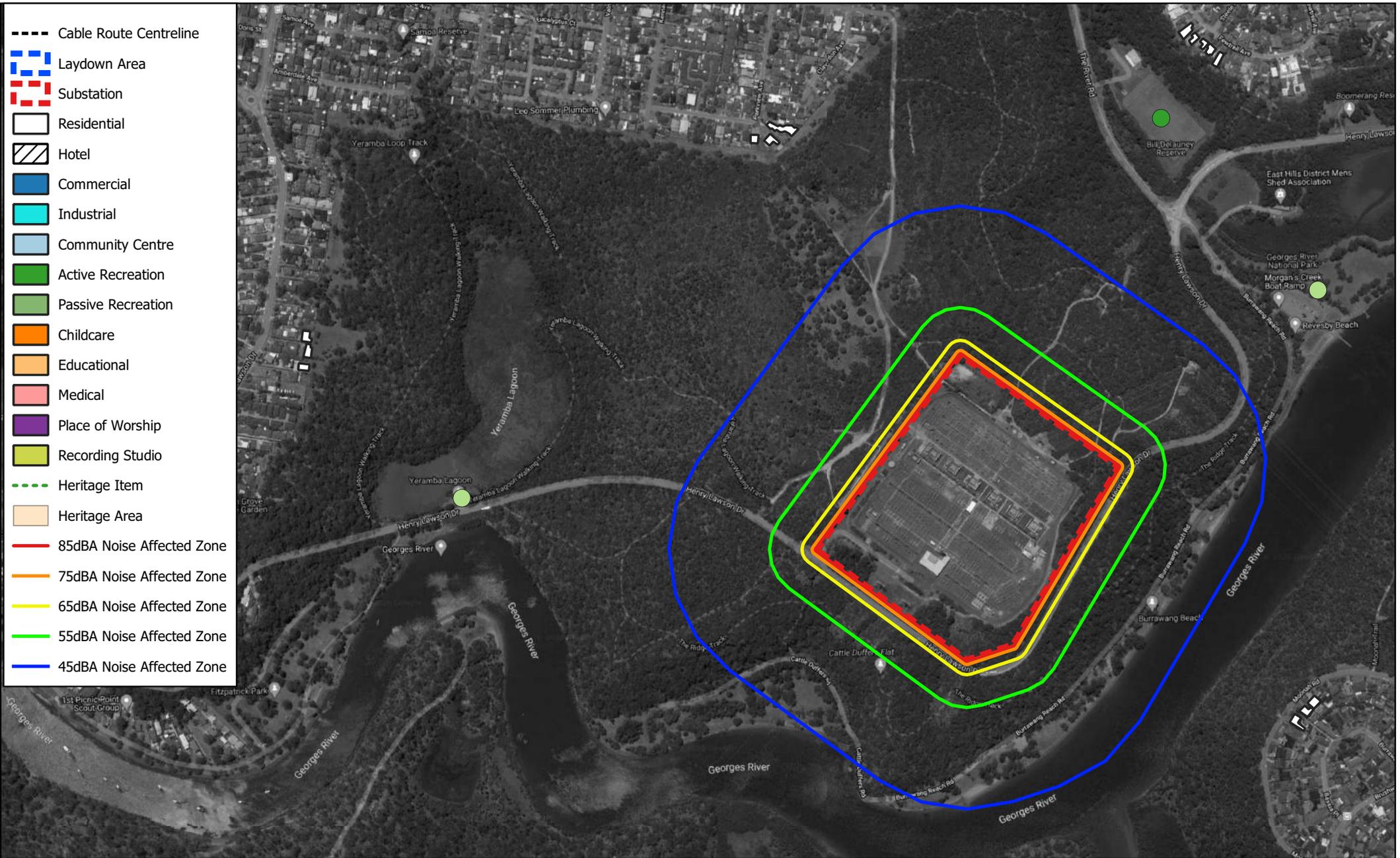


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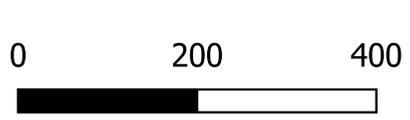


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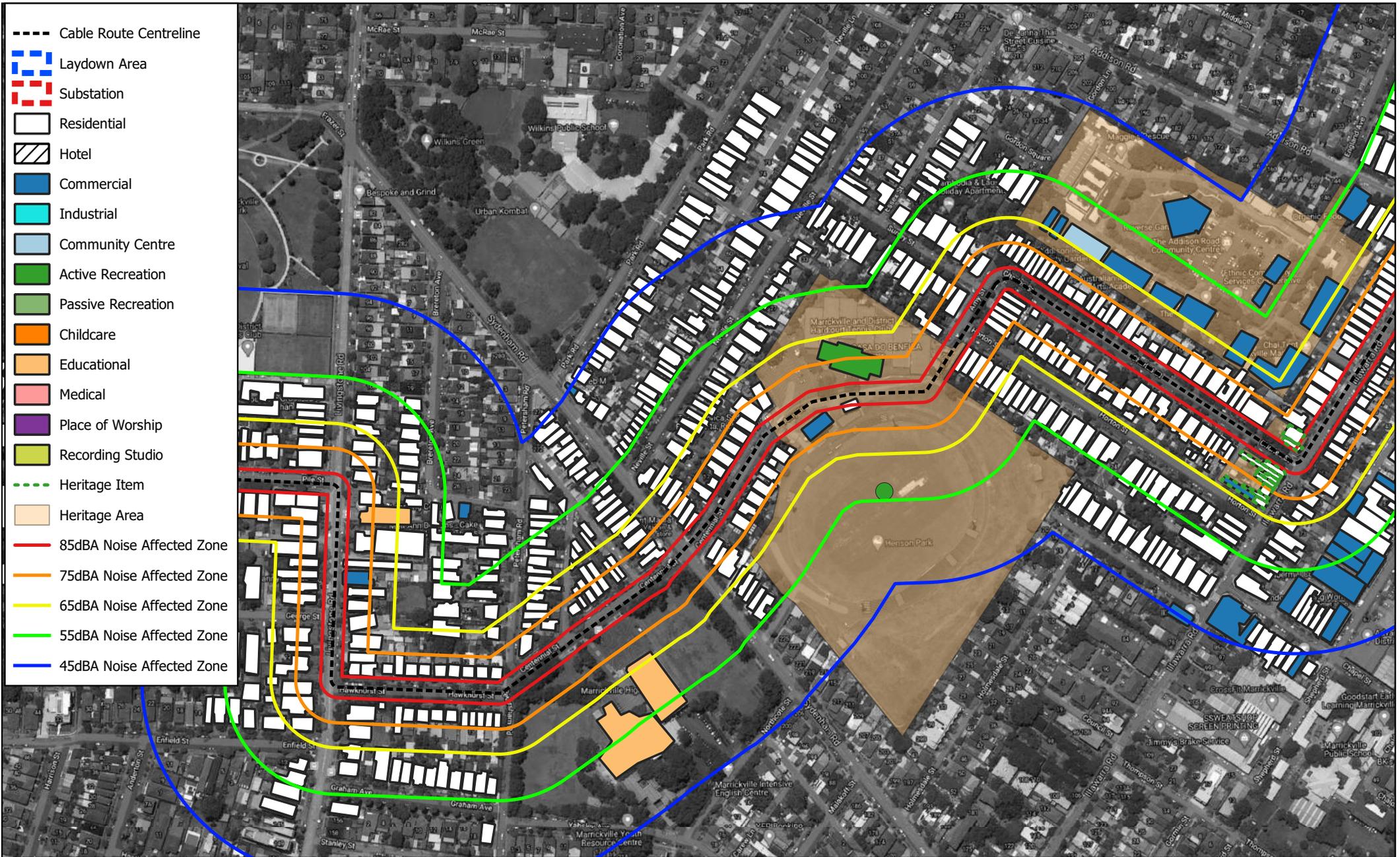


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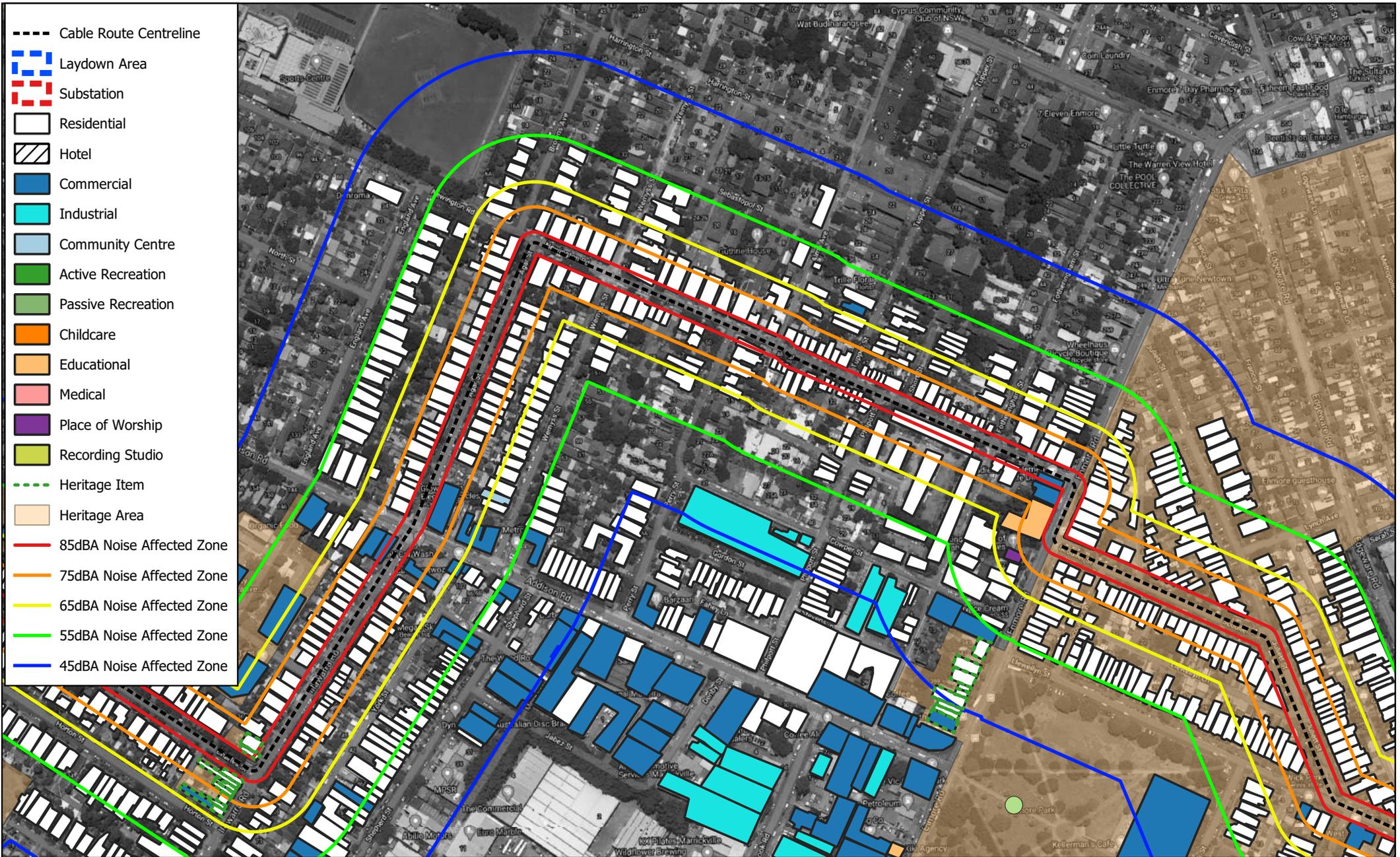


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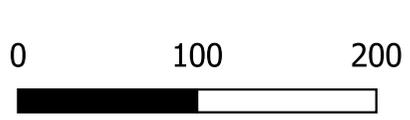


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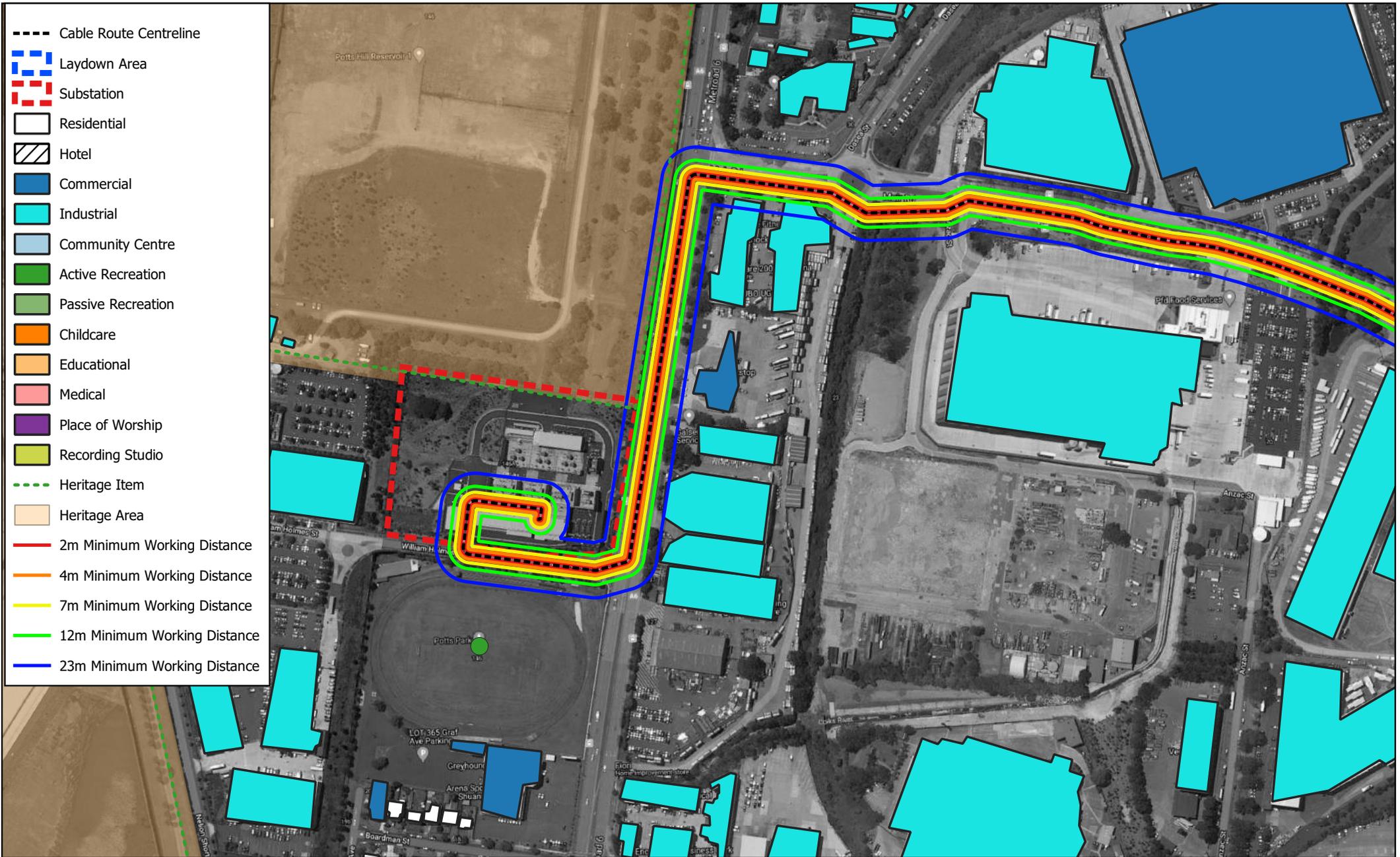


