Australian Government

Department of Infrastructure, Transport, Regional Development and Communications

File Reference: F21/3792-16

Ben Armstrong
Associate Director Environment Operations, Customer & Place Making
Sydney Metro
PO Box K659
Haymarket NSW 1240

Dear Mr Armstrong

Noise and Vibration Construction Environmental Management Plan (CEMP)

I write to notify you that, in accordance with Condition 39 of the Airport Plan, I have today approved the Noise and Vibration CEMP (Rev4) submitted by Sydney Metro on 27 January 2022. This follows my recent approval of the Construction (Rail) Plan. Thank you for Sydney Metro's engagement with the department over the last few months as these plans were developed.

Now that the Noise and Vibration CEMP has been approved Sydney Metro is required:

a. To take reasonable steps to ensure that each person involved in carrying out a development that is part of the Rail Development is informed of, and complies with, the approved Noise and Vibration CEMP (Condition 45(3) of the Airport Plan).

b. To maintain accurate records demonstrating implementation of, and compliance with, the approved Noise and Vibration CEMP, and other applicable conditions contained in Section 3.11.6 of the Airport Plan. Records must be made available to the Infrastructure Department on request (Condition 46 of the Airport Plan).

c. To publish information in a report about its compliance with the conditions set out in section 3.11.6 of the Airport Plan (Rail Conditions) and its implementation of the approved Noise and Vibration CEMP (Condition 47 of the Airport Plan).

d. To ensure that an independent audit of its compliance with the conditions set out in section 3.11.6 (except Condition 44) and condition 46 of the Airport Plan (Rail Conditions) is conducted, by an approved independent auditor, in respect of the 12-month period commencing with commencement of Rail Construction Works. The independent audit report must be submitted to the Infrastructure Department, with a copy provided to the Environment Department, within six months of the end of the period in respect of which the audit was conducted (Condition 48 of the Airport Plan).

e. Unless otherwise agreed by an Approver, to publish the approved Noise and Vibration CEMP on its website (Condition 50 of the Airport Plan).

If you have any queries in relation to this letter, please do not hesitate to contact me.

Yours sincerely

David Jansen
Assistant Secretary
Western Sydney Airport Regulatory Policy Branch

10 March 2022

Sydney Metro Western Sydney Airport
Noise and Vibration Construction Environmental Management Plan

Sydney Metro Integrated Management System (IMS)

Applicable to:	Airport Rail Development
Document Owner:	Sydney Metro
System Owner:	-
Status:	Final
Version:	Rev05
Date of issue:	18 February 2022
Review date:	-

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Figures

Tables

Document Control

Title	Sydney Metro- Western Sydney Airport Noise and Vibration Construction Environmental Management Plan
Document No/Ref	SM-21-00033431

Version Control

Revision	Date	Description
01	17 June 2021	Draft for Tender
02	12 August 2021	Draft for WSA Review
03	1 November 2021	Issued for DITRDC
04	25 January 2022	Final for DITRDC
05	18 February 2022	Final

Terms and Definitions

Terms	Definitions
The Act	Airports Act 1996 (Cth) (Airports Act)
AEPR	Airports (Environment Protection) Regulations 1997
AEW	Advanced and Enabling Works
Airport	The Western Sydney International (Nancy-Bird Walton) Airport located at the Airport Site. Note: The Airport is referred to in the Act as Sydney West Airport and is commonly known as Western Sydney International (Nancy-Bird Walton) Airport
Airport Lease	An airport lease for the Airport granted under section 13 of the Act
Airport Lessee Company	The company that is granted a lease over the Airport Site
Airport Plan	Means the airport plan for the Airport Site as determined by the Infrastructure Minister under section 96B of the Airports Act in December 2016 as varied from time to time in accordance with the Airports Act.
Airport Site	The site for Sydney West Airport as defined by the Airports Act.
AS	Australian Standard
BC Act	Biodiversity Conservation Act 2016 (NSW)
CCS	Community Communication Strategy
CEMF	Construction Environmental Management Framework
CEMP	Construction Environmental Management Plan
CIZ	Construction Impact Zone
CNVIS	Construction Noise and Vibration Impact Statement
CNVS	Construction Noise and Vibration Standard
CoA	Conditions of Approval
CSSI	Critical State Significant Infrastructure
CTMF	Construction Traffic Management Framework
CTR	Compliance Tracking Review
Cwth	Commonwealth
dB	Decibels
DAWE	Department of Agriculture, Water and the Environment (Cwth)
DECC	NSW Department of Environment and Climate Change
DPI	NSW Department of Primary Industries
DITRDC	Department of Infrastructure, Transport, Regional Development and Communications
DNVIS	Detailed Noise and Vibration Impact Statement
DPIE	Department of Planning, Industry and Environment
Ecological sustainable development	Using, conserving and enhancing the community's resources so that the ecological processes on which life depends are maintained and the total quality of life now and in the future, can be increased (Council of Australian Governments, 1992).
ECM	Environmental Control Map
ECZ	Environmental Conservation Zone
EESG	NSW Environment, Energy and Science Group (formerly OEH)

Terms	Definitions
EIS	Environmental Impact Statement
EP&A Act	Environment Planning and Assessment Act 1979 (NSW)
EPA	NSW Environment Protection Authority
EPBC Act	Environment Protection and Conservation Act 1999 (Cwth)
EPL	Environment Protection Licence under the POEO Act
ER	Environmental Representative
EWMS	Environmental Works Method Statement
E&SMS	Environment and Sustainability Management System
FAW	Finalisation Auxiliary Works
ICNG	Interim Construction Noise Guideline
IMS	Sydney Metro Integrated Management System
Infrastructure Department	The department responsible for administering the Airports Act, currently the Australian Government Department of Infrastructure, Transport Regional Development and Communications (DITRDC)
ISO	International Standardization Organisation
KPI	Key Performance Indicator
LV	Low Voltage
NVCEMP	Noise and Vibration Construction Environmental Management Plan
NVMP	Noise and Vibration Management Plan
OCCS	Overarching Community Communication Strategy
OOHW	Out-of-Hour Works
POEO Act	Protection of the Environment Operations Act 1997 (NSW)
Preparatory Activities	Preparatory Activities mean the following: a. day to day site and property management activities; b. site investigations, surveys (including dilapidation surveys), monitoring, and related works (e.g. geotechnical or other investigative drilling, excavation, or salvage); c. establishing construction work sites, site offices, plant and equipment, and related site mobilisation activities (including access points, access tracks and other minor access works, and safety and security measures such as fencing but excluding bulk earthworks); d. enabling preparatory activities such as: i. demolition or relocation of existing structures (including buildings, services, utilities and roads); ii. the disinterment of human remains located in grave sites identified in the European and other heritage technical report in volume 4 of the EIS; and iii. application of environmental impact mitigation measures; and e. any other activities which an Approver determines are Preparatory Activities for this definition
Project	The Sydney Metro Western Sydney Airport Construction and operation as approved by the EPBC and Airport Plan as the Action or Rail Development within the Rail Construction Impact Zone on-airport, being the WSI airport, in agreeance with the Deed between SM - WSA and WSA Co.
Proponent	The person or organisation identified as the proponent in Schedule 1 of the planning approval. In this case Sydney Metro Authority

Terms	Definitions
REMM	Revised Environmental Mitigation Measure
RCIZ	Rail Construction Impact Zone
ROL	Road Occupancy Licence
SBT	Station Boxes and Tunnelling
SCAW	Surface Civil & Alignment Works
SCO	Sydney Coordination Office
SEMF	Site Environmental Management Framework
Planning Secretary	The Secretary of the Department of Planning, Industry and Environment
SEMF	Site Environmental Management Framework
Site Occupier	Site Occupier means: (a) before an Airport Lease is granted – the Commonwealth; and Note: Where a condition specifies an activity to be carried out by the Commonwealth, the Infrastructure Department will be responsible for carrying out the activity on behalf of the Commonwealth (unless stated otherwise). (b) after an Airport Lease is granted – the ALC.
SM	Sydney Metro
SM - WSA	Sydney Metro - Western Sydney Airport
SM WSA EIA	SM - WSA EPBC Act Final Environmental Impact Assessment of On-airport proposed action (EPBC 2019/8541)
SMP	Sustainability Management Plan
SSI	State Significant Infrastructure
SSTOM	Stations Systems, Trains, Operations & Maintenance
SWMS	Safe Works Method Statement
TACEMP	Traffic and Access Construction Environmental Management Plan
TfNSW	Transport for New South Wales
WSA	Western Sydney Airport Co
WSI airport	Western Sydney International airport

1. Introduction

1.1. Sydney Metro

Sydney Metro is Australia's biggest public transport project. Services between Rouse Hill and Chatswood started in May 2019 on the new stand-alone metro railway system. The Sydney Metro network and program of work includes the Metro North West Line (which opened in May 2019), Sydney Metro City & Southwest (which is currently under construction and due to open in 2024), Sydney Metro West (with construction due to start in 2020) and Sydney Metro – Western Sydney Airport (SM – WSA) (the project). Potential future extensions to Schofields/Tallawong in Rouse Hill in the north and to Macarthur in the south are under consideration and are being safeguarded but do not form part of the Project.

The Rail Development (Project) is shown in Figure 1-1 and would become the transport spine for Greater Western Sydney, connecting communities and travellers with the new Western Sydney International (Nancy-Bird Walton) Airport (referred to as Western Sydney International) (WSI airport) and the growing region.

The Project is being delivered under the Western Sydney City Deal, a partnership between the NSW Government, Australian Government and eight councils of the Western Parkland City. The NSW and Australian Governments have a shared objective of having the rail line operational when WSI airport is planned to open for passenger services.

The new railway line will service Greater Western Sydney and the new WSI airport. It will become the transport spine for the Western Parkland City's growth for generations to come, connecting communities and travellers with the rest of Sydney's public transport system with a fast, safe and easy metro service. The Project will link residential areas with job hubs from St Marys through to the new airport and the Western Sydney Aerotropolis.

It would provide a major economic stimulus for Western Sydney, supporting more than 14,000 jobs during construction for the NSW and national economies, including more than 250 new apprenticeships. The Project comprises components that are located outside WSI airport (off-airport) and components that are located within WSI airport (on-airport).

The approval process for the Project's off-airport and on-airport components are different and outlined below. One outcome of the on-airport approval is that a condition of working on the WSI airport site will require the Project to produce and have approved, a series of Construction Environmental Management Plans (CEMP) prior to the SM – WSA Project commencing construction on-airport. This Noise and Vibration CEMP (NVCEMP) is one of a series of nine CEMPs for the Project which will be consistent with the WSI airport CEMPs and address all on-airport environmental components of the Project.