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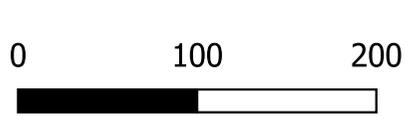
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- Heritage Area
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- 4m Minimum Working Distance
- 7m Minimum Working Distance
- 12m Minimum Working Distance
- 23m Minimum Working Distance

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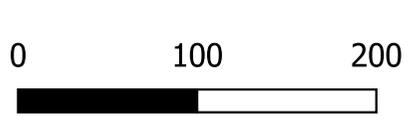
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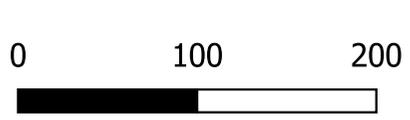


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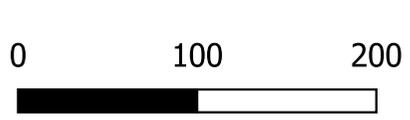
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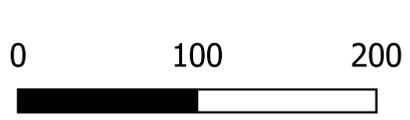
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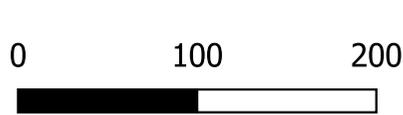


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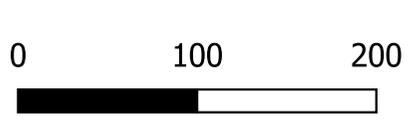


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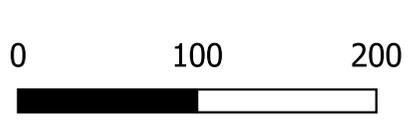


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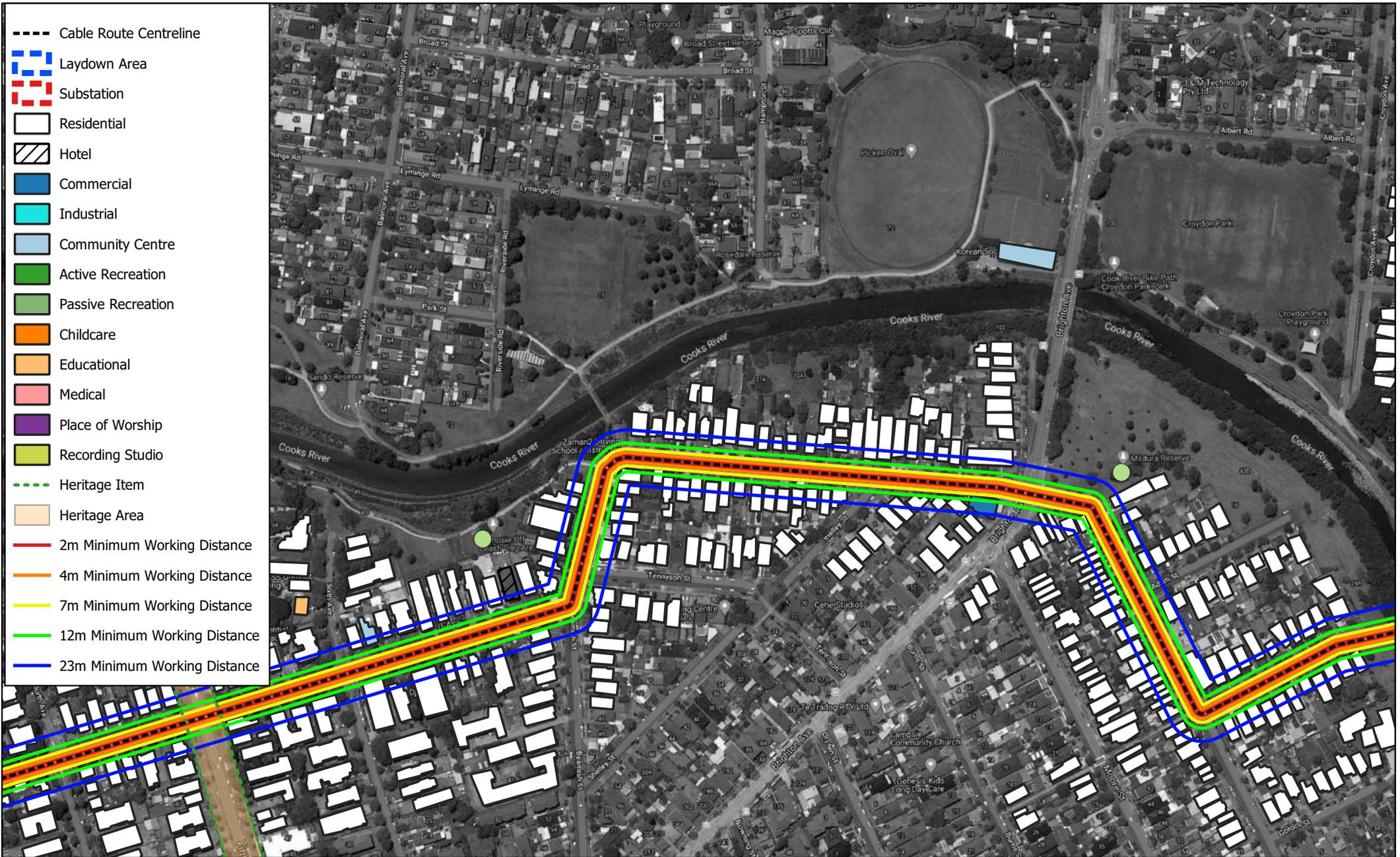


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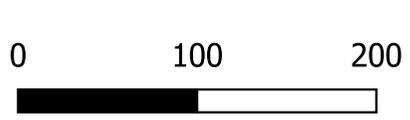


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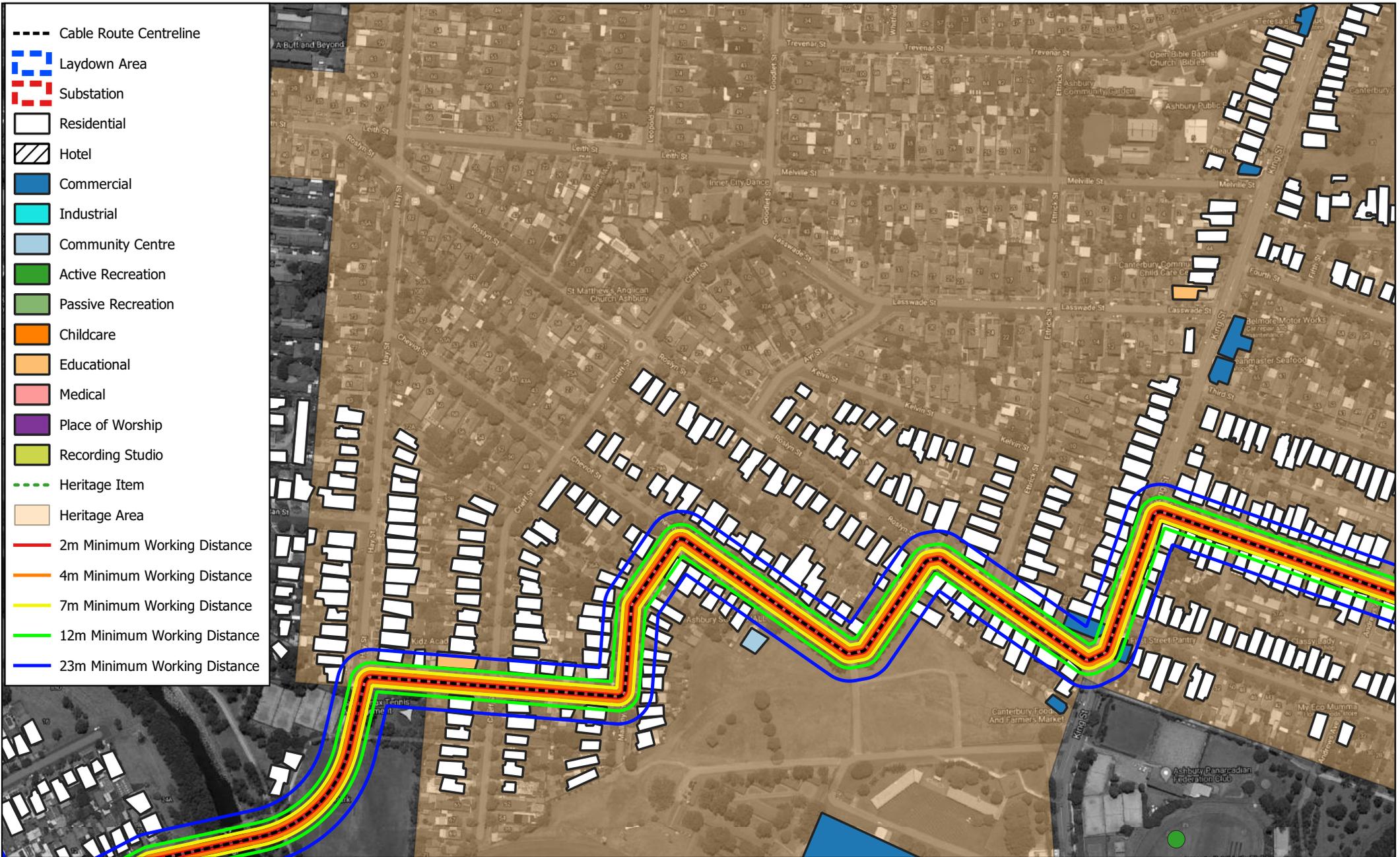


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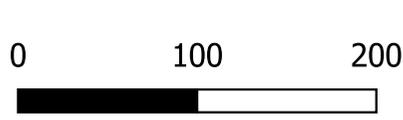


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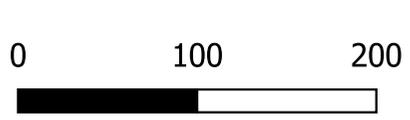


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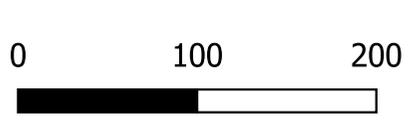
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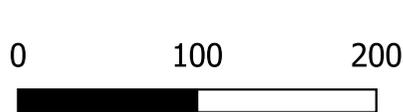


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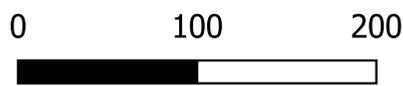
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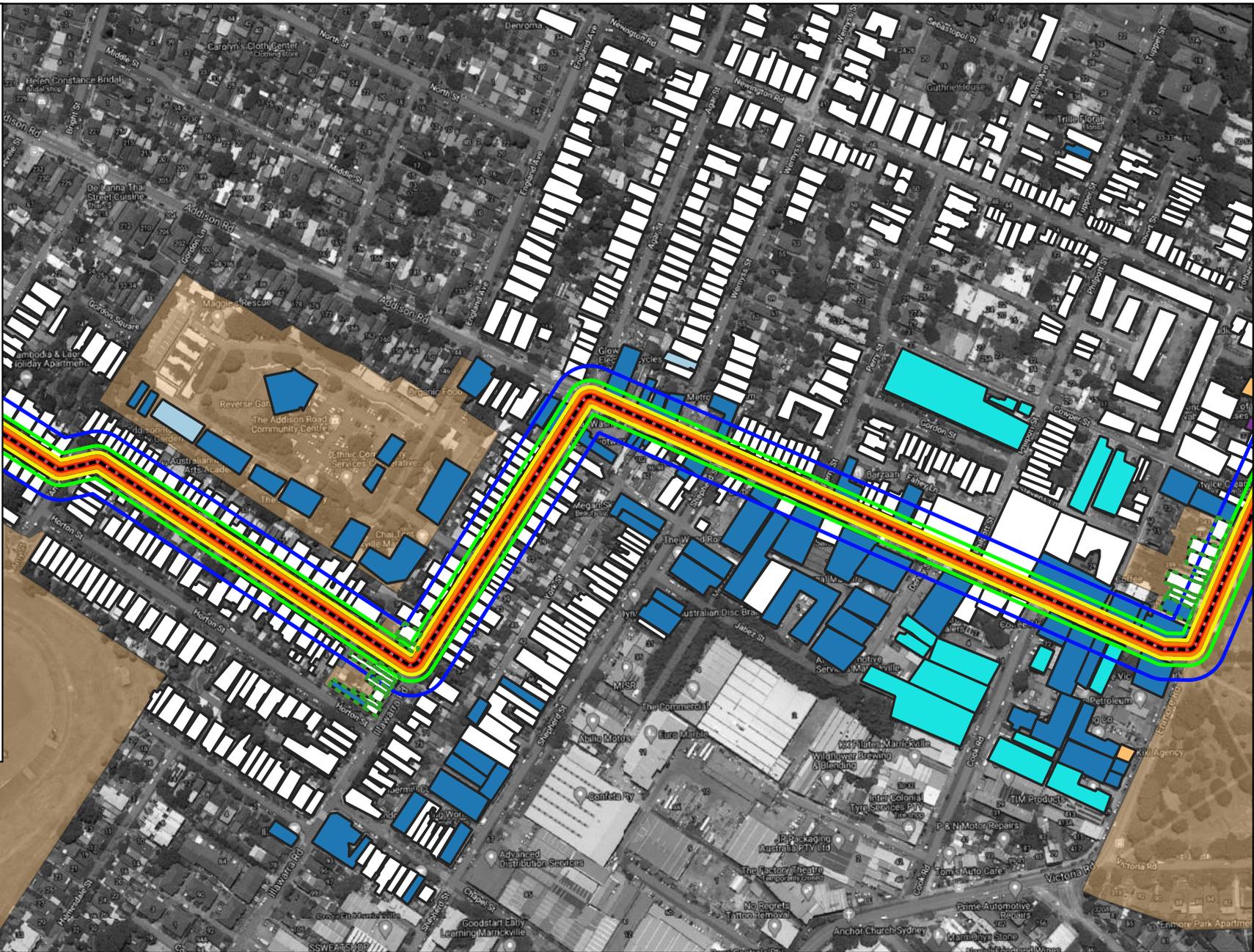


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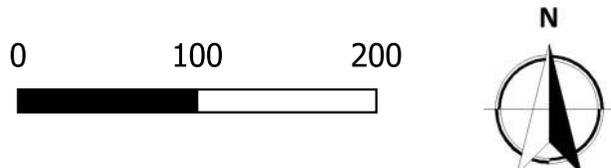
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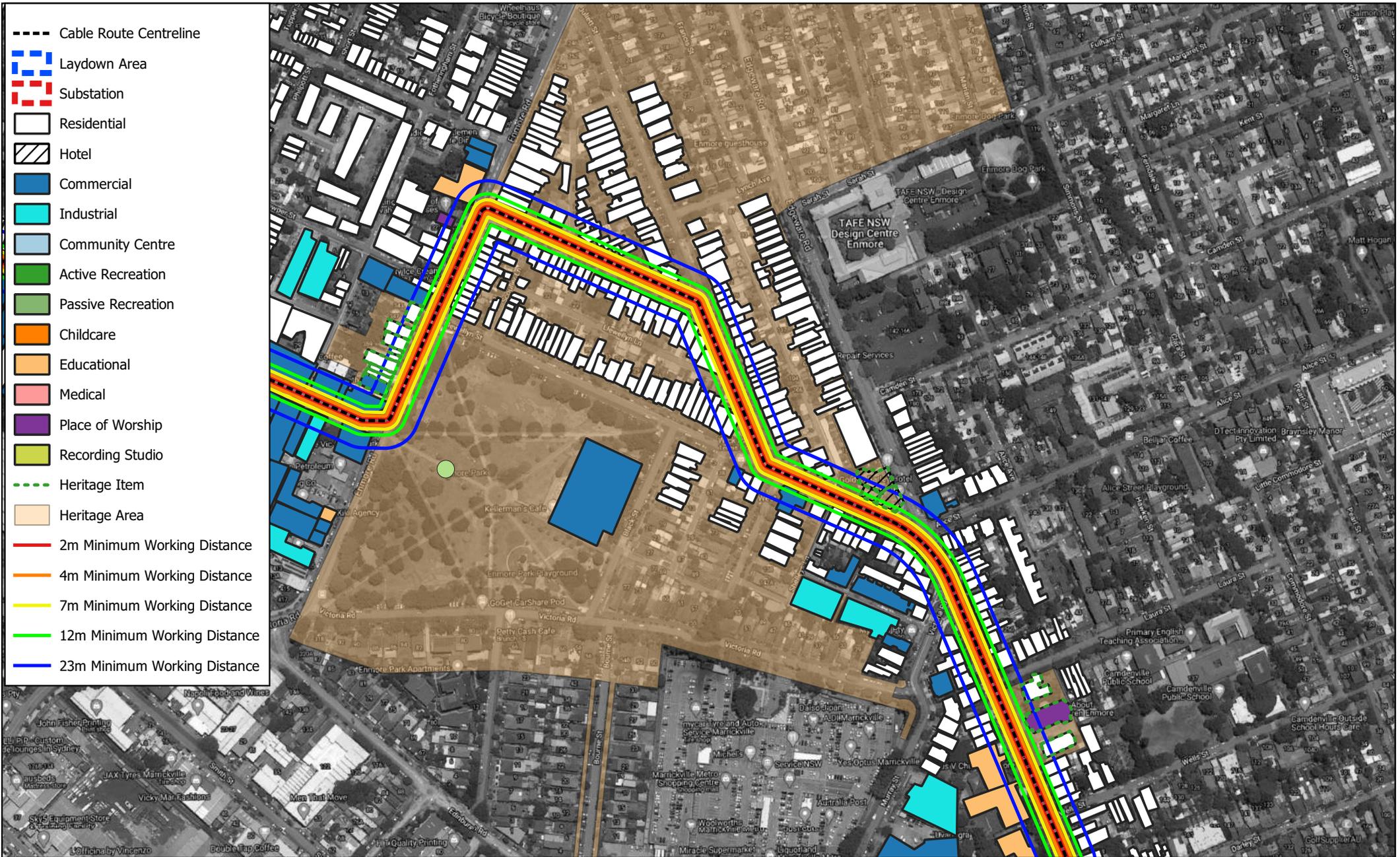


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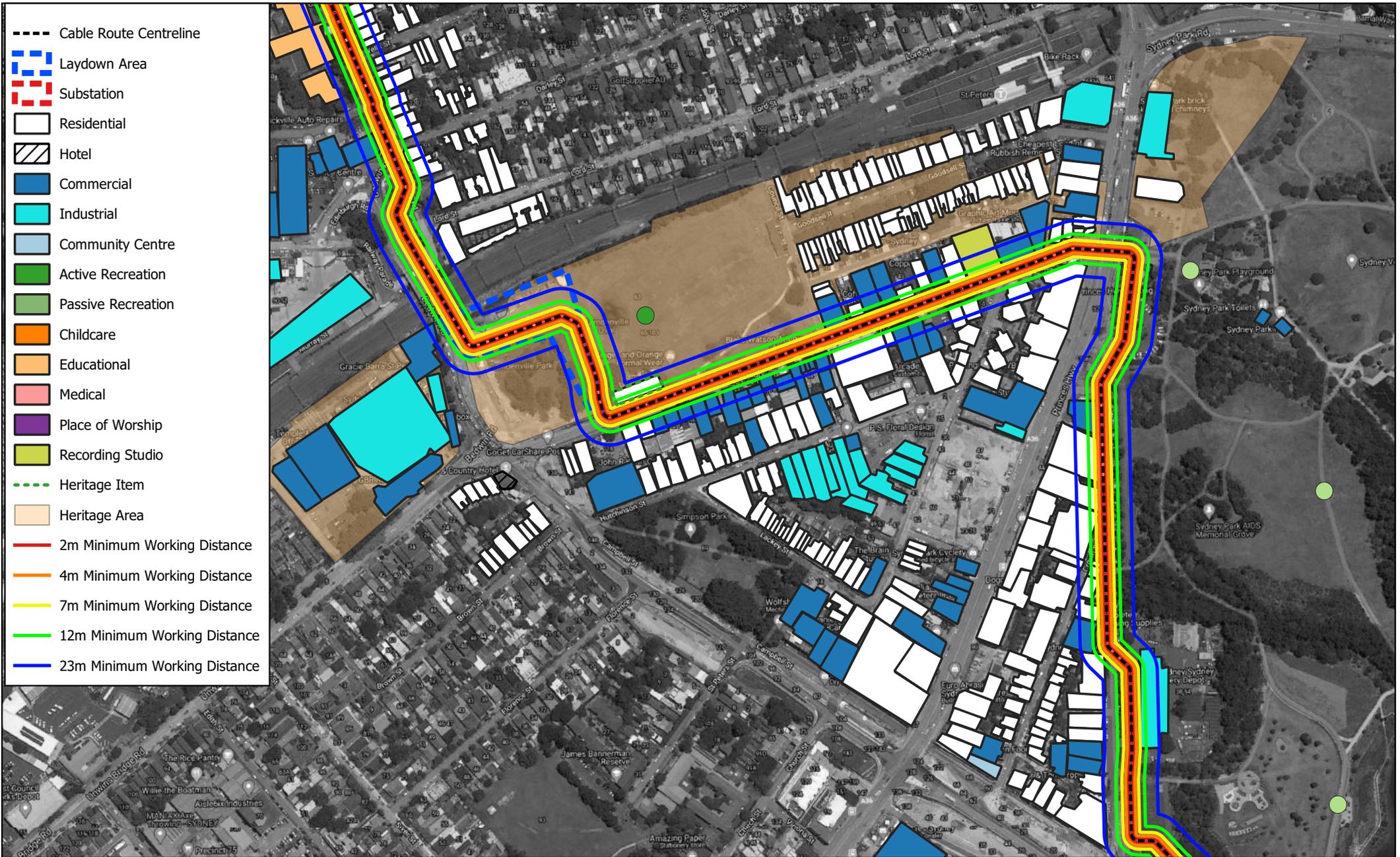


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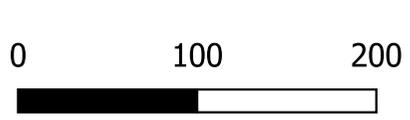


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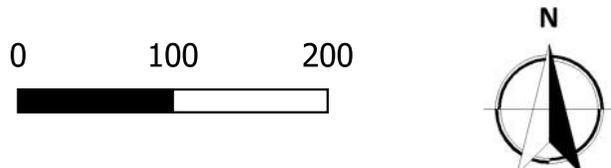
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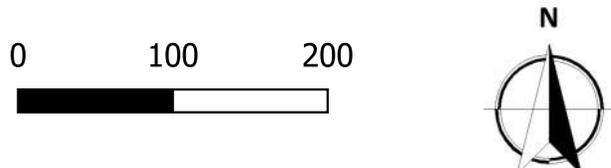


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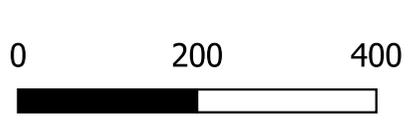


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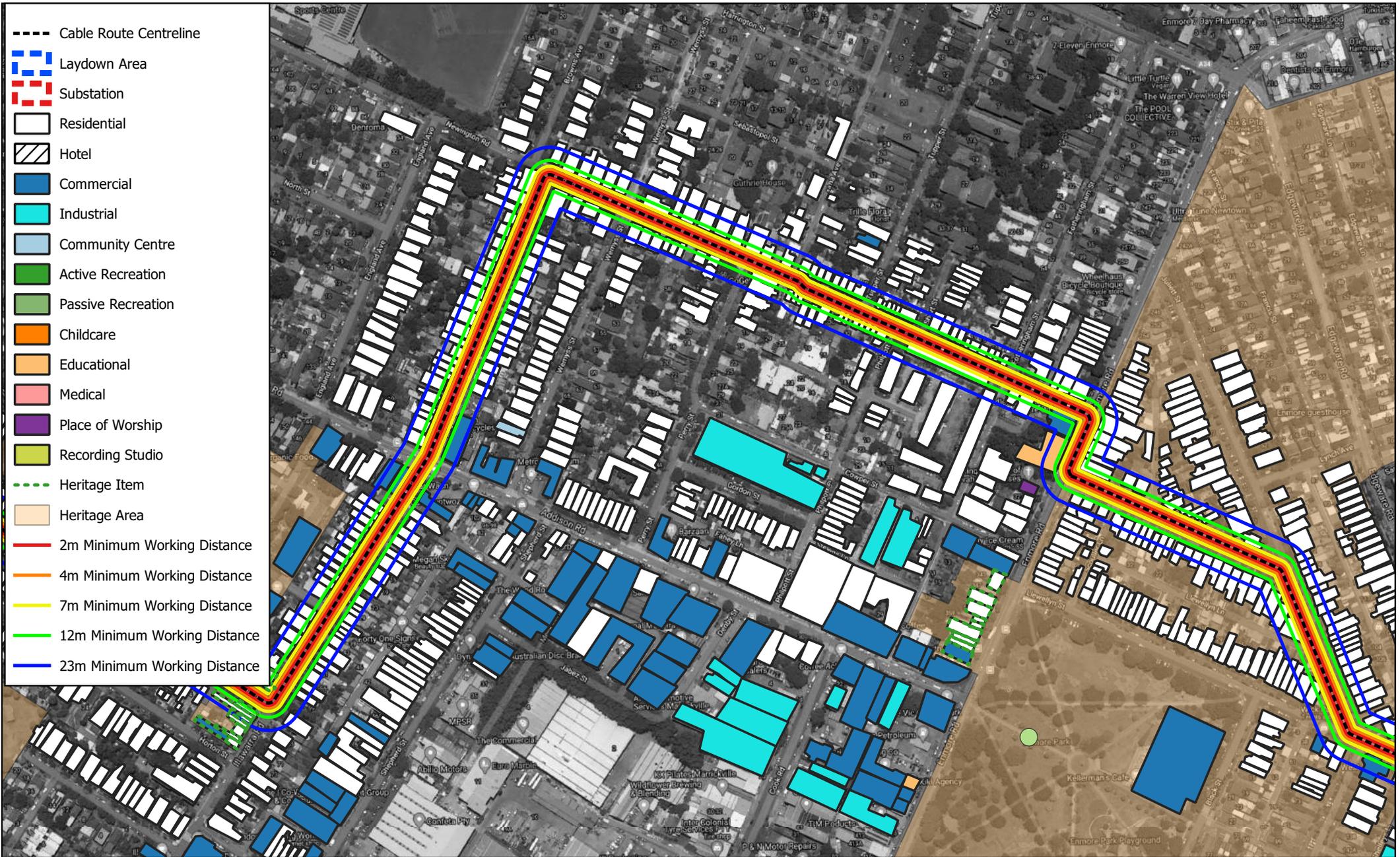


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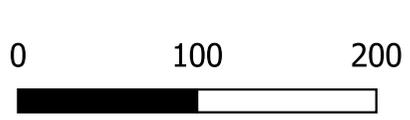


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Supporting Noise and Vibration Technical Detail and Information

C7.5 Sleep Disturbance

The ICNG recommends that where construction works are planned to extend over more than two consecutive nights (between 10pm and 7am), maximum noise levels and the extent and frequency of maximum noise level events exceeding the RBL should be considered and is examined below.

The EIS NIA make reference to guidance provided in the ICNG for assessing the potential for sleep disturbance which recommends that to minimise the risk of sleep disturbance during the night-time period (10pm to 7am), the LA1(1 minute), noise level outside a bedroom window should not exceed the RBL by more than 15 dBA (Sleep Disturbance Screening Level). EIS NIA considers it appropriate to use the Sleep Disturbance Screening Level to assess the likelihood of sleep disturbance. While this Sleep Disturbance Screening Level is not a firm criterion to be met, where the Sleep Disturbance Screening Level is met sleep disturbance is not likely. If this Sleep Disturbance Screening Level is exceeded, a more detailed analysis must be undertaken to consider the likelihood of awakening reactions and the number of times this may happen during the night-time period.

The EIS NIA presents a review of research into sleep disturbance which represents advice on the subject of sleep disturbance due to noise events. It concludes that having considered the results of research to date that, *'Maximum internal noise levels below 50 to 55 dB(A) are unlikely to cause awakening reactions'*. Therefore, the EIS NIA proceeds, *given that an open window provides approximately 10 dB noise attenuation from outside to inside, external noise levels of 60 to 65 dBA are unlikely to result in awakening reactions*. The EIS NIA concludes: *Noise levels above 65 dBA may cause awakening and have been adopted as the awakening reaction level for the project*.

The EIS NIA (refer to Table 5-4 of the EIS NIA) nominated an LA1(1 minute) Sleep Disturbance Screening Level of RBL plus 15 dBA and an LA1(1 minute) Awakening Reaction Level of 65 dBA in accordance with the ICNG.

Experience on similar projects, suggests that the difference between the LA1(1 minute) and LAeq(15 minute) noise level from construction activities is typically less 10 dBA. Accordingly, for CNVIS noise predictions purposes (refer to **Section 9.3**) it is appropriate to estimate the maximum noise levels (LA1(1 minute)) from the Project by adding 10 dBA to the predicted noise emission levels (LAeq(15 minute)). For example, reference can be made to the 55 dBA Noise Affected Zone (green line) in the Baseline CNVIS presented in **Appendix B** to identify residential sensitive receivers predicted to potentially experience a noise level greater than the LA1(1 minute) Awakening Reaction Level of 65 dBA.

C7.7 Workplace Health and Safety Noise Limits

Construction noise can induce hearing loss and typically occurs when individuals are exposed to excessive noise levels for extended periods of time (normally over several months or perhaps years). Alternatively, hearing damage can occur when a person is exposed to very high (peak) noise levels.

Section 56 of the "Work Health and Safety Regulation 2011" (WHS Regulation) provides acceptable noise limits for the workplace. The full section is reproduced below:

56 Meaning of "exposure standard for noise"

(1) In this Regulation, "exposure standard for noise", in relation to a person, means:

- (a) LAeq(8hour) of 85 dB(A), or*
- (b) LCpeak of 140 dB(C).*

Supporting Noise and Vibration Technical Detail and Information

The “noise level equivalent” is defined as the steady sound pressure level which in the course of an 8-hour period, delivers the same A-weighted sound energy as the actual noise on any particular representative working day. The peak noise level is the C-weighted peak sound pressure level.

For employees confined to one work location for a typical 8-hour shift, the LAeq noise level for that particular task will represent their daily noise exposure. Conversely, if an employee works on a variety of tasks during a typical 8-hour shift then the total noise exposure level would be composed of several partial noise exposures for the variety of tasks undertaken. The relationship between noise exposure level and duration is demonstrated in **Table 17**.