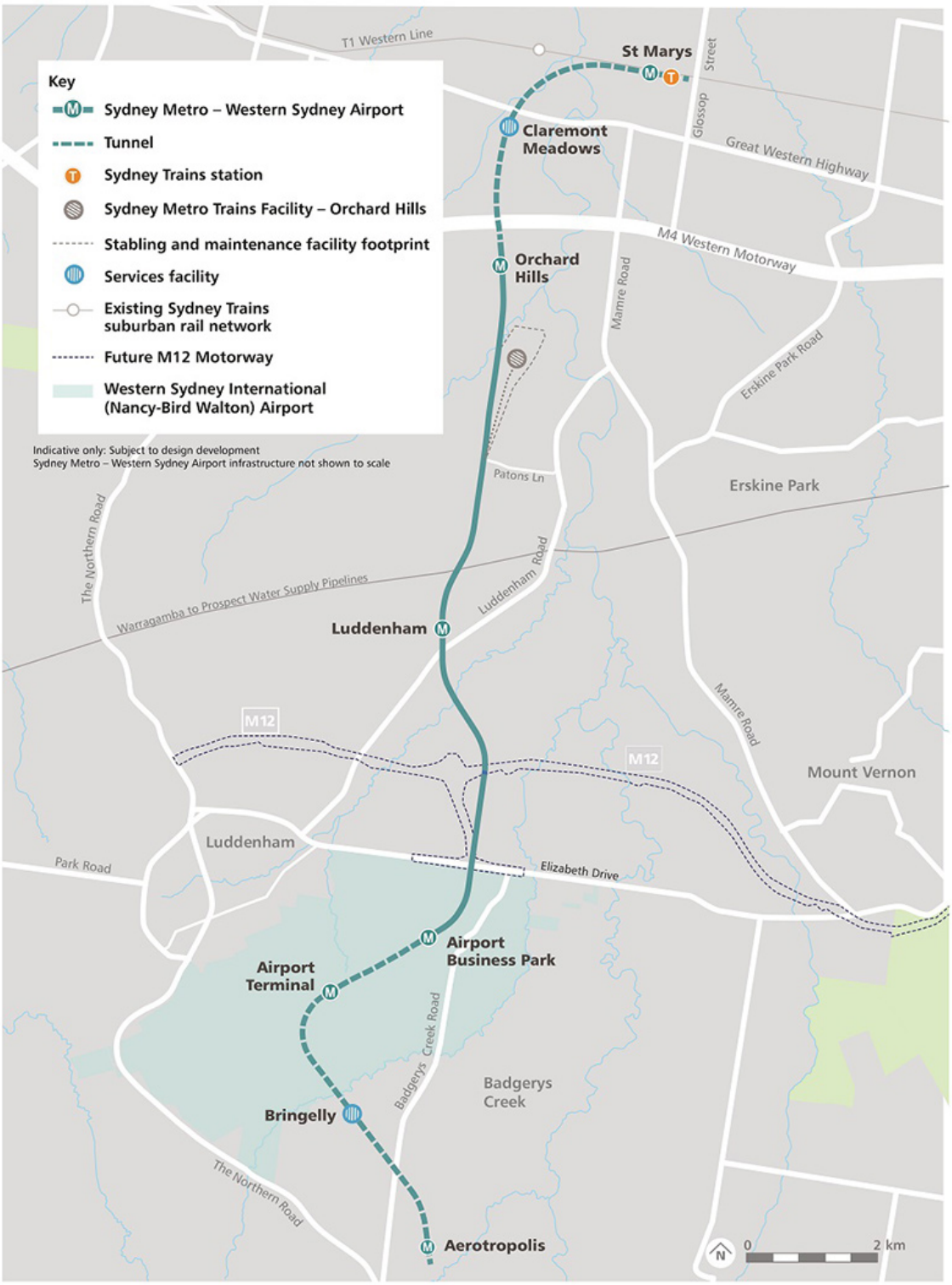


Figure 1-1 Sydney Metro - Western Sydney Airport

1.2. Sydney Metro Western Sydney Airport

The Western Sydney Airport Plan sets out the vision for the development and operation of Western Sydney International and provides authorisation for Stage 1 of the airport. The construction of Stage 1 of the airport is expected to be completed to enable operations to commence in 2026 and will comprise a single runway, a terminal and other relevant facilities to accommodate around 10 million passengers annually as well as air freight traffic.

Interface with Western Sydney International Rail access to Western Sydney International Airport would contribute to the success of the airport and the Western Parkland City, as it would facilitate passengers' and workers' journeys, reduce road congestion and support the economic viability of the airport.

The Project is proposed to enter the WSI airport site from the north and would include Airport Business Park Station and Airport Terminal Station. The rail line would travel through the airport, before exiting the airport site beneath Badgerys Creek in the southeast. Sydney Metro has been, and will continue, working closely with Western Sydney Airport to ensure design development and Construction (Rail) Planning of the Project is coordinated with the construction and operation of WSI airport.

1.3. Background/ Context

The Airport Plan for the WSI airport was determined in December 2016, following preparation and exhibition of an Environmental Impact Statement (EIS), and incorporates the conditions specified by the Commonwealth Environment Minister. The delivery of the Project on the WSI airport site has been authorised through a variation of the Airport Plan by the Commonwealth Infrastructure Minister on 15 September 2021, taking into account advice from the Commonwealth Environment Minister.

In September 2019, the Commonwealth Infrastructure Minister referred the On-airport components of the Project to the Commonwealth Environment Minister. In December 2019, the delegate of the Commonwealth Environment Minister decided that advice is required under section 160 of the EPBC Act as the proposed action is likely to have a significant impact on the environment and will require further assessment (EPBC 2019/8541).

The following documents were prepared as part of the SM - WSA EIS, to respond to the Request for Further Information, and were published, in accordance with the Direction to Publish, from 21 October to 18 November 2020:

- SMWSA EPBC Act Final Environmental Impact Assessment of on-airport proposed action (EPBC 2019/8541)
- SMWSA EIS Technical Paper 3: Biodiversity Development Assessment Report
- SMWSA EIS Appendix F: Construction Environmental Management Framework.

An EPBC Act Final Environmental Impact Assessment of on-airport proposed action

(EPBC 2019/8541) and an updated Biodiversity Development Assessment Report were approved by the Commonwealth Department of Agriculture, Water and the Environment (DAWE) and formed part of the conditions of the Airport Plan which was lodged with the Department of Infrastructure, Transport, Regional Development and Communications (DITRDC) and approved by the Commonwealth Environment Minister.

This NVCEMP (this Plan) has been prepared to satisfy the requirements of Condition 3.11.6 of the Airport Plan (AP) for the Railway Development of the WSI Airport. Condition 39 (2(a)) of the Airport Plan requires that a Sydney Metro NV CEMP be approved under the Airport Plan prior to the commencement of the Project.

This NV CEMP provides the management approach and requirements for managing noise and vibration during construction of the Project. This Plan forms one of nine CEMPs which are collectively covered by the Sydney Metro Construction Environmental Management Framework (CEMF). To ensure the environmental resources, responsibilities and management measures are implemented during the construction activities the SM CEMF will be included within the Sydney Metro Construction (Rail) Plan.

The implementation of the Sydney Metro Construction (Rail) Plan and the CEMF are aligned with Project level management plans including the Community Communications Strategy and the Sustainability Plan as illustrated in Figure 1-2.

The Construction (Rail) Plan, including the CEMF, and nine CEMPs provide the environmental management approach and requirements and therefore should not be read in isolation to each other due to interconnecting management outcomes and objectives. Specifically, for the Noise and Vibration CEMP, it is considered that the following management plan linkages can be made:

- Traffic and Access CEMP – Construction traffic will be a contributor to noise.
- Biodiversity CEMP – Noise impacts on fauna will be a management consideration.
- Community Communications Strategy – Similar to visual and landscape impacts, it is anticipated that the surrounding community and stakeholders will be sensitive to noise and vibration impacts, particularly during works undertaken outside of the normal construction hours and / or prolonged noisy activities.
- Sustainability Plan– Management and reduction of noise and vibration impacts about quality of life for surrounding communities.

Where relevant, linkages to other CEMPs and management objectives have been included in the risk assessment and the environmental control measures, Section 7.3 and Section 9 respectively. Table 1-1 highlights relationships and linkages of this Noise and Vibration CEMP with other CEMPs and management plans including key cross-referencing to Airport Plan and EIS requirements.

Table 1-1 Visual and Landscape CEMP relationship with other CEMP documentation

CEMP	Airport Plan (3.11.6)	SM - WSA EIA Table 8-1: On-airport environmental management framework requirements	SM - WSA EIA Table 8-3: Mitigation measures
Aboriginal Cultural heritage	39 2(f)	CEMF5	AH8
Air quality	39 2(e)	CEMF10	AQ1-3
Biodiversity	39 2(b)	CEMF6	FF1, 3, 5, 6, 9-11 HR2
Community Communications Strategy	40	N/A	N/A
European and other heritage	39 2(g)	CEMF5	NAH9

Noise and vibration	39 2(a)	CEMF4	NV1
Soil and water	39 2(c)	CEMF3 CEMF8	HYD1 WQ1-2 GW4-6 SC1,5-9, 11 HR1,3
Sustainability plan	41	N/A	SUS1-3 GHG1
Traffic and access	39 2(d)	CTMF	T1,3 ,4,6
Visual landscape	39 2(i)	CEMF7	LV1-3
Waste and resources	39 2(h)	CEMF9 CEMF11	WR1-3

Key
Moderate to high relevance to this CEMP
Some relevance to this CEMP

1.4. Document purpose

The purpose of this Plan is to provide the foundation for the management of noise and vibration impacts in accordance with best practice and legal requirements (including environmental mitigation measures, controls, monitoring and reporting) during the construction phase of the Project based on the assessment undertaken as part of the EIS.

Construction noise and vibration would be managed in accordance with the Sydney Metro Construction Noise and Vibration Standard which provides standard mitigation measures and additional mitigation measures for certain noise and vibration impact levels. Site specific mitigation measures have also been identified to reduce noise and vibration impacts, including potential for acoustic sheds to be installed.

This Plan details the noise and vibration management requirements that must be satisfied in order to demonstrate compliance with the conditions of approval as set out in Condition 6 of Section 3.11.6 of the Airport Plan for the construction of the Project of the Western Sydney Airport.

Legal and other requirements are identified and maintained in a register within the CEMF (refer CEMF chapter 2). Mitigation measures (specific to noise and vibration) required to satisfy these requirements are derived from the EIS and through risk assessment processes (refer to Section 7.3) and included within this CEMP Section 9. Where the development of the Project environmental assessment has not covered that addressed by the WSA assessment, the WSA mitigation measures have been adopted also to provide consistency with the WSA CEMPs (Section 9).

Implementation of these measures is ensured through monitoring, training and competence, inspection, audit and reporting actions detailed in Sections 12 and 13, with the responsibilities for implementation identified in Section 11. Continual improvement processes in relation to compliance with regulatory requirements are detailed in the CEMF Section 3.18.

In summary, this plan sets out to achieve the following:

- Provision of details for the management and mitigation measures to be implemented, including timing and responsibilities;
- Ensuring the commitments of the Conditions (as set out in the Airport Plan) and regulatory requirements are met and satisfied by both Sydney Metro and contractors;
- Provision of process for monitoring implementation, reporting, and auditing of noise and vibration related management and compliance related issues;
- Commitment to meeting the requirements of AS/NZS ISO 14001: 2016 Environmental Management Systems including the need for continual improvement;
- Provision of a process to be implemented for the management of complaints, for stakeholder engagement, and for the management of emerging environmental issues as they arise; and
- Provision of a system including procedures, plans and documentation for implementation by Sydney Metro personnel and contractors to enable Project completion in accordance with the environmental requirements; and
- Consistency with the WSI airport CEMPs.

Effective implementation of this plan will assist Sydney Metro and relevant contractors to achieve compliance with necessary environmental regulatory and policy requirements in a systematic manner with an outcome of continual environmental management performance.

1.5. Consistency

A major requirement of these plans is for Sydney Metro to maintain consistency with the already approved WSA CEMPs. This consistency requirement results in SM not needing to undertake consultation as is the requirement of WSA for their plans.

SM approached the development of these plans to meet the requirements of the Airport Plan, ensure compliance with Tables 8-1, 8-2 and 8-3 of the EPBC 2019/8541 and remain consistent with the WSA CEMPs.

SM have achieved this consistency through the following:

- Consistent format
- Consistent language
- Consistent existing environment with the addition of the SM – WSA RCIZ existing environment
- Consistent aspects and impacts but removing those not applicable and adding specific SM – WSA aspects and impacts
- Consistent risk assessment but removing those not applicable and adding specific SM – WSA risksConsistent mitigation measures but removing those not applicable and adding SM – WSA specific mitigation measures
- Consistent monitoring with the addition of any SM – WSA specific monitoring requirements
- Consistent auditing and reporting

- References to SEMF replaced with consistent CEMF requirements.

1.6. Sydney Metro environmental management system overview

Sydney Metro operates in general accordance with AS/NZS ISO 14001 – Environmental management systems. A copy of the Sydney Metro environmental policy is provided in Appendix A of the SM CEMF.

The Project will be undertaken in accordance with the Construction (Rail) Plan including the SM CEMF and the associated CEMPs (including this Plan).

The SM CEMF forms an appendix to the Construction (Rail) Plan and is the overarching environmental plan for the implementation of the nine CEMPs. It provides a structured and systematic approach to environmental management and provides an expectation and guidance with regards to environmental management for the overall construction of the Project.

The structure of the environmental management system for the Project is shown in Figure 1-2.