Table 17 Relationship between Noise Exposure Level and Noise Exposure Duration

Noise Exposure Level (LAeq)	Approximate Duration of Noise Exposure Equivalent to WHS Regulation Level of LAeq(8hour) 85 dBA
80 dBA	24 hours
82 dBA	16 hours
85 dBA	8 hours
88 dBA	4 hours
92 dBA	2 hours
95 dBA	1 hour
98 dBA	30 minutes
101 dBA	15 minutes
104 dBA	8 minutes
107 dBA	4 minutes
110 dBA	2 minutes
113 dBA	1 minute
116 dBA	30 seconds

C8 Construction Vibration Criteria

C8.1 Human Comfort Vibration Criteria

Vibration and its associated effects on people are usually classified as continuous, impulsive or intermittent as follows:

- *Continuous vibration*: machinery, steady road traffic, continuous construction activity such as underground drilling
- *Impulsive vibration*: infrequent activities that create up to three distinct vibration events in an assessment period, e.g. occasional dropping of heavy equipment, occasional loading and unloading
- *Intermittent vibration*: trains, nearby intermittent demolition activity, rock breakers and jack hammers.

Supporting Noise and Vibration Technical Detail and Information

Structural vibration in buildings can be detected by the occupants possibly affecting them in various ways including reducing working efficiency and quality of life. Complaint levels from occupants of the buildings subject to vibration depend on the use of the building and the time of day.

C8.1.1 Human Comfort Continuous and Impulsive Vibration Criteria

Acceptable levels of continuous vibrations depend on the time of day and the activity being undertaken. The preferred values for continuous and impulsive vibration for office and residential buildings are presented in **Table 18** and **Table 19** (extracted from AVTG, Table 2.2).

Table 18 Criteria for exposure to Continuous Vibration (Acceleration)

Space Occupancy	Time of Day	RMS Acceleration (m/s ²)	
		Preferred ¹	Maximum
Residential	Day	0.01	0.02
	Night	0.007	0.014
Offices	Day/Night	0.02	0.04

Note 1: The Preferred RMS Acceleration presented represent a “perceptible level of vibration”.

Table 19 Criteria for exposure to Impulsive Vibration (Acceleration)

Space Occupancy	Time of Day	RMS Acceleration (m/s ²)	
		Preferred ¹	Maximum
Residential	Day	0.3	0.6
	Night	0.1	0.2
Offices	Day/Night	0.64	1.28

Note 1: The Preferred RMS Acceleration presented represent a “perceptible level of vibration”.

The RMS acceleration levels presented in **Table 18** and **Table 19** are also represented in **Table 20** and **Table 21** as peak vibration velocity levels for ease of measurement and assessment (extracted from AVTG, Table C1.1).

Table 20 Criteria for exposure to Continuous Vibration (Velocity)

Space Occupancy	Time of Day	Peak velocity(mm/s)	
		Preferred ¹	Maximum
Residential	Day	0.28	0.56
	Night	0.20	0.4
Offices	Day/Night	0.56	1.1

Note 1: The Preferred Peak Velocity presented represent a “perceptible level of vibration”.

Table 21 Criteria for exposure to Impulsive Vibration (Velocity)

Space Occupancy	Time of Day	Peak velocity(mm/s)	
		Preferred ¹	Maximum
Residential	Day	8.6	17.0

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	Night	2.8	5.6
Offices	Day/Night	18.0	36.0

Note 1: The Preferred Peak Velocity presented represent a “perceptible level of vibration”.

C8.1.2 Human Comfort Intermittent Vibration Criteria

In the case of intermittent vibration, which is caused by plant such as rock breakers, the criteria are expressed as a Vibration Dose Value (VDV). The calculation of a VDV is used to evaluate the cumulative effects of bursts of intermittent vibration. Various studies have shown that VDV assessment methods far more accurately assess the level of disturbance than methods which assess the vibration magnitude only.

The acceptable VDV intermittent vibration for residential and office building uses are outlined in **Table 22** (extracted from AVTG Table 2.4).

Table 22 Acceptable Vibration Dose Values

Space Occupancy	Time of Day	VDV ($m/s^{1.75}$)	
		Preferred	Maximum
Residential	Day	0.20	0.40
	Night	0.13	0.26
Offices, schools, educational institutions, places of worship	Day/Night	0.40	0.80

C8.3 Cosmetic Damage Vibration Criteria

The recommended vibration limits from BS 7385 for transient vibration to ensure minimal risk of cosmetic damage to structurally sound heritage structures, residential, commercial and industrial buildings are presented in **Table 23**.

Table 23 Transient vibration guide values – minimal risk of cosmetic damage

Type Building	Peak Component particle velocity in frequency range of predominant pulse	
	4Hz to 15Hz ¹	15Hz and above ¹
Reinforced or framed structures, industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	
Dwellings and buildings of similar design and/or use	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

Note 1: Vibration values may need to be reduced by up to 50% if the dynamic loading caused by continuous vibration gives rise to dynamic magnification due to resonance, especially at the lower frequencies where lower guide values apply.

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C8.4 Structural Damage to Structurally Unsound Heritage Buildings Vibration Criteria

BS 7385 notes that a building of historical value should not, unless it is structurally unsound, be assumed to be more sensitive. In the case of heritage listed buildings which are considered to be “structurally unsound”, guidance for structural damage can be derived from the German Standard DIN 4150-3 (2016-12) *Vibrations in Buildings - Part 3: Effects on Structures*. The guideline values for vibration levels for heritage buildings are reproduced in **Table 24**.

Table 24 DIN 4150 Recommended PPV vibration levels for Heritage Listed Buildings

Group	Type of Structure	Peak Particle Velocity (mm/s)			
		At Foundation			Plane of Floor of Uppermost Storey
		1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz ¹	All Frequencies
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 at 10 Hz increasing to 40 at 50 Hz	40 at 50 Hz increasing to 50 at 100 Hz	40
2	Dwellings and buildings of similar design and/or use	5	5 at 10 Hz increasing to 15 at 50 Hz	15 at 50 Hz increasing to 20 at 100 Hz	15
3	Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Lines 1 or 2 and have intrinsic value (e.g. buildings that are under a preservation order)	3	3 at 10 Hz increasing to 8 at 50 Hz	8 at 50 Hz increasing to 10 at 100 Hz	8

Note 1: For frequencies above 100 Hz the upper value in this column should be used.

C8.5 Buried Utilities Vibration Criteria

Vibration limits for buried utilities may be available from the asset owner. TransGrid and its Contractors will liaise directly with the asset owner (e.g. Sydney Water) to confirm if there are any specific vibration limits nominated for the adjoining utilities. The following vibration criteria would also be adopted to control vibration emission to adjoining buried utilities.

The most relevant vibration damage criteria for evaluating the effects of transient vibration on buried pipework is the German Standard DIN 4150 Part 3 -1999 “*Structural Vibration - Part 5.3: Effects on Buried Pipework*” which provides the guideline values reproduced in **Table 25**.

Table 25 Vibration Guideline Values for Buried Pipework

Pipe Material	Guideline Values for Velocity Measured on the Pipe
Steel (including welded pipes)	100 mm/s
Clay, concrete, reinforced concrete, pre-stressed concrete, metal (with or without flange)	80 mm/s

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Pipe Material	Guideline Values for Velocity Measured on the Pipe
Masonry, plastic	50 mm/s

It should be noted that the guideline values above refer to velocity measured on the pipe. Appendix D.1 of the Standard states that where it is difficult to measure vibration on the pipe itself, such as in this case, measurements can be made on the ground surface. Furthermore that *“vibration measured on the ground surface is usually greater than that measured directly on pipes.”*

Additionally, the guideline values relate to transient vibration, which does not give rise to resonant responses in structures and/or is not likely to induce fatigue failure of the structure. Subclause 6.3 of the Standard states that where the dynamic loading caused by continuous vibration is such as to give rise to dynamic magnification due to resonance, then the guide values may need to be reduced by up to 50%. Rock-breaking activities, for example, are considered to have the potential to cause dynamic loading and it may therefore be appropriate to reduce the above values by 50%.

Where vibration measurements cannot be undertaken directly on the pipe, the vibration measurements can be undertaken in the ground immediately adjacent to the pipeline or on the ground surface above the pipeline. The criterion nominated above would still apply to the measured level. It is noted that this approach is likely to be conservative since it does not take into account the likely lower (attenuated) vibration levels to be expected on the pipe structure.

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C9 Construction Methodology - Noise and Vibration Sources

C9.2 Noise and Vibration Sources

C9.2.1 Plant and Equipment at Source Noise Control

The proposed plant and equipment to be used during construction have been identified **Table 26** and the nominated maximum allowable Sound Power Level (SWL) to manage noise emissions from the Project Works.

Table 26 Maximum Plant and Equipment Sound Power Levels

Activity	Plant / Equipment	Maximum Allowable Plant SWL per item – dBA		Overall SWL per Activity	
		L _{Aeq} (15 minute)	L _{A1} (1 minute)	L _{Aeq} (15 minute)	L _{A1} (1 minute)
Trenching works	Kobelco excavator SK 135R with rock breaker attachment	119	127	122	129
	Kobelco excavator SK45 SRX with rock breaker	115	123		
	Wacker Neuson tandem roller RD18-100	107	113		
	Bomag tandem roller BW120AD-4	109	115		
	Wacker Neuson Vibration plate WP1550W	108	114		
	Wacker Neuson Rammer BS60-4	108	114		
	Flex drive pumps	97	100		
	3 tonne tipper	97	105		
	10 tonne tipper	103	111		
	Small 240V petrol generator	103	106		
Joint Bay Installation	Truck & dogs	108	116	122	130
	As per trenching works above.	122	129		
	25tonne franna crane	98	104		
Cable Jointing Works	Hiab crane truck – Isuzu FYJ 350 with HMF2120 hiab	113	119	103	109
Cable Installation	Powerlite 20kVA generator set	103	109	108	116
	Dosec 6T hydraulic winch and 8 tonne tipper Isuzu FVZ 1400	103	111		
Cable Installation	Cable drum transport – cable trailer with power pack and prime mover.	103	111	108	116

Supporting Noise and Vibration Technical Detail and Information

Activity	Plant / Equipment	Maximum Allowable Plant SWL per item – dBA		Overall SWL per Activity	
		L _{Aeq} (15 minute)	L _{A1} (1 minute)	L _{Aeq} (15 minute)	L _{A1} (1 minute)
	Atlas Copco compressor XAS 300 DD7	99	109		
	Redmond Gary cable pusher RG.PA1053 and 15kW Kubota power pack	103	106		
	Fibre winch – Redmond Gary 5/10kN capstan winch skid	94	99		
Special crossings - Muir Road Bridge	Kobelco excavator SK 225R with rock breaker attachment	121	129	125	133
	Kobelco excavator SK135 SRX with rock breaker	119	127		
	Kobelco excavator S050 SRX with rock breaker	115	123		
	Wacker Neuson tandem roller RD18-100	107	113		
	Wacker Neuson Vibration plate WP1550W	108	114		
	Wacker Neuson Rammer BS60-4	108	114		
	Flex drive pumps	97	100		
	Small 240V petrol generator	103	106		
	Lighting towers - Powerlite 20kVA generator set	105	108		
	Mobile Concrete pump – Truck mounted	109	112		
	Bogey trucks	103	111		
	Truck & dogs	108	116		
	Concrete pumps – Line pump and extended pump	102	105		
	Craneage – 400 tonne Grove All Terrain Mobile Crane	113	119		
	Utes with reversing quackers	88	96		
	SF-50 Hydraulic CFA Piling Rig	112	117		
Semi Trailer Delivery units – with extended Jinkers – Semi Truck	108	116			

Supporting Noise and Vibration Technical Detail and Information

Activity	Plant / Equipment	Maximum Allowable Plant SWL per item – dBA		Overall SWL per Activity	
		L _{Aeq} (15 minute)	L _{A1} (1 minute)	L _{Aeq} (15 minute)	L _{A1} (1 minute)
Special crossings - Bedwin Road Bridge	Kobelco excavator SK 225R with rock breaker attachment	121	129	126	133
	Kobelco excavator SK135 SRX with rock breaker	119	127		
	Kobelco excavator S050 SRX with rock breaker	115	123		
	Wacker Neuson tandem roller RD18-100	107	113		
	Wacker Neuson Vibration plate WP1550W	108	114		
	Wacker Neuson Rammer BS60-4	108	114		
	Flex drive pumps	97	100		
	Small 240V petrol generator	103	106		
	Lighting towers - Powerlite 20kVA generator set	105	108		
	Mobile Concrete pump – Truck mounted	109	112		
	Bogey trucks	103	111		
	Truck & dogs	108	116		
	Concrete pumps – Line pump and extended pump	102	105		
	Craneage – 250 tonne Grove All Terrain Mobile Crane	113	119		
	Craneage – 350 tonne Grove All Terrain Mobile Crane	113	119		
	Craneage – 400 tonne Grove All Terrain Mobile Crane	113	119		
	Craneage – 450 tonne Grove All Terrain Mobile Crane	113	119		
	Utes with reversing quackers	88	96		
	SF-50 Hydraulic CFA Piling Rig	112	117		
	Semi Trailer Delivery units – with extended Jinkers – Semi Truck	108	116		
Substations	Kobelco excavator SK135 SRX with rock breaker	119	127	124	131
	Kobelco excavator S050 SRX with rock breaker	115	123		
	Wacker Neuson tandem roller RD18-100	107	113		
	Wacker Neuson Vibration plate WP1550W	108	114		
	Wacker Neuson Rammer BS60-4	108	114		

Supporting Noise and Vibration Technical Detail and Information

Activity	Plant / Equipment	Maximum Allowable Plant SWL per item – dBA		Overall SWL per Activity	
		L _{Aeq} (15 minute)	L _{A1} (1 minute)	L _{Aeq} (15 minute)	L _{A1} (1 minute)
	Flex drive pumps	97	100		
	Small 240V petrol generator	103	106		
	Lighting towers - Powerlite 20kVA generator set	105	108		
	Mobile Concrete pump – Truck mounted	109	112		
	Bogey trucks	103	111		
	Truck & dogs	108	116		
	Concrete pumps – Line pump and extended pump	102	105		
	Utes with reversing quackers	88	96		

Source: Garde indicative plant list dated 14 May 2020.