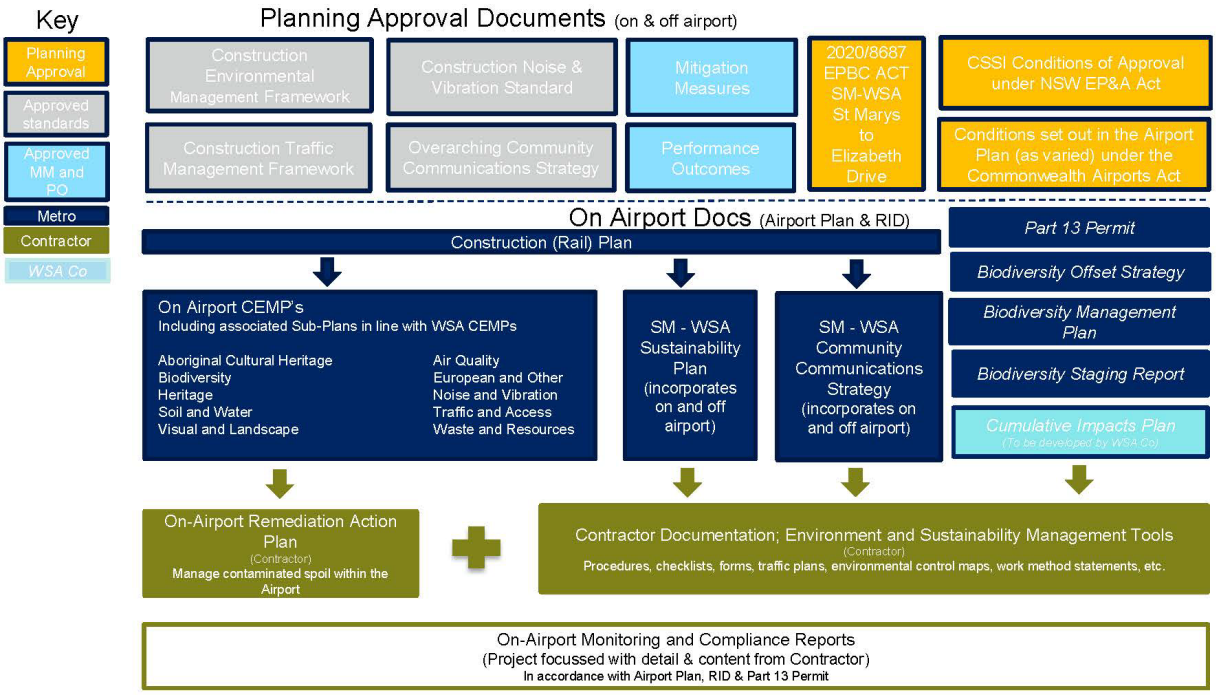


Figure 1-2 SM - WSA Environmental Management System and CEMP context

1.7. Consultation requirements of this document

There is no direct consultation condition requirement for the Project under the Airport Plan and as such, there has been no direct consultation completed during the development of this CEMP, however, WSA completed consultation during the development of the latest WSA BCEMP (Revision 0) and subsequently and during the review and update of Revision 0 and 1 in 2018 and Revision 2 in 2019 of their BCEMP document. (Sections 1.7 and 1.8). SM-WSA will continue to consult with WSA in the development of these plans and as required with relevant stakeholders prior to seeking approval for these plans.

WSA Consultation will continue with agencies, councils and other relevant stakeholders throughout the Project where there is a change to a WSA CEMP. Where the outcomes of this consultation impact on the scope of the Project, to maintain consistency, the change will be documented in subsequent revisions of the relevant CEMPs, with details of such consultation included in the applicable document.

1.8. Certification and approval

This NV CEMP has been reviewed and approved for issue by the SM - WSA Environment Manager prior to submission to Department of Infrastructure, Transport, Regional Development and Communications (Infrastructure Department.).

1.9. Distribution

All Sydney Metro personnel and contractors will have access to this NVCEMP via the project document control management system. Unless otherwise agreed by the Approver, the Approved Plan must be published on Sydney Metro's website within one month of being approved and be available until the end of the Construction Period. An electronic copy can be found on the Project website.

This document is uncontrolled when printed. One controlled hard copy will be maintained by the quality manager at the project office.

2. Scope of works

2.1. Overall project scope

The Sydney Metro Construction Plan details the construction staging of the Airport Railway Development.

The delivery of the Project will be through a packaging strategy with a wide variety of package sizes, risk profiles and contracting entities. Each package will have different levels of environmental risk and environmental obligations, depending on the scope of works, location of works and sensitivity of the receiving environment and cultural heritage issues and relevant statutory requirements and obligations.

The packages have been divided into:

- AEW – Advanced and Enabling Works;
- SCAW – Surface and Civil Alignment Works;
- SBT – Station Boxes and Tunnelling Works;
- SSTOM – Stations, Systems, Trains, Operations and Maintenance.

The On-Airport Railway Development of the Project comprises the following key features as described in the Sydney Metro Construction (Rail) Plan (which is consistent with the Airport Plan and EIA Chapter 4):

- Around two kilometres of surface rail alignment within Western Sydney International (SCAW);
- Around 3.3 kilometres of twin rail tunnels (including tunnel portal) within Western Sydney International (SBT);
- Around three kilometres of twin rail tunnels between Western Sydney International and the Aerotropolis Station (SBT);
- Two new metro stations, Airport Business Park Station and Airport Terminal Station (STOM);
- All operational systems and infrastructure (SSTOM);
- A rail segment factory comprising a concrete batch plant and stockpile area (SBT and SCAW); and
- Spoil stockpile areas (SBT and SCAW).

Details of the Project construction activities, staging and programming including the phases of works is described in the Sydney Metro Construction (Rail) Plan (2021) as required by the Airport Plan Variation.

The proposed construction activities that would be undertaken for the Project include:

- preparatory activities (AEW);
- main construction works including;
    - tunnelling and associated works (SBT);
    - corridor and associated works (SCAW);

- stations and associated works (SSTOM);
- rail systems fitout (SSTOM);
- activities required for tunnel and viaduct segment manufacture and storage and temporary haulage roads (SBT and SCAW); and
- finishing works and testing and commissioning (FAW).

The Project would also include the potential permanent placement of spoil at two sites to support the development of future stages of the airport.

The Rail Construction Impact Zone (CIZ) including the construction footprint and key construction sites proposed for use during the construction of the Project are shown in Figure 2-1. This figure also indicates the Western Sydney International Stage 1 CIZ and the Environmental Conservation Zone within Western Sydney International.

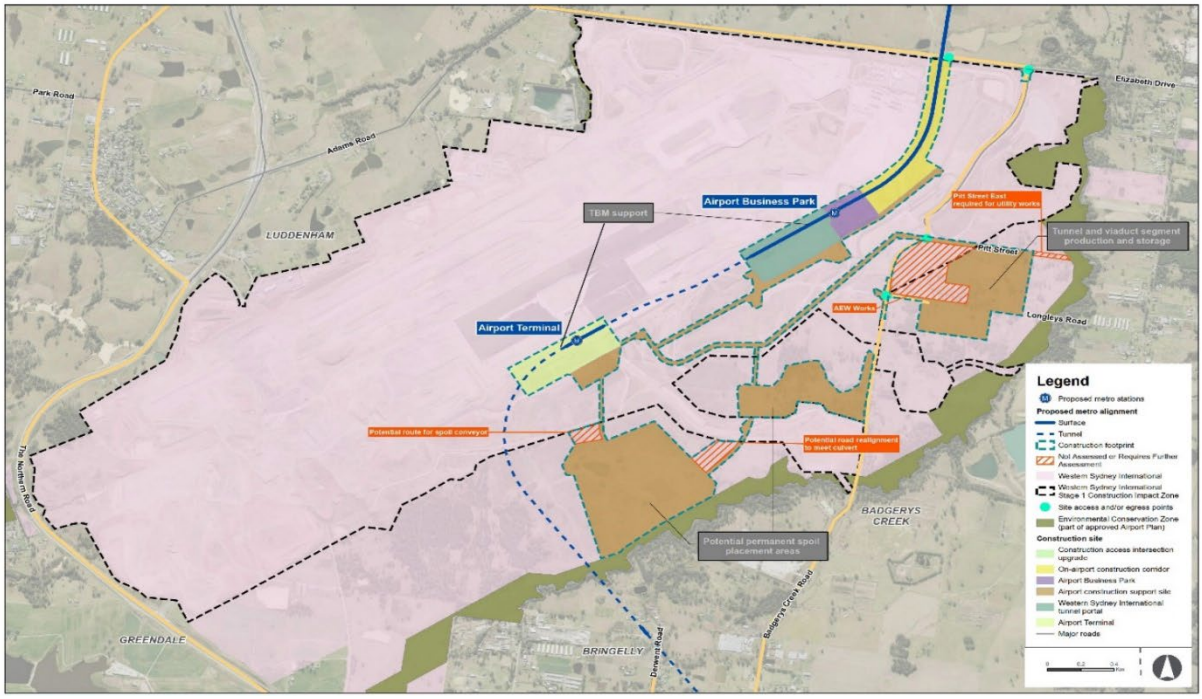


Figure 2-1 SM-WSA construction footprint and key construction sites

It is anticipated that the Project construction works would commence in 2021 and take about five years to complete, subject to planning approval. The Operational Sydney Metro opening is anticipated to align with the opening of passenger services for Western Sydney International in 2026. An indicative main construction program for the project is shown in Figure 2-2.

Construction Activities			Overview of Program																					
			2021				2022				2023				2024				2025				2026			
	Start	Finish	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Enabling Work	25-Jan-21	19-Sep-22																								
SBT Enabling Works	27-Apr-22	23-Jan-23																								
SBT Station & Tunnel Portal Excavation	23-Jun-22	17-Jun-23																								
SBT Tunnel Construction	20-Apr-23	20-Dec-24																								
SCAW Surface work	14-Feb-23	19-Jun-24																								
SCAW Station works	14-Feb-23	13-Jul-23																								
SSTOM Station Construction and fitout	17-Jul-23	29-Aug-25																								
SSTOM Rail System fitout	18-Jun-24	3-Oct-25																								
SSTOM Systems Testing and commisioning (incl integrated)	31-Jan-25	15-Dec-26																								

Figure 2-2 Indicative main construction program for the project

2.2. Preparatory activities

Preparatory activities for the proposed action are required to establish key construction sites and facilitate construction activities.

The majority of the preparatory activities are expected to commence in advance of main construction works, such as tunnelling and station excavation, while some preparatory activities would continue concurrently with the main construction works. Preparatory activities would include:

- detailed site investigations and subsequent clearance works;
- provision of construction haul roads;
- relocating, adjusting and protecting utilities and services affected by the proposed action;
- supplying power, water and other utilities to construction sites and other areas within the construction footprint;
- vegetation clearance (as required); and
- establishment of construction sites.

2.3. Construction sites

The Project's construction activities will be carried out within and to the south-west of the WSI airport Stage 1 CIZ. The indicative works at proposed construction sites required for the construction of the Project are shown in Figure 2-3. The use of these sites will be confirmed by the construction contractor(s) (when appointed) in consultation with Western Sydney Airport.

Location	Preparatory activities	TBM launch	TBM support	TBM retrieval	Spoil handling and removal	Roadheader launch/support	Ancillary facility construction	Stabling and maintenance facility construction	Major earthworks	Bridge and viaduct construction	General civil works	Concrete batch plant	Equipment and material laydown	Rail system fitout	Site offices and worker amenities	Water treatment plant	Potential acoustic shed	Vehicle parking
On-airport																		
On-airport construction corridor	✓				✓		✓		✓	✓	✓		✓	✓	✓			✓
Airport Business Park	✓				✓		✓		✓		✓		✓	✓	✓			✓
Western Sydney International tunnel portal	✓	✓	✓		✓	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓
Airport Terminal	✓		✓		✓	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓
Airport construction support site	✓				✓				✓		✓	✓	✓	✓	✓			✓

Figure 2-3 Indicative works at proposed construction sites

3. Objectives and targets

3.1. Objectives

The key objective of this NV CEMP is to ensure that impacts from noise and vibration are managed to within permitted criteria as far as practicable and best practice mitigation practices are implemented to ensure construction phase emissions do not unduly affect the amenity of surrounding receivers. To achieve this objective, the following will be undertaken:

- Ensure appropriate measures are implemented to address the mitigation measures detailed in Table 23 of the WSA NVCEMP and Tables 8-1, 8-2 and 8-3 of the SM - WSA EIA;
- Identifying sensitive receivers and ensure appropriate environmental controls and procedures are implemented during construction activities;
- Minimising potential adverse noise and vibration impacts to the environment and community;
- Managing impacts if they occur through a systematic analysis of mitigation strategies;
- Identify a process for monitoring implementation, reporting and auditing;
- Describe the process for managing complaints, stakeholder engagement and emerging environmental management issues as they arise; and
- Ensure appropriate measures are implemented to comply with all relevant legislation, licences and other requirements
- Minimise unreasonable noise and vibration impacts on residents and businesses;
- Avoid structural damage to buildings or heritage items as a result of construction vibration;
- Undertake active community consultation;
- Maintain positive, cooperative relationships with schools, childcare centres, local residents and building owners; and
- Detail all the noise and vibration management objectives and be consistent with the WSA Noise and Vibration CEMP, including all appendices to the WSA CEMP.

3.2. Targets and Performance objectives

Performance criteria specific to noise and vibration have been established for the management of noise and vibration impacts during the Project which have been, in part, derived from the performance criteria identified in the EIS Table 28-2, as presented below in Table 3-1.

Table 3-1 Noise and vibration targets

Objective	Target	Document Reference
Community Management	No noise or vibration-related complaints associated with the project	Complaints database (Community Communications Strategy)
	All works are to be undertaken within the designated construction hours or with an out-of-hour work approval	Complaints database (Community Communications Strategy)
Statutory compliance	Nil instances of non-compliance with environmental statutory requirements (e.g. infringement notices, clean-up notices, etc.)	Infringement notices Incident and non-conformance reporting Audit reporting Annual Compliance Report
CEMP compliance	Weekly Environmental Inspections completed	Weekly environmental inspection reports and monthly reporting
	All Environmental Audits completed	Environmental audit reporting
	All incidents and non-conformances closed out in a timely manner	Incident and non-conformance register
	Implementation of feasible and reasonable noise mitigation measures with the aim of achieving the construction noise management levels detailed in the Interim Construction Noise Guideline (ICNG) (DECC, 2009)	Environmental inspection checklist Monitoring results Monthly reporting Annual Compliance Report
Plant and Equipment	All plant and equipment maintained in accordance with manufacturers' requirements	Plant and equipment log books

The targets in Table 3-1 have been set to provide a benchmark performance objective to which Sydney Metro will endeavour to achieve. Failure to achieve the targets will not be considered a non-conformance, however, will prompt internal review of environmental management and assessment of potential improvement opportunities.

4. Legal and other requirements

Relevant environmental legislation and other requirements are identified below.

4.1. Relevant legislation and guidelines

As the Project is to be developed under the Airport Plan (Rail Conditions) determined under the Airports Act, some state laws will not be applicable to the Project (s112 of this Act). Where state law is applicable, this Plan will set out the relevant applicable state legislation and requirements and demonstrate how compliance with those laws including obtaining relevant permits will be achieved. Where state laws are not applicable, there may nonetheless be a requirement to have regard to those laws, for example, through mitigation measures to be incorporated in CEMPs to satisfy conditions under the Airport Plan.

4.1.1. Legislation

Relevant Legislation and regulations for this Plan are summarised in Table 4-1.

Table 4-1 Principal legislation and relevance

Legislation or regulation	Relevance	CEMP compliance provisions
Commonwealth		
Airports Act 1996 (Airports Act)	The Airports Act and regulations made under the Airports Act set out the framework for the regulation and management of activities at airports that could have potential to cause environmental harm. This includes offences related to environmental harm, environmental management standards, monitoring and incident response requirements. The Airport Plan prepared under the Airports Act covers several environmental matters and details specific measures to be carried out for the purposes of preventing, controlling or reducing the environmental impact associated with the airport. Criminal offences are applicable if these measures are not complied with.	This CEMP forms part of the overall Sydney Metro environmental management system which has as a target, full compliance with the Airport Plan. Relevant mechanisms within this CEMP that will contribute to this include but are not limited to: • Section 3.1 – Objectives • Section 4.3 – Airport Plan Conditions • Section 4.4.1 – Environmental Impact Statement requirements • Section 7.3 – Risk Assessment • Section 9 – Environmental Control Measures • Section 11 – Environmental Roles and Responsibilities • Section 12 – Environmental Inspection, Monitoring and Auditing • Section 12.6 – Environmental Incidents and complaints management • Section 12.5 – Review of approved plans
Airports (Environment Protection) Regulations 1997 (AEPR)	Imposes various duties including a general duty to avoid adverse impacts on existing aesthetic values of the local area. Promotes improved environmental management practices at airports. Includes provisions setting out acceptable limits as well as environmental monitoring and reporting requirements.	Refer to commentary on Airport Plan above.

Legislation or regulation	Relevance	CEMP compliance provisions
Airports (Building Control) Regulations 1996	The Regulations set out the standards that WSA need to meet for specific hazards and risks, such as noise, machinery, and manual handling. The Regulations also set out the licenses that may be required for specific activities, the records you need to keep, and the reports you need to make.	This document.
NSW: As the Airport is to be developed under the Airport Plan determined under the Airports Act, 1996 (Cth), some state laws will not be applicable to the project (see for example S 112 of that Act). Where state laws are not applicable, it is still intended to have regard to relevant laws for example through inclusion of mitigation measures incorporated into this CEMP. These laws are identified below.		
Environmental Planning and Assessment Act 1979 (EPA Act)	Objects of the Act include the encouragement of proper management and conservation of natural and artificial resources and the promotion of the orderly and economic use and development of land in NSW. The EP&A Act also provides for the making of environmental planning instruments including State Environmental Planning Policies (SEPPs) and Local Environmental Plans (LEPs), which include land use controls, such as development standards applicable to the land within the area covered by each instrument.	Section 9 – Environmental Control Measures
Roads Act 1993	Governs the opening, operation and management, and closure, of public roads in NSW	Section 9 – Environmental Control Measures
Work Health and Safety Act 2011 & Work Health and Safety Regulation 2017.	The Work Health and Safety Act 2011 (NSW) (the Act) provides a framework to protect the health, safety and welfare of all workers and others in relation to NSW workplaces and work activities. The Work Health and Safety Regulation 2017 set out specific requirements for particular hazards and risks, such as noise, machinery, and manual handling.	This document.
State Environmental Planning Policy (Western Sydney Aerotropolis) 2020 (Aerotropolis SEPP)	The Aerotropolis SEPP was made in accordance with division 3.3 of the EP&A Act and provides planning controls for development within the Western Sydney Aerotropolis. The Aerotropolis SEPP overrides any LEP provisions that apply to that land.	Section 9 – Environmental Control Measures

Legislation or regulation	Relevance	CEMP compliance provisions
Liverpool Local Environmental Plan 2008 (Liverpool LEP)	The Liverpool LEP provides local environmental planning controls and standards for land in the Liverpool LGA in accordance with the standard environmental planning instrument under section 3.20 of the EPA Act.	Section 9 – Environmental Control Measures
Penrith Local Environmental Plan 2010 (Penrith LEP)	The Penrith LEP provides local environmental planning controls and standards for land in the Penrith LGA in accordance with the standard environmental planning instrument under section 3.20 of the EPA Act.	Section 9 – Environmental Control Measures

4.1.2. Guidelines and standards

Guidelines and standards that are relevant to noise and vibration management and this plan are summarised in Table 4-2.

Table 4-2 Noise and vibration guidelines and standards

Guidelines and standards
The Australian and New Zealand Environment Conservation Council (ANZECC) guideline – Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration (ANZECC, 1990)
NSW Interim Construction Noise Guideline (ICNG) (DECC 2009)
Noise Policy for Industry (2017)
NSW Assessing Vibration: A Technical Guideline (DE 2006)
German DIN 4150-3: Structural Vibration: Effects of Vibration on Structures
Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration (1990) Australian and New Zealand Environment and Conservation Council (ANZECC)
Australian Standard AS 2187.2-2006: Explosives - Storage and use - Use of explosives
Liverpool Local Environmental Plan 2008 (NSW)
AS/NZS ISO 14001:2015 – Environmental Management Systems
Western Sydney Aerotropolis Development Control Plan 2020 Phase 1

4.2. Approvals and other specifications

- Functional Specifications;
- Sydney Metro Western Sydney Airport Plan;
- Sydney Metro Western Sydney Airport Environmental Impact Statement;
- Sydney Metro Sustainability Plan;
- Sydney Metro Community Communications Strategy; and
- Sydney Metro – WSA Final EPBC EIA for on-airport (EPBC
- Sydney Metro Construction Rail Plan
- SM Construction Environmental Management Framework (CEMF).
- SM Construction Noise and Vibration Standard (CNVS).

4.2.1. Construction Noise and Vibration Standard

The Construction Noise and Vibration Standard (CNVS) (https://icentral.tdocs.transport.nsw.gov.au/otcs/cs.exe/app/nodes/272123288) establishes a framework for managing construction noise and vibration impacts and adopting appropriate mitigation measures (including minimum requirements):

- Is included in the CSSI planning approval documentation;
- Forms part of the contract requirements that contractors must comply with;
- Defines a minimum standard for managing noise and vibration impacts that considers current best practice guidelines and other regulatory requirements; and
- Sets minimum requirements for all OOH work, including the need for and development of Construction Noise and Vibration Management Plans, Construction Noise and Vibration Impact Statements and Detailed Noise and Vibration Impact Statements.

4.3. Airport Plan conditions

Construction conditions relevant to noise and vibration management during construction of the Project are provided in Section 3.11.6 of the Airport Plan and summarised in Table 4-3. Compliance with the Airport Plan conditions is a statutory requirement and as such, failure to comply may constitute a criminal offence liable to criminal prosecution under the relevant legislation.

Table 4-3 Airport Plan conditions applicable to noise and vibration management

Condition No.	Condition	Timing	Responsibility	Reference within this CEMP
39.1	The rail authority must not: (a) Commence Rail Construction Works until each and all of the CEMPs specified in paragraph (2) have been prepared and approved in accordance with this condition; or (b) Carry out any Rail Development inconsistently with any of the approved Rail CEMPs.	Prior to Main Construction Works	Sydney Metro	CEMP sections 7, 9, 11, 12
39.2	The Rail Authority must prepare and submit to an Approver for approval; (a) a Noise and Vibration CEMP in relation to the carrying out of the Rail Development.	Prior to Construction Works	Sydney Metro All contractors	This document (Noise and Vibration CEMP)
39.3	The criteria for approval of each of the Rail CEMPs are that an Approver is satisfied that (a) the CEMP complies with the mitigation measures and other requirements set out in Table 8-1 and Table 8-3 of the EIA which are relevant to that CEMP; (b) the Rail Authority, in preparing the CEMP has taken into account any performance outcomes specified in Table 8-2 of the EIA which are relevant to that CEMP; and (c) the CEMP is otherwise appropriate	Prior to Construction Works	Sydney Metro	This document (Noise and Vibration CEMP) Table 4.5
39.4	The Rail Authority must ensure that: (a) a Rail CEMP is to the extent possible, consistent with a CEMP of the Site Occupier; and (b) no Rail CEMP is inconsistent with the approved Construction (Rail) Plan.	CEMP preparation	Sydney Metro	Section 1.3 Section 4.4 Section 9

Condition No.	Condition	Timing	Responsibility	Reference within this CEMP
45.3	The Rail Authority must take reasonable steps to ensure that: (a) each person involved in carrying out a development which is part of the Rail Development: (i) is informed of the conditions that are relevant to the carrying out of the Rail Development; and (ii) in carrying out the Rail Development, complies with those conditions as if they applied to the person in the same way as they apply to the Rail Authority; and (b) each person involved in operating a development described in section 3.10 of Part 3 of the Airport Plan: (i) is informed of the conditions that are relevant to the operation of the development; and (ii) in operating the development, complies with those conditions as if they applied to the person in the same way as they apply to the Rail Authority.	Prior to construction	Sydney Metro	Section 13
46	Each Site Occupier, the Rail Authority and each Plan Owner must maintain accurate records which demonstrate its compliance with the conditions, including measures taken to implement the Approved Plans, and must make the records available upon request to the Infrastructure Department.	During construction	Sydney Metro	Section 12
47.4	Unless otherwise agreed in writing by an Approver, the Rail Authority must prepare a report addressing its compliance with each condition set out in section 3.11.6, including implementation of any Approved Plan, in respect of: (a) the 12-month period commencing with the commencement of Rail Construction Works; and (b) each subsequent 12-month period until the end of the Rail Construction Period; and (c) any period between the commencement of Rail Construction Works and the end of the Rail Construction Period that is not covered by paragraph (a) or (b).	During construction	Sydney Metro	Section 12.4
47.5	Unless otherwise agreed in writing by an Approver, the Rail Authority must publish each report prepared under subcondition (4) on its website within three months of the end of the period in respect of which the report was prepared. Documentary evidence providing proof of the date of publication must be provided to the Infrastructure Department at the same time as each report is published (with a copy to be provided to the Environment Department). Each report must remain on the Rail Authority's website for a minimum of 12 months (beginning on the date of publication).	During construction	Sydney Metro	Section 12.4