Appendix D Out of Hours Work Protocol



Out-of-Hours Work (OOHW) Protocol
Potts Hill to Alexandria Transmission Cable Project
Powering Sydney's Future



Report Number 10-1779

Taihan Electric Australia Pty Ltd

126 Beaconsfield Street
SILVERWATER NSW 2128

PREPARED FOR: Taihan Electric Australia Pty Ltd
126 Beaconsfield Street
SILVERWATER NSW 2128

PREPARED BY: VMS Australia Pty Ltd
Unit 1, 41-43 Green Street
BANKSMEASOW NSW 2019
ABN: 52 168 418 013

Quality Management

Reference	Status	Date	Prepared	Authorised
10-1779	Final	5 August 2020	Mark Blake	Mark Blake
10-1779	Revision 1	12 August 2020	 Mark Blake BE Mechanical MIEAust MASS	 Mark Blake M Environmental Eng; M Structural Eng. MIEAust MASS

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Appendix C	Variation to Work Hours Process

Glossary

Term/Acronym	Definition
Acceleration	Acceleration is defined as the rate of change of Velocity of a particle over a period of time and is typically measured in the units of m/sec ² .
Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Amendment Report	The Amendment Report (Powering Sydney's Future: Potts Hill to Alexandria Transmission Cable Project Amendment Report, AECOM dated February 2020) prepared post the EIS being exhibited which describes the design refinements to the Project and identifies any changes to the environmental management and mitigation measures that are proposed to minimise environmental impacts.
AMMM	Additional Mitigation Measures Matrix
Ancillary facility	A temporary facility for construction of the SSI including an office and amenities compound, construction compound, material crushing and screening plant, materials storage compound, maintenance workshop, testing laboratory and material stockpile area.
Annoying Activities	As defined by the Interim Construction Noise Guideline to include: <ul style="list-style-type: none"> • 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
AS 1055	Standards Australia AS1055–1997™ – Description and Measurement of Environmental Noise
AS2187:2006	Australian Standard AS 2187.2-2006: Explosives - Storage and Use - Use of Explosives
AS2436	Standards Australia AS 2436–2010™ – Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites.
AS61672 or AS1259	Standards Australia AS IEC 61672.1–2004™ – Electro Acoustics - Sound Level Meters Specifications Monitoring or Standards Australia AS1259.2-1990™ – Acoustics – Sound Level Meters – Integrating/Averaging as appropriate to the device.
Attenuation	The reduction in the level of sound or vibration.
AVTG	Assessing Vibration – a technical guideline
A-weighting, dBA	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
BS 6472	British Standard (BS 6472–1992) – Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz) dated 1992;

Term/Acronym	Definition
BS 7385	British Standard BS7385: Part 2-1993 - Evaluation and Measurement for Vibration in Buildings Part 2 – Guide to Damage Levels from Ground-borne Vibration, dated 1993.
CCLP	Contractor Community Liaison Plan
CCS	Community Communication Strategy
CEMP	Construction Environmental Management Plan
CMRP	Compliance Monitoring and Reporting Program
CMS	Complaints Management System
CMSS	Construction Managers Site Superintendent
CNVIS	Construction Noise and Vibration Impact Statement
CNVMP	Construction Noise and Vibration Management Plan (CEMP Sub-plan)
CoA	Conditions of Approval for SSI 8583
Completion of construction	The date upon which construction is completed and all requirements of the Planning Secretary (if any) have been met. If construction is staged, completion of construction is the date upon which construction is completed and all requirements of the Planning Secretary (if any) have been met, in respect of all stages of construction.
Construction	Includes all physical work required to construct the Project, as defined in the CoA
Contractor	Any contractor or subcontractor appointed to the Project
Council	City of Canterbury-Bankstown Inner West Council City of Sydney
COVID-19 Extended Standard Hours	7 am to 6 pm all days
CPIMP	Construction Public Infrastructure Management Plan
CR	Complaints Register
CRT	Community Relations Team
SCRG	Community and Stakeholder Reference Group
DEC	Department of Environment and Conservation (now EPA)
DECC	Department of Environment and Climate Change (now EPA)
DECCW	Department of Environment, Climate Change and Water (now EPA)
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s_1 and s_2 is given by $20 \log_{10}(s_1 / s_2)$. The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is $20\mu\text{Pa}$.
DIN4150:3	German Institute for Standardisation – DIN 4150 (1999-02) Part 3 – Structural Vibration - Effects of Vibration on Structures.
DP&I	NSW Department of Primary Industries (now DPIE)
DPIE	NSW Department of Planning, Industry and Environment
ECM	Environmental Control Measure
EES	The DPIE's Environment, Energy and Science Group

Term/Acronym	Definition
EIS	The Environmental Impact Statement titled Powering Sydney's Future: Potts Hill to Alexandria Transmission Cable Project Environmental Impact Statement, prepared by AECOM Australia Pty Limited, dated October 2019, including the Submissions Report and Amendment Report.
EIS CNVIS	The Construction Noise and Vibration Impact Assessment attached as Appendix E to the EIS.
EMR	Independent Environmental Management Representative appointed by TransGrid
EMMM	Environmental Management Mitigation Measures (Chapter 3 of the Amendment Report)
EMS	Environmental Management System
Environment	Includes all aspects of the surroundings of humans, whether affecting any human as an individual or in his or her social groupings
EP&A Act	Environmental Planning and Assessment Act 1979 (NSW)
EP&A Regulation	Environmental Planning and Assessment Regulation 2000 (NSW)
EPA	NSW Environment Protection Authority
EPL	Environment Protection Licence under the POEO Act
ESM	Environment & Sustainability Manager
Fast/Slow Time Weighting	Averaging times used in sound level meters.
Feasible and reasonable	Consideration of best practice taking into account the benefit of proposed measures and their technological and associated operational application in the NSW and Australian context. Engineering considerations and what is practical to build. Reasonable Feasible relates to relates to the application of judgement in arriving at a decision, taking into account mitigation benefits and cost of mitigation versus benefits provided, community views and nature and extent of potential improvements.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Heavy Vehicle	Has the same meaning as in the <i>Heavy Vehicle National Law</i>
Heritage item	A place, building, work, relic, archaeological site, tree, movable object or precinct of heritage significance that is listed under one or more of the following registers: the State Heritage Register under the Heritage Act 1977 (NSW), a heritage item registered under a Local Environmental Plan under the EP&A Act, the World, National or Commonwealth Heritage lists under the Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth), and an Aboriginal object or Aboriginal place as defined in section 5 of the National Parks and Wildlife Act 1974 (NSW).
Hertz, Hz	The unit of Frequency (or Pitch) of a sound or vibration. One hertz equals one cycle per second.
HNML	Highly Noise Affected Management Level - 75 dB(A) LAeq(15 minute)
ICNG	Interim Construction Noise Guideline (OEH, 2009)
Incident	An occurrence or set of circumstances that causes or threatens to cause material harm and which may or may not be or cause a noncompliance.
Infrastructure Approval	SSI project approval for SSI 8583 granted by the Minister for Planning and Public Spaces on 14 May 2020

Term/Acronym	Definition
Land	Has the same meaning as the definition of the term in section 1.4 of the EP&A Act
Landowner	Has the same meaning as "owner" in the <i>Local Government Act 1993</i> and in relation to a building means the owner of the building
LGA	Local Government Area. Area of administration of Council.
L90,15minute	A noise level index. The noise level exceeded for 90% of the time over a 15-minute period. L90 can be considered to be the "average minimum" noise level and is often used to describe the background noise.
Leq,15minute	A noise level index called the equivalent continuous noise level over a 15-minutes period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
Lmax,T15minute	A noise level index defined as the maximum noise level during a 15-minute period. Lmax is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
Maximise	Implement all reasonable and feasible mitigation measures to achieve the specified outcome
Minimise	Implement all reasonable and feasible mitigation measures to reduce the impacts of the SSI
Minister	NSW Minister for Planning and Public Spaces, or delegate
Minor	Not very large, important or serious
Monitoring Program	Construction Noise and Vibration Monitoring Program
NCA	Noise Catchment Area
Negligible	Small and unimportant, such as to be not worth considering
NML	Project Specific Noise Management Level as derived from the Interim Construction Noise Guideline (2009)
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
NPfI	NSW Noise Policy for Industry (2017)
Non-compliance	An occurrence, set of circumstances or development that is a breach of this approval
NSW Vibration Guideline, the	NSW Department of Environment and Conservation – NSW Environmental Noise Management - Assessing Vibration: a Technical Guideline (the NSW Vibration Guideline), February 2006.
Octave Band	A range of frequencies whose upper limit is twice the frequency of the lower limit.
OEH	Office of Environment and Heritage (now EPA)
OOH	Out of Hours – All periods which are not Standard Construction Hours
OOHW	Out of Hours Works
OOHW Protocol	Out of Hours Work Protocol (this document)
POEO Act	Protection of the Environment Operations Act 1997 (NSW)
Planning Secretary	Planning Secretary of the DPIE

Term/Acronym	Definition
PPV	The particles of a medium are displaced from their random motion in the presence of a vibration wave. The greatest instantaneous velocity of a particle during this displacement is called the Peak Particle Velocity (PPV) and is typically measured in the units of mm/s.
Privately-owned land	Land that is not owned by a public agency
Project	Powering Sydney's Future - Potts Hill to Alexandria Transmission Cable Project Construction and operation of a new 330 kilovolt underground transmission cable circuit between the existing Rookwood Road substation in Potts Hill and the Beaconsfield West substation in Alexandria.
Project Area	The area subject to disturbance and/or infrastructure development, as shown on the project layout plans
Proponent	TransGrid
Public infrastructure	Linear and related infrastructure that provides services to the general public, such as roads, railways, water supply, drainage, sewerage, gas and fuel supply, electricity, telecommunications, etc.
RBL	The Rating Background Level for each period is the median value of the Assessment Background Level values for the period over all of the days measured. There is therefore an RBL value for each period (day, evening and night)
Relevant council	The council of the land on which works are to be carried out
Residence	Existing or approved dwelling
Residential zones	As defined by the relevant Local Environment Plan including Zone R1 General Residential, Zone R2 Low Density Residential, Zone R3 Medium Density Residential, Zone R4 high Density Residential
Respite Period	Any period which highly noise intensive works as defined in CoA E5 are not undertaken
RMS	NSW Roads and Maritime Services
RNP	NSW Road Noise Policy (DECCW 2011)
SCEC	Senior Community Engagement Consultant
Sensitive periods	Period of time determined in consultation with affected sensitive receiver
Sensitive receiver	Includes residences, educational institutions (including preschools, schools, universities, TAFE colleges), health care facilities (including nursing homes, hospitals), religious facilities (including churches), child care centres, passive recreation areas (including outdoor grounds used for teaching), active recreation areas (including parks and sports grounds). Receivers that may be considered to be sensitive include commercial premises (including film and television studios, research facilities, entertainment spaces, temporary accommodation such as caravan parks and camping grounds, restaurants, office premises, and retail spaces) and industrial premises, and others as identified by the Secretary
Sound Power	Sound Power is the rate at which sound energy is emitted, reflected, transmitted or received, per unit time. Unlike sound pressure, sound power is neither room-dependent nor distance-dependent.

Term/Acronym	Definition
Sound Power Level (SWL)	The Sound Power Level is the sound power relative to a standard reference pressure of 1pW (20×10^{-12} Watts) on a decibel scale. The SWL of a simple point source may be used to calculate the SPL at a given distance [®] using the following formula: $SPL = SWL - 10 \times \text{Log}_{10}(4 \times \pi \times r^2)$ <p>Note that the above formula is only valid for sound propagation in the free-field (see below).</p>
Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Pressure Level (SPL)	The sound level is the sound pressure relative to a standard reference pressure of 20µPa (20×10^{-6} Pascals) on a decibel scale.
Spoil	All material generated by excavation into the ground
SSI	The State Significant Infrastructure (the Project), as generally described in Schedule 1 of the Infrastructure Approval (SSI 8583)
Standard Construction Hours	7 am to 6 pm Monday to Friday, and 8 am to 1 pm on Saturdays No work Sundays or public holidays
Submissions Report	Powering Sydney's Future: Potts Hill to Alexandria Transmission Cable Project Submissions Report, AECOM dated February 2020. The Submissions Report outlines TransGrid's response to submissions received on the EIS during the public exhibition period, including updates to the environmental management and mitigation measures presented in the EIS.
Sub-plans	Sub Plans to the CEMP requiring the approval the Secretary of the Department of Environment and Planning under Conditions C3 and C7 including traffic and transport, noise and vibration, air quality, vegetation and biodiversity, soil and water, heritage, public infrastructure and waste.
SWMS	Safe Work Method Statement
Taihan	Taihan Electric Australia Pty Ltd, the principal construction contractor responsible for delivering the Project.
TfNSW	Transport for New South Wales
TPIM	Third Party Interface Manager (TPIM), Stakeholder and Community Relations
TransGrid	Proponent of the Project
Underboring	This is a trenchless method for installing cables involving passing the conduits under infrastructure (such as a road or railway corridor) or a watercourse. Underboring could be via thrust boring (also known as micro tunnelling), or horizontal directional drilling.
Vibration Dose, VDV	When assessing intermittent vibration it is necessary to use the vibration dose value (VDV), a cumulative measurement of the vibration level received over an 8-hour or 16-hour period. The VDV formulae uses the RMS Acceleration raised to the fourth power and is known as the Root-mean-quad method. This technique ensures the VDV is more sensitive to the peaks in the acceleration levels. VDV's are typically measured in the units of $\text{m/s}^{1.75}$.
VMS	VMS Australia Pty Ltd
WHS Regulation	Work Health and Safety Regulation 2011
Works	All physical activities to construct the Project

1 Introduction

1.1 Purpose

VMS Australia Pty Ltd (VMS) has been engaged by Taihan Electric Australia Pty Ltd (Taihan) to prepare the Out-of-Hour-Work Protocol (OOHW Protocol) as part of the Construction Noise and Vibration Management Plan (CNVMP) to provide guidance in managing the risks and impacts for Out-of-Hours works (OOHW) associated with the Powering Sydney's Future – Potts Hill to Alexandria Transmission Cable Project (the Project).

This Protocol will be used to address the relevant requirements of the Conditions of Approval (CoA) (SSI 8583) and applicable legislation. This Protocol will be submitted to the Planning Secretary of the Department of Planning Industry and Environment (DPIE) before the commencement of the Project Works.

1.2 Context

The Project involves the construction and operation of a new 330kV underground transmission cable circuit between the existing TransGrid Rookwood Road substation in Potts Hill and the Beaconsfield West substations in Alexandria. This project includes upgrades to the Sydney South, Rookwood Road and Beaconsfield West substations. TransGrid is the proponent of the Project and Taihan is the appointed Contractor. Garde in turn is the Contractor appointed by Taihan for the Civil Works construction. Roles and responsibilities may be assigned to TransGrid or its Contractors.

In order to complete the Project, a number of activities will be required outside standard construction hours to allow for road and rail possessions, utility authority requirements and appropriate safety management for both workers and members of the public as well as to minimise the impacts to the noise and vibration sensitive receivers.

As OOHW have the potential to impact on the amenity of adjacent noise and vibration sensitive receivers, these works require assessment and approval prior to commencement. This OOHW Protocol defines the process for that assessment and approval for all OOHW associated with the Project. The OOHW Approval process is shown in **Figure 2**.

1.3 Scope and Objectives of the OOHW Protocol

This OOHW Protocol identifies the process for the consideration, management and approval of Works which are outside the Approved Construction Hours nominated in CoA E4 and CoA E5 (refer **CNVMP Section 6.1** and **CNVMP Section 6.2**). This OOHW Protocol provides a process for the consideration of out-of-hours works against the relevant noise and vibration criteria, including the determination of low and high-risk activities, the identification of mitigation measures for residual impacts, including respite periods in consultation with the community at each affected Sensitive Receiver as required under CoA E9.

This OOHW Protocol is to be implemented when the proposed OOHW triggers the requirement to prepare an OOHW application in accordance with the Variation to Work Hours Process presented in **CNMVP Figure 6**.

This OOHW Protocol has been prepared to address the requirements of the following:

- Conditions of Approval (CoA) for the Project, in particular CoA E8
- Mitigation measures listed in the Environmental Management and Mitigation Measures (EMMM), presented in Chapter 3 of the Amendment Report, *Powering Sydney's Future: Potts Hill to Alexandria Transmission Cable Project Amendment Report*, AECOM, dated February 2020 and Chapter 6 of the Submissions Report, *Powering Sydney's Future: Potts Hill to Alexandria Transmission Cable Project Submissions Report*, AECOM, dated February 2020
- TransGrid's *Environmental Guidance Note - Construction Noise*

- CoA B2 Community Communication Strategy (CCS)
- Applicable guidelines and legislation

The Compliance Matrix in **Appendix A** provides a comprehensive list of compliance requirements and environmental documents.

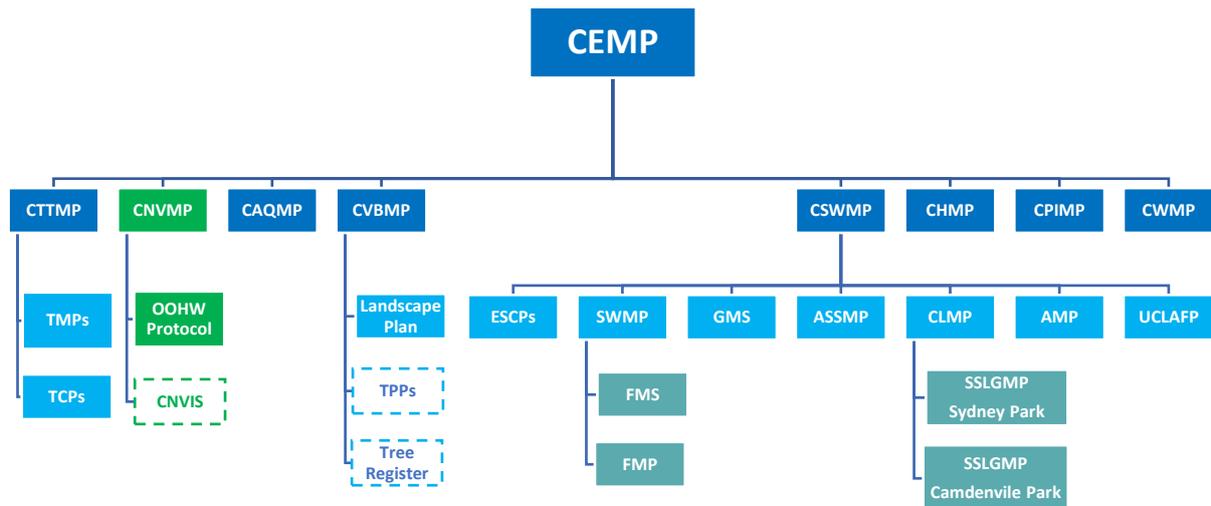
1.4 Project Environmental Management System

The Project Environmental Management System (EMS) is described in **Figure 1**.

To achieve the intended environmental performance outcomes, TransGrid and its Contractors have established, implemented, maintained and continually improved an EMS.

The EMS consists of environmental plans, procedures, protocols, including this OOHW Protocol, and tools as set out below and illustrated in **Figure 1**.

Figure 1 Project Environmental Management System



1.5 Consultation for Preparation of the OOHW Protocol

In accordance with CoA E8(a), this OOHW Protocol has been developed in consultation with the relevant councils (City of Canterbury-Bankstown, Inner West Council and City of Sydney). In accordance with CoA C4, a copy of the correspondence received from the Councils as result of the consultation is provide in **Appendix B**.

Consultation will continue throughout the construction of the Project with relevant stakeholders and agencies. Where relevant, the outcomes of this consultation will be documented in subsequent revisions of this OOHW Protocol.

1.6 CNVMP Amendments

This OOHW Protocol will be updated as required (refer to **CNVMP Section 1.6**).

1.7 Planning Secretary Approval

This OOHW Protocol must be approved by the Planning Secretary before commencement of the Project works Governance.

This OOHW Protocol is to be used in conjunction with the Construction Noise and Vibration Assessment (CNVIA) prepared by AECOM dated October 2019, the CNVMP and any future Construction Noise and Vibration Impact Statements (CNVIS), and any applicable EPLs. These documents establish minimum requirements for managing OOHW noise and vibration impacts on the Project. All construction noise and vibration documentation including CNVMP and CNVIS that discuss OOHW must be consistent with this OOHW Protocol.

1.8 Out of Hours Works Construction Noise and Vibration Impact Statement (OOHW CNVIS)

The Baseline CNVIS presented in **CNVMP Appendix B** will be used to identify the sensitive receivers where the CoA E1 Construction NMLs (refer to **CNVMP Section 7.2**) and CoA E2 vibration (refer to **CNVMP Section 8.1** and **CNVMP Section 8.6**) objectives are likely to be exceeded to determine the required mitigation measures (refer to **CNVMP Section 10**), where noise and vibration monitoring would be undertaken during the OOHWs (refer to **CNVMP Section 11**) and provide input to the community and other stakeholders communication in accordance with CoA B1 and CoA B2 Community Communication Strategy (CCS). A specific OOHW CNVIS (refer to **Section 6**) will be prepared for High Risk OOHWs (refer to **Section 7**).

The specific OOHW CNVIS would be prepared prior to OOHWs commencing.

The OOHW CNVIS would include specific mitigation measures identified through consultation with affected sensitive receivers (refer to **Section 9.2**).

For Project Works not requiring a specific OOHW CNVIS, potentially impacted sensitive receivers will be identified as being within the CoA E1 Construction NML Noise Affectionation Zones (refer to **CNVMP Section 7.2**) and CoA E2 Minimum Working Distance offsets presented in **CNVMP Appendix B**.

1.9 Environmental Protection Licence

TransGrid and Contractors do not currently hold an EPL for the Project. This OOHW Protocol may be revised if an EPL is obtained for the Project.

1.10 Roles and Responsibilities

The project management structure is shown in **CNVMP Section 4**.

2 OOHW Construction Hours

OOHW Construction Hours are triggered and this OOHW Protocol enacted when the proposed works meet all the following criteria (as depicted in **Table 1**):

- Works being undertaken outside the Approved Construction Hours (as per CoA E4, refer to **CNVMP Table 5**); and
- Works not included in CoA E4 as being allowed to be undertaken at anytime (refer to **CNVMP Table 5**);
or

- Works are highly noise intensive (> 75 dBA $L_{Aeq}(15 \text{ minute})$), as per CoA E5, refer to **CNVMP Section 6.2**); or
- Works do not meet the CoA E6 Variation to Work Hours requirements (refer to **CNVMP Section 6.3**).

Table 1 Summary – When to follow the OOHW Protocol – Noise

Activity (works) Table 4 CoA	Activity/Impact	Monday - Friday 7am -6pm	Monday - Friday 6pm-7am	Saturday 8am-1pm	Sat 1pm-8am	Sunday and Public Holiday
(a) Linear infrastructure – Site preparation, trenching and excavation, joint bays, restoration of road surfaces, other (b) Substation upgrade works	Delivery and police	Not triggered	Not triggered	Not triggered	Not triggered	Not triggered
	Emergency	Not triggered	Not triggered	Not triggered	Not triggered	Not triggered
	Approved Under Existing OOHW Protocol	Not triggered	Not triggered	Not triggered	Not triggered	Not triggered
	>75dBA CoA E5	Not triggered	OOHW Protocol is Triggered	Not triggered	OOHW Protocol is Triggered	OOHW Protocol is Triggered
	> RBL + 5dBA	Not triggered	OOHW Protocol is Triggered	Not triggered	OOHW Protocol is Triggered	OOHW Protocol is Triggered
	≤ 45 NML	Not triggered	Not triggered	Not triggered	Not triggered	Not triggered
	> 45 NML	Not triggered	OOHW Protocol is Triggered	Not triggered	OOHW Protocol is Triggered	OOHW Protocol is Triggered
	Vibration Perceptible inside Residence	Not triggered	OOHW Protocol is Triggered	Not triggered	OOHW Protocol is Triggered	OOHW Protocol is Triggered
(c) Linear infrastructure – Works in classified road reserves and signalised intersections, cable pulling and jointing, (d) Special crossings – cable bridges and underboring (e) Construction laydown areas	Delivery and police	Not triggered	Not triggered	Not triggered	Not triggered	Not triggered
	Emergency	Not triggered	Not triggered	Not triggered	Not triggered	Not triggered
	Approved Under Existing OOHW Protocol	Not triggered	Not triggered	Not triggered	Not triggered	Not triggered
	>75dBA CoA E5	Not triggered	OOHW Protocol is Triggered	Not triggered	OOHW Protocol is Triggered	OOHW Protocol is Triggered
	> RBL + 5dBA	Not triggered	Not triggered	Not triggered	Not triggered	Not triggered
	≤ 45 NML	Not triggered	Not triggered	Not triggered	Not triggered	Not triggered
	> 45 NML	Not triggered	Not triggered	Not triggered	Not triggered	Not triggered
	Vibration Perceptible inside Residence	Not triggered	Not triggered	Not triggered	Not triggered	Not triggered

The Variation to Work Hours process is shown in **CNVMP Figure 6** (replicated in **Appendix C**).

In accordance with ECM-NV12 (refer to **CNVMP Table 12**) consider respite periods where the $L_{Aeq(15min)}$ noise levels exceed 75 dBA at the same receiver after midnight for more than three consecutive nights.

3 Highly Noise and Vibration Intensive Works

Highly noise and vibration intensive works include any plant or activity that generates noise with impulsive, intermittent, tonal or low frequency characteristics that result in an exceedance of the 75 dBA $L_{Aeq(15\text{ minute})}$ Highly Noise Affected Noise Management Level (HNML) (refer to CoA E1, **CNVMP Section 7.3**) or human comfort vibration criteria nominated in **CNVMP Section 8.1**.

4 Out of Hours Works Protocol Process

OOHW determined to be subject to this OOHW Protocol (refer to **CNVMP Section 6.2**) would follow the OOHW approvals process presented in **Figure 2**.

4.1 Identification of Requirement to follow OOHW Protocol

This OOHW Protocol must be followed if triggered under **CNVMP Figure 6** (replicated in **Appendix C**). In summary, for this OOHW Protocol must be followed if both of the following conditions are met for non-emergency and non-delivery works:

- Works to be undertaken Outside Standard Construction Hours (refer to **Section 2**); and
- Works anticipated to exceed the Construction NML (refer to CoA E1, **CNVMP Table 7**) or human comfort vibration criteria nominated in **CNVMP Section 8.1**.

4.2 Preparation of OOHWS Application

The OOHW Application will include the following information:

- Justification for the OOHW (e.g. works during standard construction hours not permitted by road authority) (refer to **Section 5**)
- Details of the works
 - Location
 - Description of works
 - dates and times of works)
- Details of alternative (less intrusive) construction methodology and plant
- Identification of nearest sensitive receivers, including details of any consultation carried out and any existing agreements with the community
- Noise and Vibration Assessment (refer to **Section 6**)
 - Prepared in accordance with **CNVMP Section 9.3**
 - Assessment against Construction NMLs (refer to **Section 6**)
 - Identification if activity is low or high risk level (refer to **Section 7**) and corresponding approval path for OOHW Application (ie Environment & Sustainability Manager (ESM) or DPIE Planning Secretary, respectively)
- Proposed mitigation and management
 - Confirmation of Standard Noise and Vibration Environmental Control Measures (ECMs, refer to **CNVMP Table 12**) will be implemented
 - Identification of works specific further ECMs that have been adopted (refer to **CNVMP Section 10.3**)
 - Additional Noise Mitigation Measures (AMMM) to be applied to manage residual impacts (refer to **CNVMP Section 10.3.1**)

- Identified third party works in the vicinity of the proposed OOHW and coordination of respite periods for concurrent works
- Identification of actions required under the Community Consultation Strategy (CCS) and any additional actions (refer to **Section 4.6**, **Section 9** and **CNVMP Section 12**)

4.3 Environment & Sustainability Manager Review of OOHW Application

The Environment & Sustainability Manager (ESM) will review the OOHW Application for adequacy and provide any recommendations for amendments prior to consideration by community representative.

4.4 Community Relations Manager Endorsement of OOHW Application

The Community Relations Manager (CRM) will review the OOHW Application and include outcomes from community consultation undertaken in accordance this OOHW Protocol (refer to **Section 4.6**, **Section 9** and **CNVMP Section 12**) for inclusion by the contractor. The CRM will provide input of local knowledge of the area, current understanding of sensitive receiver requirements and other relevant factors such as use of premises.

4.5 Risk Based Approval Process

Once the contractor has finalised the OOHW Application, through addressing adequacy requirements of the ESM and CRM, the application will determine the level of risk (low or high risk) associated with the proposed OOHW activity for endorsement by the ESM.

If the risk of the OOHW activity is low, the Environment & Sustainability Manager will review the OOHW Application and consider approval for the OOHW activity.

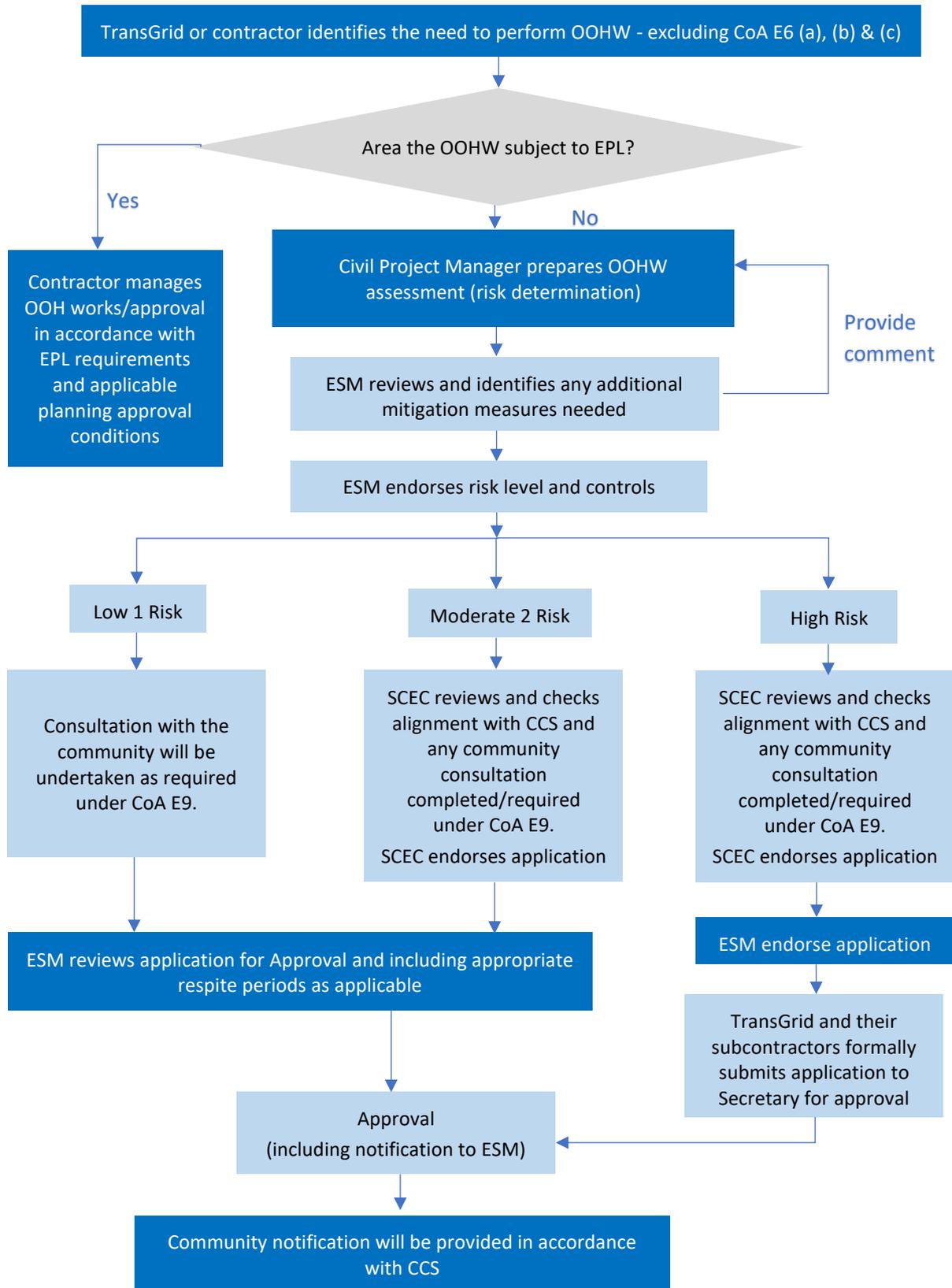
If the risk of the OOHW activity is high, the Environment & Sustainability Manager will review and endorse the OOHW Application and submit to the Planning Secretary for approval of the OOHW activity. High risk OOHW Applications will be submitted for review 4 weeks before the scheduled start date of the OOHW. However, work can commence upon the Secretary's approval.