Condition No.	Condition	Timing	Responsibility	Reference within this CEMP
48.4	The Rail Authority must ensure that an independent audit of its compliance with the conditions set out in section 3.11.6 (except condition 44) is conducted in respect of the 12-month period commencing with the commencement of Rail Construction Works.	During construction	Sydney Metro	Section 12.4
48.5	The Rail Authority must ensure that an independent audit of its compliance with condition 46 is conducted in respect of the 12-month period from commencement of Rail Operations.	During construction	Sydney Metro	Section 12.4
48.6	The Rail Authority must submit the report of each audit conducted under subcondition (4) or (5) to an Approver (with a copy to the Environment Department) within six months of the end of the period in respect of which the audit was conducted. For each audit, the independent auditor must be approved by an Approver prior to the commencement of the audit. Audit criteria must be agreed by an Approver and the report of the audit must address the criteria to the satisfaction of an Approver.	During construction	Sydney Metro	Section 12.4
49.1	The Plan Owner may seek approval for a variation of an Approved Plan by submitting to an Approver a version of the plan with the proposed variation clearly marked in it (**varied plan**).	During construction	Sydney Metro	Section 12.5
49.2	The criteria for approval of the varied plan are the same as those in the Approval Condition, but only to the extent that they are relevant to the proposed variation.	During construction	Sydney Metro	Section 12.5
49.3	If an Approver approves a varied plan prepared under subcondition (1) or paragraph (6)(b), or the Infrastructure Minister varies an Approved Plan under paragraph (6)(a), then, from the date when it is approved or varied (as the case may be), the plan as varied is taken to be the Approved Plan for the purposes of the conditions.	During construction	Sydney Metro	Section 12.5
49.4	The ALC must review each Approved Plan for which it is the Plan Owner every five years to ensure that the Approved Plan continues to meet the approval criteria for that plan. The ALC must provide a report on the review (which may be included in an annual report required under condition 47). If the plan does not continue to meet the approval criteria, within three months of the provision of the report, the ALC must prepare and submit for approval under subcondition (1) a variation to the Approved Plan to ensure it continues to meet the approval criteria	During construction	Sydney Metro	Section 12.5

Condition No.	Condition	Timing	Responsibility	Reference within this CEMP
49.5	Despite subcondition (4), the ALC must review the Cumulative Impacts Plan every 12 months in consultation with the Rail Authority to ensure that the Plan continues to meet the approval criteria. The ALC must provide a report on the review (which may be included in an annual report required under condition 47). If the plan does not continue to meet the approval criteria, within three months of the provision of the report, the ALC in consultation with the Rail Authority must prepare and submit for approval under subcondition (1) a variation to ensure it continues to meet the approval criteria.	During construction	Sydney Metro	Section 12.5
49.6	The Infrastructure Minister may: (a) vary an Approved Plan; or (b) request in writing that the Plan Owner prepare and seek approval for a specified variation of an Approved Plan in accordance with subcondition (1), if the Infrastructure Minister believes on reasonable grounds that: (c) a condition has been contravened and the nature of the contravention is relevant to the subject matter of the Approved Plan; and (d) the variation or the request for a specified variation (as the case may be) will address the contravention.	During construction	Sydney Metro	Section 12.5
49.7	The Plan Owner must comply with a request made by the Infrastructure Minister in accordance with subcondition (5) within three months of the date of the request.	During construction	Sydney Metro	Section 12.5
49.9	Within two months of the grant of an Airport Lease, the ALC must prepare and submit for approval, in accordance with subcondition (1), a variation of each plan that was approved under a condition before the lease was granted, and for which the ALC is the Plan Owner, to reflect the change in Site Occupier resulting from the grant of the Airport Lease.	During construction	Sydney Metro	Section 12.5
50.1	Unless otherwise agreed in writing by an Approver, the Plan Owner must publish all Approved Plans on its website.	During construction	Sydney Metro	Section 12.5
50.2	Each Approved Plan must be published on the Plan Owner's website within one month of being approved and remain so published: (a) for CEMPs and Rail CEMPs – until the end of the Airport Construction Period or Rail Construction Period as relevant; (f) for all other plans – until there is a Master plan for the Airport.	During construction	Sydney Metro	Section 12.5

4.4. Environmental Impact requirements

4.4.1. WSA EIS requirements

The requirements of noise and vibration management to be considered and addressed during the construction phase of the Project on the Stage 1 area are included in the WSA EIS, specifically Table 28-2 and 28-3. In line with the requirement of the SM - WSA CEMPs to be consistent with the WSA CEMPs, Sydney Metro have ensured that the implementation, risk assessment, management measures, monitoring, auditing, reporting and responsibility for biodiversity management by the Project is aligned with the requirements of the WSA NVCEMP.

4.4.2. SM - WSA EIA requirements

The requirements of noise and vibration management to be considered and addressed during the construction phase of the Project are included in the SM - WSA EIA Tables 8-1 CEMF 4, Table 8-2, 8-3 and the CNVS. A summary of these requirements and how they have been addressed in this NVCEMP is presented in Table 4-5.

Table 4-4 Summary of SM - WSA EIA Noise and Vibration requirements applicable to this CEMP

EIA Reference	Topic	Summary	Noise and Vibration CEMP Reference
Table 8-1 CEMF4	Framework Requirement	The on-airport Noise and Vibration CEMP would detail the Sydney Metro – Western Sydney Airport noise and vibration management objectives, including:	
		• minimise unreasonable noise and vibration impacts on residents and businesses	Section 8 – Construction noise and vibration assessment Section 9 – Environmental control measures
		• avoid structural damage to buildings or heritage items as a result of construction vibration;	
		• undertake active community consultation and	
		• maintain positive, cooperative relationships with schools, childcare centres, local residents and building owners.	
		The on-airport Noise and Vibration CEMP would be consistent with the Western Sydney Airport Noise and Vibration CEMP, including all appendices (and sub plans) to the CEMP. The plan would include as a minimum:	This SM - WSA CEMP was based on the WSA CEMP
		• identification of work areas, site compounds and access points	Section 2 –Scope of works
		• identification of sensitive receivers and relevant construction noise and vibration goals	Section 5 - Existing environment Section 6 – Noise and Vibration Criteria Section 8 – Construction noise and vibration assessment
		• details of construction activities and an indicative schedule for construction works, including the identification of key noise and/or vibration generating construction activities (based on representative construction scenarios) that have the potential to generate noise or vibration impacts on surrounding off-airport sensitive receiver.	Section 2 – Scope of works Section 7 – Noise and Vibration aspects and impacts Section 8 – Construction noise and vibration assessment
		• identification of feasible and reasonable mitigation measures to manage potential impacts	Section 9 Environmental Control Measures

EIA Reference	Topic	Summary	Noise and Vibration CEMP Reference
		• additional requirements in relation to activities undertaken 24 hours of the day, 7 days per week	Section 9 Environmental Control Measures Section 10 – Working outside of standard construction hours
		• compliance record generation and management, including: ○ Records of noise and vibration monitoring results against appropriate NMLs and vibration criteria and ○ Records of community enquiries and complaints, and the Contractor's response	Section 12 – Environmental Inspection, monitoring, auditing and reporting
		• identification of feasible and reasonable procedures and mitigation measures to ensure relevant vibrations and blasting criteria are achieved, including a suitable blast program	N/A – no blasting occurring
		• noise monitoring requirements	Section 12 – Environmental Inspection, monitoring, auditing and reporting
		Detailed Construction Noise and Vibration Impact Statements will be prepared for noise-intensive construction sites and or activities to ensure the adequacy of the noise and vibration mitigation measures. Specifically, Construction Noise and Vibration Impact Statements will be prepared for works proposed to be undertaken outside of standard construction hours and to support applications to undertake out of hours works (this includes variations of EPLs and applications to relevant agencies).	Section 9 Environmental Control Measures Section 10 - Working outside of standard construction hours
		The on-airport Noise and Vibration CEMP would include the following noise and vibration mitigation measures: • hoarding and enclosures would be implemented where required to minimise airborne noise impacts • layout of construction sites would aim to minimise airborne noise impacts to surrounding receivers • provision of respite periods equipment would be selected with consideration of their maximum noise levels. Where required, works would be undertaken in accordance with the Western Sydney Airport Out of Hours Works procedure.	Section 9 Environmental Control Measures Section 10 - Working outside of standard construction hours

EIA Reference	Topic	Summary	Noise and Vibration CEMP Reference
Table 8-1 CNVS1	Construction noise and vibration standard	Quantitative noise and vibration impact assessments will be carried out prior to construction. Where a potential exceedance of the construction noise and vibration management levels is identified, additional mitigation measures (such as individual briefings, letter box drops, phone calls, emails and specific notifications to affected sensitive receivers) would be considered.	Section 9 Environmental Control Measures Section 10.5 Community notification
Table 8-1 CNVS2		Noise monitoring would be carried out where a potential exceedance of the construction noise management levels has been identified.	Section 9 Environmental Control Measures Section 12 – Environmental Inspection, monitoring, auditing and reporting
Table 8-1 CNVS3		Vibration monitoring would be carried out at the nearest affected receiver where it is anticipated that an item of plant would exceed the cosmetic damage or human response/ground-borne noise criteria.	Section 8 – Construction Noise and Vibration Assessment Section 9 Environmental Control Measures Section 12 – Environmental Inspection, monitoring, auditing and reporting
Table 8-1 CNVS4		Where feasible and reasonable, construction would be carried out during the standard daytime working hours. Work generating high noise and/or vibration levels would be scheduled during less sensitive time periods.	Section 9 Environmental Control Measures
Table 8-1 CNVS5		All complaints handling would be in accordance with the Sydney Metro Overarching Community Communications Strategy and Construction Complaints Management System and in consultation with Western Sydney Airport.	Section 9 Environmental Control Measures Section 10.5 Community notification
Table 8-2 Performance Outcomes	Noise and vibration	Construction noise and vibration impacts on local communities (including airborne noise and ground-borne noise and vibration) are managed in accordance with the Sydney Metro Construction Noise and Vibration Standard, the Interim Construction Noise Guideline, and the Airports (Environment Protection) Regulations 1997	Section 9 Environmental Control Measures Section 10.5 Community notification
Table 8-3 Consolidated list of on-airport	NV1	Where acoustic sheds are installed, the internal lining and type of material used in the construction of the sheds would be considered during design development and construction planning to ensure appropriate attenuation is provided	Section 9 Environmental Control Measures Section 10.5 Community notification
	NV2	Not required/applicable	N/A

EIA Reference	Topic	Summary	Noise and Vibration CEMP Reference
mitigation measures	NV3	An Operational Noise and Vibration Review would be prepared during design development to confirm the mitigation measures required to manage: • airborne and ground-borne noise impacts from rail operations • airborne noise impacts from the stabling and maintenance facility • airborne noise impacts from fixed industrial sources, including stations and services facilities. The Operational Noise and Vibration Review would establish Project Noise Trigger Levels based on existing land use and background noise levels at that point of time.	Section 9 Environmental Control Measures

5. Existing environment

Assessments have been undertaken by both the WSA and SM WSA as part of their EIS process. The assessment for the SM - WSA was done after works had commenced on the WSA Co airport site. The results are presented below in separate sections.

The following information is summarised from the SM – WSA EIS – Specifically for the noise and vibration assessment, refer to Technical paper 2 (Part 1-6).

For the purpose of the phases of Works covered by this CEMP, the existing environment described herein is considered consistent and acceptable for consideration in the risk assessment process and the identification of suitable environmental mitigation measures and controls - for details with regards to environmental mitigation measures and controls for management of noise and vibration impacts refer to Section 9.

5.1. SM - WSA Rail Construction

5.1.1. On-airport

Construction work is currently being undertaken at the WSI airport. Noise generated by these works has been observed to have little impact on the existing noise environment at the nearest sensitive receivers. This observation is consistent with the predicted impacts from the construction noise assessment for Western Sydney International as part of the Western Sydney Airport – Environmental Impact Statement (Department of Infrastructure and Regional Development, 2016b), which suggests that due to the large size of the site, construction noise experienced off-airport is anticipated to be localised to the areas adjacent to where bulk earthworks occur.

5.1.2. Existing noise environment

The noise environment is characteristic of a semi-rural landscape. The background noise environment is characterised by natural sounds, with most of the area having little road traffic noise, and generally characterised by moderately low background noise levels. Traffic along sub-arterial roads such as Luddenham Road and Elizabeth Drive, and arterial roads such as The Northern Road, are the main noise sources within this area.

During construction, there are two sensitive receivers within the Western Sydney International; the Airport Experience Centre and Western Sydney Airport site offices. No residential receivers currently exist within Western Sydney International. In the future (during operation), the on-airport sensitive receivers would broadly consist of the new airport terminal and ancillary buildings, air traffic control tower, and the proposed business park.

5.1.3. Noise Catchment Areas

Noise Catchment Areas (NCAs) are groups of sensitive receivers that are likely to experience similar impacts from the proposed action. Predicted impacts for each NCA are considered to represent typical noise and vibration impacts at each individual receiver within that NCA. Table 5-2 describes the location of the NCAs adopted for the proposed action which are also presented in Figure 5-3.

The NCAs are delineated by landmark features, such as roads, to encompass groupings of houses with similar background noise environments. These NCAs contain sensitive receivers approximately two kilometres around the proposed action.