4.6 Community Consultation

The contractor Community Relations Team will issue community notifications and conduct out of hours work community consultation in accordance with the approved OOHW Application and Community Communication Strategy (CCS), including specific notification, that will be carried out prior to or when implementing the OOHW.

The Senior Community Engagement Consultant will advise the outcome of the community consultation and the appropriate respite and mitigation measures determined.

Figure 2 Approval of OOHW Process



5 OOHW Justification

Generally works are considered justified as OOHW to:

- Maintain the functional integrity of major roads such as Punchbowl Road, Old Canterbury Road, Roberts Road, Rookwood Road and the Hume Highway (through appropriate road access permits);
- Promote the safety of road users, construction personnel and the public in general;
- As required to minimise impacts on rail infrastructure through rail possession requirements;
- Minimise potential services/utilities disruptions (e.g. businesses and residential areas);
- Where works are required to be completed continuously (eg jointing) and above NML
- Where works are conducted by agreement with affected receivers; or
- Where works are of a low impact nature (i.e Compliant with the Noise Management Levels and vibratory impact guidance).

Justification for any activities proposed as OOHW must be established to the satisfaction of the ESM and CRM, including the noise assessment as detailed in **Section 6** prior to commencement.

6 OOHW Construction Noise and Vibration Impact Statement

The specific OOHW CNVIS (refer to **CNVMP Section 9.3.3**) would present an assessment of the planned activities detailing the predicted noise and vibrations and comparison against the CoA E1 Construction Noise Management Levels (NMLs, refer to **CNVMP Section 7.2**) and CoA E2 vibration criteria (refer to **CNVMP Section 8.1**).

The specific OOHW CNVIS will identify the NML exceedance for each noise sensitive receiver and corresponding additional mitigation measures to be implemented for the OOHW (refer to **Section 8** and **CNVMP Section 10.3.1**).

The specific OOHW CNVIS will include a schedule of proposed OOHW and the specific OOHW CNVIS will be submitted to support the OOHW Application to the Planning Secretary for approval of the assessed high-risk activities (refer to **Section 7**) where determined to be high risk through the OOHW Application Process.

If the proposed OOHW activity is not assessed in the specific OOHW CNVIS or Baseline CNVIS (**CNVMP Appendix B**), then an additional specific OOHW CNVIS would be produced in accordance with the procedure presented in **CNVMP Section 9.3**).

7 Risk Assessment

7.1 Risk Assessment

In accordance with CoA E8 (e), the low risk out-of-hours noise and vibration generating construction activities can be undertaken without the approval of the Planning Secretary; and high risk out-of-hours noise and vibration generating construction activities need to be approved by the Planning Secretary before the commencement.

A qualitative description of low and high risk activities is presented below. In addition, four (4) risk factors have been identified. The Overall OOHW Risk is based on the sum of each of the risk factor.

Receiver specific sensitive periods would be identified through community consultation (refer to the Community Communication Strategy (CCS)).

The Overall Risk Assessment score (**Table 2**) is calculated by summing **Table 3**, **Table 4**, **Table 5** and **Table 6**.

i.e

Table 2 (score) = **Table 3** + **Table 4** + **Table 5** + **Table 6**

Table 2 Overall OOHW Risk Level

Overall Risk Assessment	Sum of Risk Factor Scores	Approval Path
Low 1 Risk Activity	1-6	Environment & Sustainability Manager (ESM)
Moderate 2 Risk Activity	7-9	
High Risk Activity	10-12	Planning Secretary

7.1.1 Low 1 Risk Activity

Low 1 risk OOHW activities are characterised by work that may have low to moderate exceedances of the relevant Construction Noise Management Level (refer to CoA E1, **CNVMP Table 7**) and human comfort vibration criteria (refer to CoA E2(a), **CNVMP Section 8.1**) during receiver specific sensitive periods (as defined for each receiver type). Low 1 risk activities should result in no or minimal negative impact to the sensitive receivers during receiver specific sensitive periods. Low 1 risk activities may be perceptible, but the degree of impact, and likelihood of annoyance resulting in complaints or other escalation are low.

7.1.2 Moderate 2 Risk Activity

Moderate 2 risk OOHW activities are characterised by works that result in noise or vibration impacts that may have moderate to high exceedances of the noise and vibration criteria during receiver specific sensitive periods, however can be managed through consultation, scheduling, respite or additional mitigation measures to prevent significant impacts to affected receivers. Moderate 2 risk activities should not generally result in impacts that affect the receiver from being used for its intended land use.

7.1.3 High Risk Activity

High risk OOHW activities are characterised by works that may result in high to very high noise or vibration impacts that are likely to exceed the relevant noise and vibration criteria during receiver specific sensitive periods resulting in impacts that may affect the receiver from being used for its intended land use despite consultation, scheduling, respite or additional mitigation measures. Activities where the Construction NML is exceeded by more than 30 dB or construction noise is greater than the 75 dBA LAeq(15minute) Highly Noise Affected Noise Management Level (HNML) or (refer to **Table 4**) or more than three consecutive nights would also be classified as potentially high risk.

7.2 Receiver Type Risk Factor

The OOHW risk score for each receiver type during each OOH period is presented in **Table 3**.

Table 3 Receiver Type Out-of-Hours Work Risk Factor

Receiver Type	Day OOHW 7am-6pm	Evening OOHW 6pm-10pm	Night OOHW 10pm-7am	Notes
Childcare	Low (1)	Low (1)	Low (1)	Not operating during OOH
Commercial	Low (1)	Low (1)	Low (1)	Sensitivity of premises to be confirmed through consultation
Industrial	Low (1)	Low (1)	Low (1)	Sensitivity of premises to be confirmed through consultation
Educational	Low (1)	Low (1)	Low (1)	Not operating during OOH
Hotel	Low (1)	Low (1)	Moderate (2)	Sensitivity of premises to be confirmed through consultation
Medical	Low (1)	Low (1)	Low (1)	Sensitivity of premises to be confirmed through consultation
Place of Worship	Moderate (2)	Moderate (2)	Low (1)	Sensitivity of premises to be confirmed through consultation
Recording Studio	Moderate (2)	Moderate (2)	Low (1)	Sensitive periods during operational periods as agreed with facility through consultation
Recreation (Active)	Low (1)	Low (1)	Low (1)	Sensitive periods during normal periods of use and review of special events calendar
Recreation (Passive)	Moderate (2)	Low (1)	Low (1)	Sensitive periods during normal periods of use and review of special events calendar
Residential	Low (1)	Moderate (2)	High (3)	Risk subject to complaints management. Respite periods to be consulted for Highly Noise Intensive Works.
Restaurant (Outdoor Dining)	Moderate (2)	Moderate (2)	Moderate (2)	Sensitivity of premises to be confirmed through consultation

7.3 Noise and Vibration Management Level Exceedance Risk Factor

The OOHW NML exceedance risk level for noise sensitive receivers during each OOH period is presented in **Table 4**.

Table 4 Noise Management Level Exceedance Risk Factor

Exceedance of NML	Day OOHW 7am-6pm	Evening OOHW 6pm-10pm	Night OOHW 10pm-7am	Qualitative description
<5 dB	Low (1)	Low (1)	Low (1)	Barely noticeable exceedance of the NML
5-15 dB	Low (1)	Low (1)	Moderate (2)	Noticeably audible exceedance of the NML
15-25 dB	Low (1)	Moderate (2)	Moderate (2)	Clearly audible exceedance of the NML
>25 dB	Moderate (2)	High (3)	High (3)	Intrusive exceedance of the NML
>75 dBA	Moderate (2)	High (3)	High (3)	Highly affected receivers

The OOHW vibration exceedance risk for residential receivers during each OOH period is presented in **Table 5**.

Table 5 Human Comfort Vibration Exceedance Risk Factor (Residential Receivers Only)¹

Vibration Assessment	Day OOHW 7am-6pm	Evening OOHW 6pm-10pm	Night OOHW 10pm-7am	Qualitative description
< Preferred	Low (1)	Low (1)	Low (1)	No noticeable floor vibration
> Preferred < Maximum	Low (1)	Moderate (2)	Moderate (2)	Barely noticeable floor vibration
> Maximum	Low (1)	Moderate (2)	High (3)	Noticeable floor vibration

Note 1: Risk only applies to residential receivers in accordance with CoA E6(D)iii and iv.

7.4 Duration of Consecutive OOHW Risk Factor

The OOHW consecutive days of operation risk level for sensitive receivers during each OOH period is presented **Table 6**.

Table 6 Duration of Consecutive OOHW Days Risk Factor

Duration	Day OOHW 7am-6pm	Evening OOHW 6pm-10pm	Night OOHW 10pm-7am	Qualitative description
1 day	Low (1)	Low (1)	Low (1)	Generally tolerable
2 days	Low (1)	Moderate (2)	Moderate (2)	Marginal Annoyance
3 days	Low (1)	Moderate (2)	High (3)	Moderate Annoyance
> 3 days	Low (1)	High (3)	High (3)	Highly disturbing

7.5 Overall OOHW Risk Level and Approval Path

The overall risk of the proposed OOHW activity is determined by the summation of the four risks factors determined above (**Table 3**, **Table 4**, **Table 5** and **Table 6**) based on the overall risk score presented in **Table 2**, together with the approval path.

8 OOHW Noise and Vibration Management and Mitigation Measures

Standard Noise and Vibration Environmental Control Measures (ECMs, refer to **CNVMP Table 12**) will be implemented for all OOHW activities.

OOHW activity specific ECMs will be identified and adopted (refer to **CNVMP Section 10.3**), including:

- Practical construction methods to reduce emissions while still achieving an acceptable project delivery.
- Paths controls will also be considered, if appropriate, primarily via installing temporary noise barriers around the perimeter of works to control high noise intrusion works, particularly from stationary OOHW.
- Respite periods will be triggered where the $L_{Aeq(15min)}$ noise levels exceed 75 dBA at the same receiver for more than 3 hours (refer to CoA E5, **CNVMP Section 6.2**).

Additional Noise Mitigation Measures (AMMM) will be applied to manage residual impacts (refer to **CNVMP Section 10.3.1**).

8.1 Coordination and Respite

Coordination of OOHW will occur to provide respite, minimise the duration and impact on sensitive receivers, and to respond to community consultation at a project-wide level.

The Interface Manger (IM) will be accountable for coordinating OOHW in a manner that minimise the cumulative noise impacts, considers the outcomes of community and stakeholder consultation, ensures compliance with the conditions of approval including Environmental Management and Mitigation Measures (refer to **CNVMP Table 12**).

The principles of coordination of OOHW will be:

- Contractor are responsible for interfacing between delivery packages and to work collaboratively to program OOHW, so as to minimise cumulative noise and vibration impacts;
- Providing respite to impacted sensitive receivers so that standards respite periods of the CoA are achieved;
- As nominated by the OOHW Applications, the Environment & Sustainability Manager (ESM) and Senior Community Engagement Consultant (SCEC) will identify what alternative mitigation will be provided to reduce impacts to sensitive receivers;
- Consult and advise the ESM of decisions relating to respite and mitigation, including and documentary evidence as necessary; and
- Works shall be coordinated with other construction projects to manage respite periods at noise affected sensitive receivers.

9 Communication, Community Consultation and Reporting

TransGrid has established a project wide *Community Communications Strategy* (CCS) for the Powering Sydney's Future program which guides the following noise management communication and engagement processes and activities.

9.1 Community Consultation and Communication

A suite of communication tools and activities will be utilised as required to target the communities requirements based on the nature of works and the potential impacts to provide clear, effective and timely information. The community consultation will be carried out as follows:

Home and business plans will utilise to identify specific community and business requirements and sensitive time periods. These plans will be completed in advance of work in the locations impacted by out of hours work.

In addition, work notifications will be distributed to the affected community and businesses 7 days in advance of night work. Work notifications will:

- clearly outline the reason that the work is required to be undertaken outside the hours;
- include a diagram that clearly identifies the location of the proposed works in relation to nearby cross streets and local landmarks;
- include details of relevant time restrictions that apply to the proposed works;
- clearly outline, in plain English (and/or other languages), the location, nature, scope and duration of the proposed works;
- detail the expected noise impact of the works on noise sensitive receivers;
- clearly state how complaints may be made and additional information obtained; and
- include project contact information including the 24/7 community hotline phone number (1800 955 588), the project website address (transgrid.com.au/psf), email address (psf@transgrid.com.au) and postal address (PO Box A1000, Sydney South, NSW, 1235).

9.2 Community Out of Hours Consultation

The Contractor Community Relations Team will carry out consultation with the community to identify appropriate respite as required under CoA E9 for out of hours work at each affected location:

During the consultation the Community Relations Team will provide the community with:

- a) a schedule of likely out-of-hours work for a period no less than two (2) months
- b) the potential works, location and duration
- c) the noise characteristics and likely noise levels of the works
- d) likely mitigation and management measures.

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 Planning Secretary.

The consultation process will be as follows:

- In advance of night work, the Community Relations Team will door knock the affected properties and provide a notification and explain the work, the potential respite periods and request community feedback.
- If the resident or business is not available, the team will leave a copy of the notification and a *"sorry we missed you card"* with a request for someone to get in touch with the team.
- If there is no response within three days, the Community Relations Team will carry out a second attempt is made via door knock, email or phone call (if the details of the stakeholder is available) to gain feedback regarding the out of hours schedule.
- The Community Relations Team will develop a summary of the feedback and pass these to the ESM.

- After the determination is received from DPIE, the Community Relations Team will draft a notification confirming the timing of the upcoming work, which will be distributed a minimum of 7 days in advance of the work starting.

10 OOHW Enquiries/Complaints Management

A Complaints Management System (CMS) prepared in accordance with CoA B4- B6 will be developed before the commencement of any construction works. All complaints handling is to be in accordance with the CMS. Complaints and response actions are documented in the Complaints Register maintained in accordance with CoA B7 and CoA B8. The Contractor Community Relations Team will promptly respond to all noise and vibration complaints.

The CMS procedure flow chart is depicted in **CNVMP Section 12**.

11 OOHW Exceedances/Non-Conformances

11.1 Management Response

Where monitored noise levels are found to be above predictions or vibration goals are exceeded, the following actions will be undertaken:

- Confirm that monitored levels are not being impacted by other noise or vibration sources;
- Implement other feasible and reasonable measures which may include reducing plant size, modify time of works, changing operational settings (such as turning off the vibratory function of the machine), and utilizing alternate construction methodology or a combination of these;
- Review work practices to ensure compliance with the CNVMP and Interim Construction Noise Guideline (ICNG);
- Confirm if the exceedance is due to an uncharacteristically loud piece of equipment;
- Identify if equipment can be swapped out for another piece of equipment or alternative equipment or plant;
- Confirm if the exceedance is due to an uncharacteristically vibratory piece of equipment;
- Confirm that the modelling reflects the actual activity being undertaken; and
- Ensure that learning's from the above are fed back into the noise modelling assessment process (refer to **CNVMP Section 9**).

Previously recorded non-conformances will also be considered prior to the approval of further OOHW Applications.

11.2 Reporting

Reporting on exceedances and complaints will be in accordance with the reporting requirements nominated in **CNVMP Section 11.8** and the Complaints Management System (CMS).

A1 Infrastructure Approval SSI 8583 - Conditions of Approval

The CoA relevant to this OOHW Protocol are listed **Table A1**. A cross reference is also included to indicate where the CoA is addressed in this OOHW Protocol or other Project documents.