Table 5-1 Noise Catchment Areas

NCA	Indicative number of receiver buildings assessed in NCA	Description
NCA10	378	Open farmland with low density single storey and multi-storey residential dwellings within the Twin Creeks area north of the proposed action, and scattered residential dwellings along Luddenham Road.
NCA11	70	Predominantly Western Sydney International land. Low density residential dwellings along Lawson Road and Martin Road to the east of the proposed action. Medium density residential dwellings at Luddenham to the west of the proposed action.
NCA12	396	Predominantly scattered low density single-storey residential dwellings, located south of the proposed action. Ambient noise conditions are dominated by traffic along The Northern Road.

5.1.4. Background noise monitoring locations

Four noise monitoring locations were used to characterise the existing noise environment in the areas surrounding the proposed action and sensitive receivers potentially impacted by the proposed action. Noise monitoring was undertaken at locations where site access was granted by the resident/occupant.

The noise monitoring locations selected for the assessment were considered to be representative of the existing background noise environment in each NCA. The weather conditions at the time of monitoring were recorded by Bureau of Meteorology weather stations located at Badgerys Creek (Station ID: 67108). The locations of the attended and unattended monitoring are presented in Table 5-3 and shown in Figure 5-3.

Table 5-2 Noise monitoring locations

Noise monitoring location	NCA	Start date	End date	Address
NM10	NCA10	17-02-20	25-02-20	27 Halmstad Boulevard, Luddenham
NM12	NCA11	17-02-20	25-02-20	5 Jamison Street, Luddenham
NM13	NCA12	27-02-20	09-03-20	80 Mersey Road, Bringelly
NM20	NCA11	27-02-20	09-03-20	25 Lawson Road, Badgerys Creek

5.1.5. Unattended noise survey results

Unattended noise monitoring was carried out by M2A between 17th February 2020 and 9th March 2020. The measured Rating Background Levels (RBLs) and ambient noise levels are summarised in Table 5-4.

Table 5-3 Summary of unattended noise monitoring results

Location	Rating Background Level (RBL) dBA[1]			Ambient noise level dBA[1] $L_{eq\ 15\ minute}$		
	Day	Evening	Night	Day	Evening	Night
NM10	(30) 35[2]	30	30	47	42	37
NM12	(34) 35[2]	32	(24) 30[2]	58	60	48
NM13	38	35	34	58	52	51
NM20	39	37	(28) 30[2]	49	47	42

Notes

1. Time periods defined as – Day: 7am to 6pm Monday to Saturday, 8am to 6pm Sunday; Evening, 6pm to 10pm; Night 10pm to 7am Monday to Saturday, 10pm to 8am Sunday

2. Where background levels are below the minimum assumed rating background noise levels outlined in the NPfI, they have been adjusted to 35dBA during the day period, and 30 dBA during the evening and night periods in accordance with the NPfI

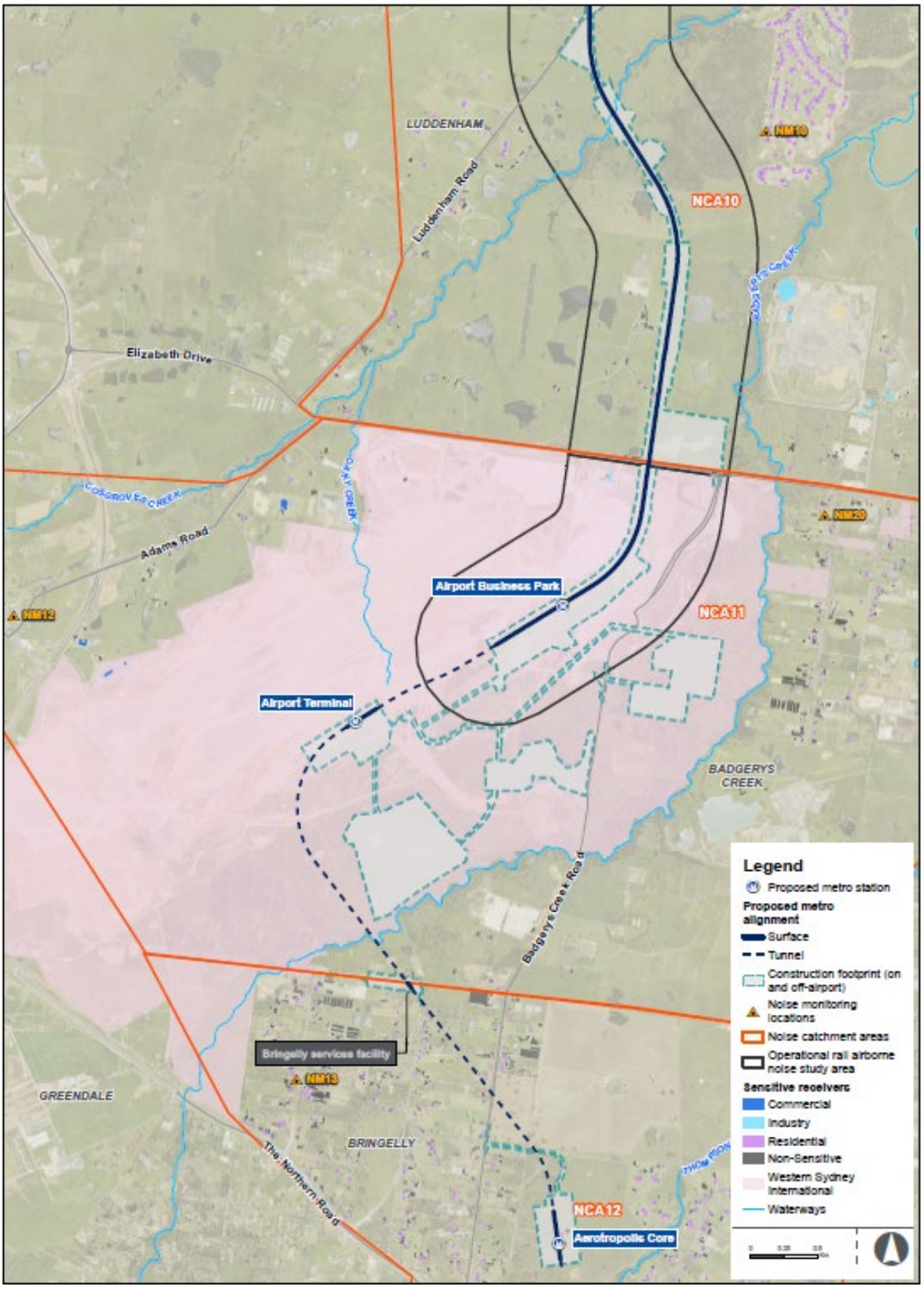


Figure 5-1 Noise catchment areas and noise monitoring locations

5.1.6. Operator attended noise survey

M2A carried out operator attended noise surveys to characterise the noise environment and identify the contributors to the acoustic environment. The results of the attended noise surveys and observations are detailed in Table 5-5.

Table 5-4 Summary of attended noise measurement results

Location	Date	Time	dBA $L_{eq(15min)}$	dBA $L_{90(15min)}$	Observations
NM10	17/02/2020	11:15	37	27	The ambient noise environment was generally characterised by natural sounds such as birds, insects, or wind through trees. Occasional car passbys on Halmstad Boulevarde were audible but uncommon.
NM12	17/02/2020	10:30	43	37	The ambient noise environment was generally characterised by natural sounds (e.g. birds and insects), as well as distant traffic along The Northern Road. The ambient noise environment was occasionally punctuated by events such as car or truck passbys along Adam Road, the occasional dog bark, and plane flyovers.
NM13	27/02/2020	10:30	57	38	The background noise environment was dominated by natural noise including cicadas. Semi-frequent truck passbys along Mersey Street, and fixed wing aircraft flyovers noted during measurements.
NM20	27/02/2020	13:15	48	43	The background noise environment was dominated by natural sounds and road traffic along Elizabeth Drive. Natural sounds were audible.

6. Noise and vibration criteria

Management levels and goals used in assessing construction noise and vibration are outlined in:

- Airports (Environment Protection) Regulations 1997 (AEPR);
- The Interim Construction Noise Guideline (ICNG) (DECC, 2009);
- Assessing Vibration: A Technical Guideline;
- The ANZECC, Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration; and
- NSW Road Noise Policy (RNP) (DECC, 2011).
- Noise Policy for Industry (EPA, 2017)
- German Standard DIN 4150-3: Structural Vibration on structures
- Australian Standard AS2436-2010 Guide to noise and vibration control on construction, demolition and maintenance sites

Relevant elements of these documents are summarised and discussed in this section.

6.1. Construction noise and assessment objectives

6.1.1. AEPR

Airports (Environmental Protection) Regulations 1997 (AEPR) includes provisions setting out definitions, acceptable limits and objectives for noise impacts, as well as monitoring and reporting requirements for the operation of Airports.

The main objectives of the AEPR are to:

- Establish, in conjunction with national environment protection measures made under section 14 of the National Environment Protection Council Act 1994, a Commonwealth system of regulation of, and accountability for, activities at airports that generate, or have potential to generate:
    - pollution; or
    - excessive noise; and
- to promote improving environmental management practices for activities carried out at airport sites.

Regulation 4.06 of the AEPR sets out a general duty to take reasonable and practicable measures to prevent the generation of offensive noise or if prevention is not reasonable or practicable, to minimise the generation of offensive noise.

Under regulation 4.07, an operator of an undertaking at an airport is complying with the duty in Reg 4.06 (AEPR) if noise levels are under the guidelines in Schedule 4 of the AEPR.

Part 2 of the AEPR include the Guidelines that are relevant to the construction of the Project include:

2.02 Noise from Construction:

a) Noise generated from construction, maintenance, or demolition of a building or other structure at an airport should not exceed 75 dB(A), calculated in accordance with subclause (2), at the site of a sensitive receptor; and
b) For sub regulation (1), the sound pressure level of a noise is the sound pressure level that is exceeded for 10 per cent of a period of at least 15 minutes, adjusted to take account of tonal character and impulsiveness (if any) of the noise.

2.03 Noise from road traffic

Noise generated from road traffic on the site of an operator of an undertaking at an airport should not exceed:

c) 60 dB(A), calculated as the equivalent continuous A-weighted sound pressure level for a 24-hour period of measurement; and
d) 55 dB(A), calculated as the equivalent continuous A-weighted sound pressure level for an 8-hour period of measurement from 22:00 hours on a day to 06:00 hours on the following day.

The AEPRs has additional criteria in relation to commercial receptors (see reg 3.02 of Sch 4).

Part 4 of Schedule 4 also provides procedures and standards for measuring construction noise (AS 1055) and Road traffic noise (AS 2702).

6.1.2. Interim Construction Noise Guidelines (ICNG)

Interim Construction Noise Guideline (ICNG) provides guidelines for the assessment and management of construction noise. The ICNG focuses on applying a range of work practices to minimise construction noise impacts rather than focusing on achieving numeric noise levels.

The main objectives of the ICNG are to:

- Identify and minimise noise from construction works;
- Focus on applying all ‘feasible’ and ‘reasonable’ work practices to minimise construction noise impacts;
- Encourage construction during the recommended standard hours only, unless approval is given for works that cannot be undertaken during these hours;
- Reduce time spent dealing with complaints at the project implementation stage;
- Provide flexibility in selecting site-specific feasible and reasonable work practices to minimise noise impacts;
- Performance criteria for managing construction noise and vibration are;
- Ensure general compliance with the ICNG;
- Compliance with vibration criteria set out in Assessing Vibration – a technical guideline (DEC 2006); and
- Compliance with residential criteria for overpressure from blasting activities (ANZECC, 1990).

6.2. Quantitative noise assessment criteria

ICNG recommends noise management levels to assist the management of noise on construction sites both during and outside standard construction hours (Monday to Friday, 7.00am to 6.00pm and Saturday 8.00am to 1.00pm). Where noise at sensitive receptors is expected to exceed noise management levels, implementation of reasonable and feasible noise mitigation is recommended and consultation with affected people encouraged.

For works during standard construction hours, the noise management level is background plus 10 dBA for residential locations. For works outside of normal construction hours, the noise management level is background plus 5 dBA.

Where construction would be undertaken during the night-time period the potential for sleep disturbance should be assessed. The current approach to identifying potential sleep disturbance impacts is to set a screening criterion 15 dB above the RBL during the night-time period (10.00pm to 7.00am). Therefore, sleep disturbance and awakening external noise level screening levels of RBL+15 dB and Lmax 65 dBA, whichever is most conservative (lowest) within each NCA, have been adopted.

The term ‘screening criterion’ indicates a noise level that is intended as a guide to identify the likelihood of sleep disturbance. It is not a firm criterion to be met, however where the criterion is met sleep disturbance is unlikely. When the screening criterion is not met, a more detailed analysis is required.

The detailed analysis should assess the maximum noise level or LA1 (one minute), the extent that the maximum noise level exceeds the background noise level and the number of times any exceedance occurs during the night-time period.

The RNP contains a section on sleep disturbance that includes a summary of current literature; concluding that:

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

6.3. Adopted project Noise Management Levels

Based on the daytime RBLs shown in Table 8, the residential NML for standard construction hours will be between 39 dBA and 49 dBA. As stated in the WSA EIS Section 11.4.2, for assessment of construction noise, a noise management level of 45 dBA may reasonably be adopted for all residential receptors. A noise management level of 40 dBA has been adopted for weekend works and early morning works (outside standard construction hours). Any exceedance in the noise levels will trigger the non-conformance process detailed in the CEMF Section 3.1.

The noise management levels set for all residential receptors are below criteria for construction at airports of 75 dBA outlined in Schedule 4 of the AEPR in Section 6.1.

6.4. Vibration criteria

The German Standard DIN 4150-3: Structural Vibration: Effects of Vibration on Structures is the most stringent vibration standard typically used to protect buildings from vibration damage. The standard recommends frequency-based vibration damage guideline values (DIN 41503) summarised in Table 6-1.

Table 6-1 Vibration damage guideline values (DIN41503)

Type of structure	Guideline value, peak particle velocity (mm/s)
Dwellings and buildings of similar design	5
Vibration sensitive buildings (heritage)	3

7. Noise and vibration aspects and impacts

7.1. SM - WSA Noise and vibration impacts from RCIZ

7.1.1. Construction Activities

Where receivers are close to construction sites or where the existing background noise levels are low (such as at the rural environments of Luddenham and Bringelly), the noise impacts during some of the works are expected to temporarily be 'high', particularly where noise intensive equipment such as concrete saws, concrete vibrators or hydraulic hammers are in use close to receivers.

Realistic worst-case and typical scenarios for noise emissions from construction have been assessed. The realistic worst-case scenarios include noisiest equipment working within the equipment work area, operating at 100 per cent duty for the 15 minute assessment period. The typical case scenarios include all equipment assessed as working within the equipment work area, operating over a proportion of the 15 minute assessment period based on the expected utilisation.

During construction, construction noise levels could significantly impact the closest receivers, during standard hours, with limited exceedances during out-of-hours works. These impacts include exceedance of noise management levels (NMLs), and potential sleep disturbance and awakening. Where exceedances have been predicted to occur during the worst case 15 minute periods (when all machinery is operating at full utilisation), these impacts are indicative of highest likely noise levels that may occur. Typical construction noise levels would be expected throughout most of the construction and would be lower than the worst case periods. There are predicted to be nine highly noise affected receivers within noise catchment area 12 (NCA12) during worst case for excavation and earthworks (Scenario 4).

The main potential sources of construction ground-borne noise and vibration are associated with the use of tunnel boring machines during tunnelling. The worse-case predicted ground-borne noise impacts are generally compliant with the management levels or result in only 'minor' impacts for most receivers. 'Moderate' or 'high' impacts are however predicted above the Western Sydney International to Bringelly tunnel either due to the tunnel being shallow at this location, or sensitive receivers being near the station shaft excavation works. However, these impacts will be transient at any individual receiver as tunnelling progresses.

There would also be minor construction or operational traffic noise impacts to receivers near a number of roads including but not limited to Badgerys Creek Road and The Northern Road. Many of the roads utilised by traffic associated with construction or operation of the project already exceed the noise criteria without the project due to existing traffic movements.

7.1.2. Representative construction scenarios

Construction activities have been classified into 9 noise generating scenarios in order to address the activities on site and their potential impact on the surrounding environment. These scenario descriptions are summarised below for on-airport works. The scenarios were developed to address construction of the Sydney Metro – Western Sydney Airport project as a whole and in some cases are not applicable to the proposed action. These instances are identified in Table 7-1 below.

Table 7-1 SM - WSA Noise generating scenarios

Scenario Code	Scenario	Description	Applicability
SC01	Enabling works	Key noise generating construction activities undertaken as part of the assessed preparatory activities scenario would include transport network adjustments to facilitate construction vehicle access and establishing construction compounds and work sites	High noise generating plant utilised as part of these activities include: use of dozers (~80 per cent utilisation per shift) during site establishment at the WSI tunnel portal and support sites.
SC02 -	Tunnelling and associated works	Key noise generating construction activities undertaken as part of the assessed tunnelling and associated works scenario would include: • Western Sydney International to Bringelly tunnel (tunnel boring machine (TBM) tunnels) and associated tunnel spoil handling (including haulage), including TBM tunnelling, excavation and demobilisation. • other techniques including the use of road-headers or excavators to excavate non-standard sections of tunnels including cross-passages and tunnel stubs. • tunnelling support activities (including tunnel section segment manufacture and storage, material handling and grout batching).	High noise generating plant utilised as part of these activities includes use of multiple hydraulic hammers (~30 per cent utilisation per shift) during station box excavation works at WSI tunnel portal, and the Airport Terminal.
SC03	Bridge and viaduct construction (viaduct segment casting)	Key noise generating construction activities undertaken as part of the assessed viaduct construction works scenario	High noise generating plant such as the use of concrete vibrators (~20 per cent utilisation per shift) during viaduct segment casting at the Airport construction support site.
SC04	Earthworks and excavation	Key noise generating construction activities undertaken as part of the assessed earthworks and excavation works scenario would include earthworks and/or excavation and station excavation.	High noise generating plant utilised as part of these activities include: use of hydraulic hammers (~30 per cent utilisation per shift) during station excavation works at the Airport Terminal and Airport Business Park sites.
SC05	Station construction	Key noise generating construction activities undertaken as part of the assessed station construction works scenario would include above ground structural works at the two airport stations such as support columns and foundations for vertical transport structures and the station buildings.	Station construction works at the Airport Terminal and Airport Business Park sites.

Scenario Code	Scenario	Description	Applicability
SC06	Construction of stabling and maintenance and other ancillary facilities	Not applicable to the proposed action.	N/A
SC07	Rail systems fitout	Key noise generating construction activities undertaken as part of the assessed rail systems fitout works scenario would include fitout of mechanical and electrical ventilation and track slab and rail fastening.	Track and ventilation fitout
SC08	Station fitout, precinct and transport integration works	Key noise generating construction activities undertaken as part of the assessed station fitout, precinct and transport integration works scenario would include architectural fitout of the stations.	Airport Terminal and Business Park Station fitouts
SC09	Finishing works	Key noise generating construction activities undertaken as part of the assessed finishing works scenario would include site reinstatement and rehabilitation carried out progressively during the works, including demobilising site compounds and facilities and removing materials, waste and redundant structures from the works sites.	High noise generating plant utilised as part of these activities include: use of hydraulic hammers (~30 per cent utilisation per shift) during site demobilisation works at WSI(including the Airport construction support site.

7.1.3. Airborne noise

The predicted noise levels for on-airport works show that no on-airport and off-airport sensitive receivers are predicted to experience noise levels that exceed the Airports Regulations specified noise limits. Limits outlined in the Airports Regulations align with highly noise affected NMLs (applicable during standard hours) as outlined in the ICNG. No receivers have been identified as highly noise affected within Western Sydney International.

The predicted noise levels for each of the nine construction work scenarios for on-airport works is presented in Section 4.3.4 and Appendix B.3 of Technical Paper 2 (Noise and vibration) of the SM WSA EIS. Maps showing the predicted noise level for residential receivers for on-airport works within the study area are presented in Appendix B of Technical Paper 2 (Noise and vibration).

Table 7-2 outlines the highest noise level experienced at a residential receiver in each NCA based on ICNG levels for on-airport construction works. NCA10 is located north of the airport site, NCA11 includes the airport site and areas immediately to the east and west and NCA12 is predominantly located south of the airport site. NCA10 and NCA12 are considered in this section as receivers are adjacent to the Western Sydney International and may be impacted by on-airport works.

The predicted noise levels are representative of the ‘typical’ expected noise levels. The predicted noise levels representative of the ‘worst case’ expected noise levels are presented in brackets in Table 7-2.

	Period	NML	Highest predicted noise level (dB)								
			SC01	SC02	SC03	SC04	SC05	SC06	SC07	SC08	SC09
NCA10 – (378 noise sensitive receivers assessed)	SH	45	54 (59)	57 (62)	54 (59)	63 (68)	53 (60)	50 (57)	50 (57)	47 (51)	58 (63)
	OOH - D	40	N/A	54 (59)	54 (59)	N/A	N/A	N/A	47 (50)	N/A	40 (49)
	OOH - E	35	N/A	54 (59)	54 (59)	N/A	N/A	N/A	47 (50)	N/A	40 (49)
	OOH - N	35	N/A	54 (59)	54 (59)	N/A	N/A	N/A	47 (50)	N/A	40 (49)
NCA11 – (68 noise sensitive receivers assessed)	SH	49	59 (62)	62 (67)	61 (66)	64 (69)	53 (60)	57 (64)	49 (55)	46 (51)	64 (67)
	OOH - D	44	N/A	61 (66)	61 (66)	N/A	N/A	N/A	48 (53)	N/A	45 (50)
	OOH - E	42	N/A	61 (66)	61 (66)	N/A	N/A	N/A	48 (53)	N/A	45 (50)
	OOH - N	35	N/A	61 (66)	61 (66)	N/A	N/A	N/A	48 (53)	N/A	45 (50)
NCA12 - (396 noise sensitive receivers assessed)	SH	48	59 (62)	56 (61)	N/A	57 (63)	51 (58)	N/A	48 (53)	45 (49)	45 (51)
	OOH - D	43	N/A	60 (64)	N/A	N/A	N/A	N/A	48 (53)	N/A	45 (50)
	OOH - E	40	N/A	60 (64)	N/A	N/A	N/A	N/A	48 (53)	N/A	45 (50)
	OOH - N	39	N/A	60 (64)	N/A	N/A	N/A	N/A	48 (53)	N/A	45 (50)

Table 7-2 Number of residential receives exceeding ICNG NMLs for on-airport works- typical and (worst case)

Notes:

ICNG standard hours includes Monday to Friday 7am to 6pm and Saturday 80am to 1pm, Out of Hours Day any time within 1pm to 6pm Saturday and 8am to 6pm Sunday, and outside standard hours, Out of Hours – Evening any time from 6pm to 10pm & Out of Hours – Night at all other times

Shaded cells indicate an exceedance of NMLs between 0 and 10 dB for typical construction works; Orange cells indicate an exceedance of NMLs between 10 and 20 dB for typical construction works; Red cells indicate an exceedance of NMLs >20dB for typical construction works;

Results in brackets indicate noise level predictions assuming full utilisation of plant (i.e. realistic worst case) N/A refers to no works for that scenario within that NCA.

7.1.4. Ground-borne noise and vibration

Assessment of ground-borne noise and vibration due to tunnelling on Western Sydney International has been undertaken for all sensitive receivers that are located within 300 metres of the tunnel alignment. The assessment has shown that ground-borne noise from tunnelling (associated with the operation of TBMs, road headers and rock breakers) can meet the most stringent ICNG residential night time targets at a separation distance of around 40 metres from the tunnel, and vibration targets can be achieved at a separation distance of around 30 metres from the tunnel.

During construction, there are two sensitive receivers within the Western Sydney International; the Airport Experience Centre and Western Sydney Airport site offices. Both receivers are well removed from the tunnel alignment and will not be adversely affected by ground-borne noise and vibration. The section of the metro alignment between Elizabeth Drive and the Western Sydney International tunnel portal will be at surface level and therefore construction ground-borne noise is not an issue for this part of the alignment. Vibration targets for this surface section of the alignment can be met within 50 metres (to avoid cosmetic damage to residential building structures) and 100 metres (for human comfort), for the most vibration intensive plant anticipated during construction (large vibratory rollers). The two sensitive receivers are both located well outside these separation distances, and therefore construction vibration is also not considered to be an issue.

For construction of the Western Sydney International to Bringelly tunnel located to south east of Western Sydney International only four receivers are predicted to experience exceedances of the relevant ground-borne noise targets during the worst case night time period. Two of these receivers are located on Derwent Road over 400 metres from the airport site and the other two receivers are located immediately east of Badgerys Creek Road over one kilometre from the airport site. In both cases the receivers are located where the tunnel intersects those roads. The exceedances would occur for a limited duration (up to three to four days) as the TBMs progress at a rate of around 100 metres per week. These exceedances are associated with tunnelling works occurring in the immediate vicinity of these receivers and outside of the Western Sydney International site.

Therefore, no impacts on sensitive receivers are anticipated from ground-borne noise and vibration associated with tunnelling within the Western Sydney International site.