Table A1 Out-of-Hours Work SSI CoA (SSI 8583)

Condition Number	Conditions	Document Reference	How addressed
E6	<p>Despite Conditions E4 and E5 works may be undertaken outside the standard hours specified in CoA E4 in the following circumstances:</p> <ul style="list-style-type: none"> (a) for the delivery of materials required by the NSW Police Force or other 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) works approved under an Out-of-Hours Work Protocol as required by Condition E8; or (d) construction that causes LAeq(15 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 Interim Construction Noise Guideline (DECC, 2009), and (ii) no more than the noise management levels specified in Condition E1 at other sensitive land uses; (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). 	CNVMP Section 6.3	Works can be undertaken outside of standard hours without additional approval, such as low noise and vibration impact activities, material deliveries as required by police or other authority, in case of emergency or previously approved OOH works. All other works will require approval under the Out-of-Hours Work Protocol.
E7	<p>On becoming aware of the need for emergency works in accordance with Condition E6(b), the Proponent must notify the Department of the reasons for such work. The Proponent must use best endeavors to notify all noise and/or vibration affected sensitive receivers of the likely impact and duration of those works.</p>	CNVMP Section 6.3 CNVMP Section 12 refer to CCS	DPIE and the community would be notified appropriately in the event of an emergency

Appendix A

Compliance Matrices

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Condition Number	Conditions	Document Reference	How addressed
E8	<p>An Out-of-Hours Work Protocol must be prepared to identify a process for the considerations, management and approval of works which are outside the hours defined in Conditions E4 and E5. The Protocol must be approved by the Planning Secretary before commencement of the works. The Protocol must:</p> <ul style="list-style-type: none"> (a) Be prepared in consultation with the relevant council(s); (b) Provide a process for the consideration of out-of-works against the relevant noise and vibration criteria, including the determination of low and high-risk activities; (c) Provide a process for the identification of mitigation measures for the residual impacts, including respite periods in consultation with the community at each affected location, consistent with the requirements of Condition E9; (d) Provide a process for the identification of out-of-hours works undertaken by third parties in the vicinity of the project area, and coordination of out-of-hours works with these third parties to achieve respite periods in locations where receivers may be affected by concurrent construction works; (e) Identify an approval process that considers the risk of activities, proposed mitigation management, and coordination including where: <ul style="list-style-type: none"> (i) Low risk activities can be undertaken without the approval of the Planning Secretary; and (ii) High risk activities that are approved by the Planning Secretary; and (f) Identify Department, EPA, and relevant council and community notification arrangements for approved out-of-hours work. 	<p>This OOHW Protocol</p> <p>Section 1.5 Section 7.1</p> <p>Section 4.6 Section 8 Section 9 CNVMP Section 12</p> <p>Section 8.1</p> <p>Section 7</p> <p>Section 9 CCS/CCLP</p>	<p>The OOHW Protocol details the justifications, application, management and approvals process that will be followed for all unapproved OOHW which are likely to impact the community. Low risk activities will be approved internally and high risk activities will require approval by DPIE.</p>
E9	<p>In order to undertake out-of-hours work, the Proponent must identify appropriate respite periods for the out-of-hours in consultation with the community at each affected location on a regular basis. The consultation must include (but not limited to) providing the community with:</p> <ul style="list-style-type: none"> (a) a schedule of likely out-of-hours work for a period of no less than two (2) months; (b) The potential works, locations and duration; (c) The noise characteristics and likely noise levels of the works; and (d) Likely mitigation and management measures <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 Planning Secretary.</p>	<p>Section 4.6</p> <p>Refer to CCS and CCLP</p>	<p>A Community Out of Hours Consultation process will be followed to inform the community and identify respite periods.</p>

A2 Environmental Management and Mitigation Measures (EMMMs)

In addition to the CoAs presented above, the Environmental Management and Mitigation Measures (EMMM) must be complied with during the development of the Project. The EMMM requirements which are relevant to this OOHW Protocol are presented in **Table A2**.

Table A2 Compliance Matrix - Updated Environmental Management and Mitigation Measures Requirements

Impact	ID	Measure	Reference
Out-of-hours protocol	NV4	<p>Where feasible and reasonable, construction will be carried out during standard construction hours. However, given that some works will be required to be undertaken outside of standard construction hours, an 'Out-of-hours Protocol' will be prepared as part of the CNVMP.</p> <p>This will evaluate the potential noise impacts of specific out-of-hours works and recommend appropriate mitigations measures such as:</p> <ul style="list-style-type: none"> • community consultation with highly noise affected receivers; • procedures to determine negotiated outcomes in consultation with affected receivers (e.g. construction scheduling during sensitive periods such as exams where construction is in the vicinity of schools); • specific mitigation measures such as respite periods; and • a monitoring program. 	<p>This OOHW Protocol</p> <p>Section 9</p> <p>Section 9 CCS</p> <p>Section 8 CNVMP Section 8</p>
Respite periods for works outside of standard construction hours	NV6	<p>The need to consider respite periods will be triggered where the $L_{Aeq(15min)}$ noise levels exceed 75 dB(A) at the same receiver after midnight for more than three consecutive nights. Where this level is exceeded, respite periods will be considered in accordance with the Out-of-hours Protocol (refer to NV4).</p>	Section 8

Appendix B

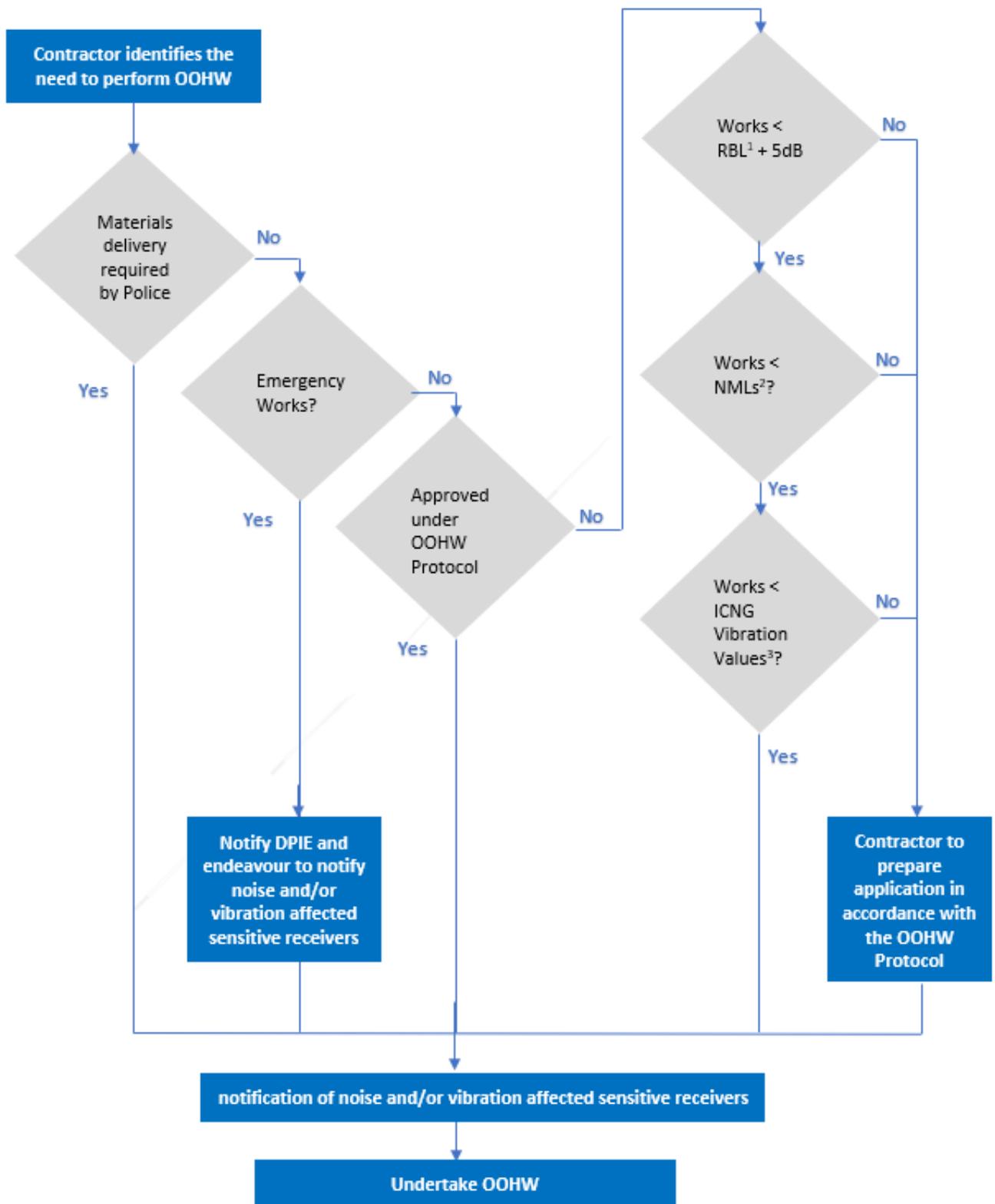
Council OOHW Protocol Consultation Correspondence 10-1779

#	Document No	Plan Title	Date	Organisation	Name	Document name Page / section / reference	Revision	Comment	TransGrid/Taihan How addressed	Status
14	TEA-PSF-MP-004.200	Construction Noise and Vibration Management Plan	26-Jun-20	City of Canterbury Bankstown	Jeff Senior		0	No comment	Noted.	Closed
15	TEA-PSF-MP-004.200	Construction Noise and Vibration Management Plan	26-Jun-20	City of Sydney	Priyanka Misra	CNVMP	0	From a heritage perspective, I have reviewed the Construction Heritage Management Plan (CHMP) and heritage aspects of the Construction Noise and Vibration Management Plan (CNVMP). I can confirm that these documents have been adequately prepared to satisfy the Conditions of Approval for SSI-8583 and identify and address heritage issues arising from the construction works.	Noted.	Closed
16	TEA-PSF-MP-004.210	Out-of-hours works protocol	26-Jun-20	City of Canterbury Bankstown	Jeff Senior	Out-of-hours works protocol	0	No comment	Noted.	Closed
<p>Consultation summary</p> <p>5 June 2020 Invitation to CEMP and sub-plan briefing.</p> <p>10 June 2020 CEMP and sub-plan "Zoom" briefing to Relevant Government Agencies/.Councils/ Authorities/Service providers.</p> <p>16 June 2020 Open invitation to all stakeholders for drop in Q&A session.</p> <p>19 June 2020 Original closure of consultation period.</p> <p>3 July 2020 Email sent to all organisations identifying (a) how all comments received on this Sub-Plan were addressed and closed; and (b) confirming formal consultation period is closed.</p>										
<p>Comment status at time of submission to DPIE</p> <ul style="list-style-type: none"> • Comments received on this OOHW Protocol from: <ul style="list-style-type: none"> • City of Sydney Council - closed • No comments received on this OOHW Protocol from: <ul style="list-style-type: none"> • City of Canterbury Bankstown Council - closed • Inner West Council - closed 										

Appendix C

Variation to Work Hours Process

10-1779



Appendix E

Council CNVMP and OOHV Protocol Consultation Correspondence

Consultation was undertaken with the relevant Councils. The Information requested by Councils and other asset owners are summarised in the table below.

Council CNVMP and OOHW Protocol Consultation Correspondence

#	Document No	Plan Title	Date	Organisation	Name	Document name Page / section / reference	Revision	Comment	TransGrid/Taihan How addressed	Status
10	TEA-PSF-MP-004.200	Construction Noise and Vibration Management Plan	19-Jun-20	Sydney Water	Peter Jansen	35 / Section 8/ 8.4 Buried Utilities	0	The contractor has not applied for any specific requirements relating to vibration impacts or concerns. Specific applications would be required to be assessed including detailed drawings, methodologies and sections to understand project impacts. Different assets (age, construction material, environment, operating pressure, soil conditions, ground water etc) have a different tolerances. WE would invite the contractor to apply through their WSC on specific assets criteria as detailed above.	TransGrid has committed to meaningfully engaging with SWC to seek comments on designs for the dual benefit of the project and the protection SWC's assets. This is outlined in TransGrid's letter to SWC dated 30 June 2020.	Closed
11	TEA-PSF-MP-004.200	Construction Noise and Vibration Management Plan	19-Jun-20	Sydney Water	Peter Jansen	36 / Section 8/ 8.7 Table 10	0	Sydney Water has not agreed or been consulted on assumptions for vibration. Assessments are based on other factors and not all utilities can be encompassed in that assessment criteria proposed.	TransGrid has committed to meaningfully engaging with SWC to seek comments on designs for the dual benefit of the project and the protection SWC's assets. This is outlined in TransGrid's letter to SWC dated 30 June 2020.	Closed
12	TEA-PSF-MP-004.200	Construction Noise and Vibration Management Plan	19-Jun-20	Sydney Water	Peter Jansen	39 / Section 9/ 9.3.3	0	Sydney Water has requested Dilapidation surveys to be undertaken in relation to our critical infrastructure Sewers DN300 and above, Water DN375 and above, all heritage assets and all stormwater channels- this does not seem to be noted? Please advise of Sydney Water assets that this is to be applied too.	All assets within our trench alignment will be exposed in accordance with the "work near underground assets guide" (Safework NSW, 2007). Sydney Water will be advised of any pre-existing damage identified as part of the dilapidation process.	Closed
13	TEA-PSF-MP-004.200	Construction Noise and Vibration Management Plan	19-Jun-20	Jemena	Vinu George Joseph		0	In terms of vibration limits , Peak particle velocity for Jemena Gas assets: Primary and Secondary (Steel Main) – 20mm/s Distribution < 1050 kPa (Nylon / Plastic) – 10mm/s	All assets within our trench alignment will be exposed in accordance with the "work near underground assets guide" (Safework NSW, 2007). Jemena will be advised of any pre-existing damage identified as part of the dilapidation process.	Closed
14	TEA-PSF-MP-004.200	Construction Noise and Vibration Management Plan	26-Jun-20	City of Canterbury Bankstown	Jeff Senior		0	No comment	Noted.	Closed
15	TEA-PSF-MP-004.200	Construction Noise and Vibration Management Plan	26-Jun-20	City of Sydney	Priyanka Misra	CNVMP	0	From a heritage perspective, I have reviewed the Construction Heritage Management Plan (CHMP) and heritage aspects of the Construction Noise and Vibration Management Plan (CNVMP). I can confirm that these documents have been adequately prepared to satisfy the Conditions of Approval for SSI-8583 and identify and address heritage issues arising from the construction works.	Noted.	Closed
16	TEA-PSF-MP-004.210	Out-of-hours works protocol	26-Jun-20	City of Canterbury Bankstown	Jeff Senior	Out-of-hours works protocol	0	No comment	Noted.	Closed

Council CNVMP and OOHV Protocol Consultation Correspondence

Consultation summary

- 5 June 2020 Invitation to CEMP and sub-plan briefing.
- 10 June 2020 CEMP and sub-plan "Zoom" briefing to Relevant Government Agencies/.Councils/ Authorities/Service providers.
- 16 June 2020 Open invitation to all stakeholders for drop in Q&A session.
- 19 June 2020 Original closure of consultation period.
- 3 July 2020 Email sent to all organisations identifying
 (a) how all comments received on this Sub-Plan were addressed and closed; and
 (b) confirming formal consultation period is closed.

Comment status at time of submission to DPIE

- Comments received on this Sub-Plan from:
 - City of Sydney Council - **closed**
 - Jemena - **closed**
 - Sydney Water - **closed**
- No comments received on this Sub-Plan from:
 - City of Canterbury Bankstown Council - **closed**
 - Inner West Council - **closed**