7.1.5. Construction traffic noise SM - WSA On-Airport outside Stage 1

Construction related vehicle movements have the potential to generate noise impacts at the nearest sensitive receivers over the duration of the construction program. Roads potentially impacted by such movements during construction of the project are classified as sub-arterial and arterial roads, as defined by the Road Noise Policy (RNP) and discussed in Section 4.1.4 (SMWSA Technical Paper 2:N&V).

A high-level assessment of construction road traffic noise impacts has been conducted for this assessment. The following assumptions were made:

- Construction traffic on public roads, including staff vehicle and truck movements associated with haulage, has been modelled.

To support the day shift:

- 50 percent of staff arriving before 7am (during the night shift) and 50 percent arriving after (during the day shift)

- all staff leaving before 10pm (during the day shift)
- 25 percent of staff movements throughout the day (for lunch, meetings, etc).

To support the night shift:

- 100 percent of staff arriving before 10pm (during the day shift)
- all staff finishing on-site and leaving before 7am (during the night shift)
- 10 percent of staff movements throughout the night (for meals, meetings, etc).

The assessment indicates that construction road traffic noise levels are not predicted to exceed relevant RNP noise criteria at the majority of project affected roads. Based on the assessment, it is considered that no additional noise mitigation or management measures are required at these locations.

7.1.6. Construction vibration SM - WSA On-Airport outside Stage 1

Vibration will be generated by specific construction plant as part of the construction works. In the absence of an applicable Australian Standard, the most stringent vibration standard, the German Standard DIN 4150- 3:1999 was used to assess building vibration damage. A lower guideline value applying to vibration sensitive buildings of 3 mm/s was adopted as a threshold of damage from construction vibration.

Vibration during construction may be generated by the ripping of rock; however, the 3 mm/s guideline value is not expected to be exceeded therefore there is no risk of damage outside the airport boundary.

Attended vibration monitoring or vibration trials will be undertaken when proposed works are within the safe working distances to ensure that levels remain below the criterion. Building condition surveys will also be completed both before and after the works at any potentially affected properties to identify existing damage and any proposal related damage.

7.2. Cumulative impacts

Sydney Metro's ongoing works will include the delivery of an increasing number of concurrent works packages. Accordingly, and with respect to noise and vibration, it is necessary to consider the cumulative impact of interfacing construction packages to ensure that effective mitigation measures are identified and implemented.

To achieve this, Sydney Metro will facilitate regular cross package planning meetings to identify potential noisy works with a focus on proposed Out of Hours activities or works where two or more work packages are located close to a receptor. The purpose of these forums will be to identify when and where concurrent Out of Hours works or high-risk works will occur such that the cumulative impact of these works can be appropriately mitigated and where possible avoided.

These mitigation measures may include:

- Selection of alternate methods or machinery
- Targeted community consultation
- Respite periods (refer to Figure 8-11)
- Alternating OOHW programs between packages

- Attended monitoring to allow real time assessment of noise impacts and targeted mitigation.

The Sydney Metro Out of Hours Work Permit prescribes that Permit applicants must consider the nature and timing of interfacing works and discuss with Sydney Metro accordingly. This permit also allows for focussed attended noise monitoring at source and receivers to be a condition of permit approval.

A targeted Sydney Metro and Contractor inspection program will also be scheduled to assess the effectiveness of controls and the potential need to increase or augment mitigations measures to manage potential cumulative impacts. A separate Cumulative Impact Plan (CIP) will be developed to allow for effective planning and management of noise and vibration from rail and airport construction activities.

For Sydney Metro works, a separate Cumulative Impact Plan (CIP) has been developed to allow for effective planning and management of noise and vibration impacts from rail and airport construction activities. Refer to the CIP (WSA00-WSA-00400-EN-PLN-000013) for more details.

7.3. Risk assessment

A risk assessment has been undertaken as part of the WSA review and development of this CEMP and in accordance with Environmental Aspects, Impact and Risk Procedure (Chapter 26 of the WSA EIS). The parts of the overall risk assessment relevant to Noise and Vibration have been extracted and summarised in Table 7-3 and applies to all phases of works that the Construction (Rail) Plan authorises.

The identification of construction activities and associated impacts that could eventuate during construction of the Project is central to the selection of appropriate environmental safeguards.

The risk management process involved an assessment of all specific Project activities/aspects in or near environmentally sensitive areas and resulted in the development of a list of environmental risks (effects and impacts) and a corresponding risk mitigation strategy and risk ranking.

The identification of risks included a review of the works, and review of the environmental risks identified by the WSA EIS. The mitigations in the risk assessment are in line with the WSA EIS mitigation measures.

7.3.1. Risk Assessment process

The following tables outline the risk assessment process using 3 steps to identify the appropriate management measures required.
Table 7-3 is used to determine the likelihood that the aspect will have an impact on the environment. Table 7-4 is used to determine the potential consequence rating of the risk identified.
From these two tables, a risk rating can then be assigned using Figure 7-1 to determine the potential severity of the risk and the appropriate management response as per Table 7-6.

Table 7-3 Likelihood descriptor

Rating	Likelihood	Description
A	Rare / improbable	• The event may only occur in exceptional circumstances.
B	Unlikely / remote	• The event may occur at some time (about once every five years).

C	Possible	• The event is likely to occur at some time (about once every year).
D	Likely	• The event will probably occur in most circumstances (at least once every six months).
E	Almost certain	• The event is expected to occur in most circumstances (at least once every month).

Table 6-4 Consequence descriptor

Rating	Consequence (impact)	Description
1	Insignificant/ Negligible (1-3)	• Short-term disturbance with minor environmental release or damage that is non-repo • No impact outside site boundary. • No community complaints or media reports.
2	Minor/low (4-10)	• Minor violation of regulation or guideline with minimal damage to the environment an • Immediately contained on site. • Local government action, minor community complaints. • Potential or actual breach of legislation.
3	Moderate (11-15)	• Violation of regulation or guideline with moderate temporary damage to the environm • Release of pollution off site. • Detrimental media reports, community concerns and complaints.
4	Major / High (16-22)	• Major environmental damage with potentially permanent consequences. • Release of pollution off site. Significant loss of environmental resources. • Detrimental media reports in the national or state media, organised community conce • High likelihood of fine or court action.
5	Catastrophic / Priority (23-25)	• Long-term environmental harm. • Permanent irreparable damage to the environment. • Sustained detrimental state and national media reports. Sustained community outrag • Penalty Infringement Notice/court action.

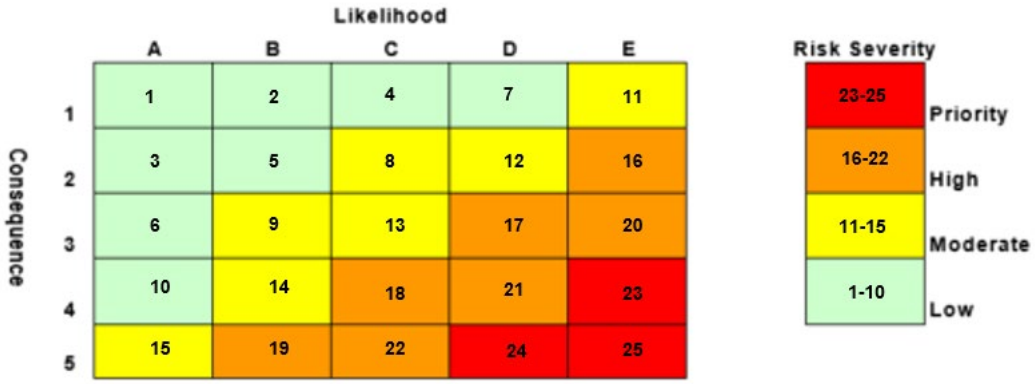


Figure 7-1 Risk severity ranking

Table 7-5 Risk severity and management response

Risk severity	Management response
Priority	• Immediate and detailed management action required. (e.g. stop or change activity)
High	• Priority management action warranted
Moderate	• Management action warranted
Low	• Management action should be considered, particularly for low-level impacts that nevertheless occur on a continual basis

Table 7-6 Noise and vibration risk assessment

Ref	Activity	Construction Aspect	Environmental Aspect	Potential Impact	Risk level [2] pre-mitigation	Mitigation measure [1]	Risk level [2] post-mitigation	Management tools
01	Use of site compound / installation of pre-fabricated structures	Earthworks to construct compound footprint	Noise generation	Community disturbance	Med (13)	NV01 NV07 NV09 NV11 NV15 NV28	Low (9)	• Noise and Vibration CEMP • Soil and Water CEMP • Biodiversity CEMP • EWMS • Induction • Environmental Control Map (ECM) • Complaints Procedure Community and Stakeholder Engagement Plan
02	Use of site compound / installation of pre-fabricated structures	Construction of compound buildings, parking and amenities	Noise generation	Community disturbance	Med (13)	NV01 NV03 NV04 NV05 NV07 NV09 NV15 NV18 NV28	Low (9)	• Noise and Vibration CEMP • Biodiversity CEMP • EWMS • Soil and Water CEMP • Induction • Environmental Control Map (ECM) • Complaints Procedure Community and Stakeholder Engagement Plan

Ref	Activity	Construction Aspect	Environmental Aspect	Potential Impact	Risk level [2] pre-mitigation	Mitigation measure [1]	Risk level [2] post-mitigation	Management tools
03	Use of site compound / installation of pre-fabricated structures	Compaction of materials	Vibration	Community disturbance and building damage	Med (13)	NV01 NV07 NV09 NV15 NV18 NV19 NV28	Low (9)	• Noise and Vibration CEMP • EWMS • Soil and Water CEMP • Induction • Environmental Control Map (ECM) • Complaints Procedure • Community and Stakeholder Engagement Plan
04	Use of site compound / installation of pre-fabricated structures	Delivery of materials to compound	Noise generation	Community and local road disturbance	Med (18)	NV01 NV07 NV10 NV16 NV17 NV20	Med (14)	• Noise and Vibration CEMP • Biodiversity CEMP • Traffic and Access CEMP • EWMS • Soil and Water CEMP • Induction • Environmental Control Map (ECM) • Complaints Procedure Community and Stakeholder Engagement Plan

Ref	Activity	Construction Aspect	Environmental Aspect	Potential Impact	Risk level [2] pre-mitigation	Mitigation measure [1]	Risk level [2] post-mitigation	Management tools
05	Use of site compound / installation of pre-fabricated structures	Operation of site compound	Noise generation	Community and local road disturbance	High (22)	NV01 NV02 NV06 NV07 NV21 NV25 NV28	Med (15)	• Noise and Vibration CEMP • Biodiversity CEMP • EWMS • Soil and Water CEMP • Induction • Environmental Control Map (ECM) • Complaints Procedure Community and Stakeholder Engagement Plan
07	Utility works	Potholing and trenching	Noise generation	Community and local road disturbance	Low (9)	NV01 NV07 NV15 NV18 NV28	Low (6)	• Noise and Vibration CEMP • Biodiversity CEMP • EWMS • Soil and Water CEMP • Induction • Environmental Control Map (ECM) • Complaints Procedure • Community and Stakeholder Engagement Plan

Ref	Activity	Construction Aspect	Environmental Aspect	Potential Impact	Risk level [2] pre-mitigation	Mitigation measure [1]	Risk level [2] post-mitigation	Management tools
08	Earthworks	Topsoil stripping	Noise generation	Community disturbance	Med (13)	NV01 NV07 NV09 NV11 NV14 NV15 NV18 NV19 NV28	Low (9)	• Noise and Vibration CEMP • Biodiversity CEMP • EWMS • Soil and Water CEMP • Induction • Environmental Control Map (ECM) • Complaints Procedure • Community and Stakeholder Engagement Plan
09	Earthworks	Vegetation clearing	Noise generation	Community disturbance	Med (18)	NV01 NV07 NV09 NV11 NV14 NV15 NV18 NV19 NV28	Low (99)	• Noise and Vibration CEMP • Biodiversity CEMP • EWMS • Soil and Water CEMP • Induction • Environmental Control Map (ECM) • Complaints Procedure • Community and Stakeholder Engagement Plan

Ref	Activity	Construction Aspect	Environmental Aspect	Potential Impact	Risk level [2] pre-mitigation	Mitigation measure [1]	Risk level [2] post-mitigation	Management tools
10	Earthworks	Embankment creation and stabilisation	Noise generation	Community disturbance	Med (18)	NV01 NV07 NV09 NV11 NV14 NV15 NV18 NV19 NV28	Med (14)	• Noise and Vibration CEMP • Biodiversity CEMP • EWMS • Soil and Water CEMP • Induction • Environmental Control Map (ECM) • Complaints Procedure • Community and Stakeholder Engagement Plan
11	Earthworks	Compaction of materials	Vibration	Community disturbance and building damage	Med (14)	NV01 NV07 NV09 NV11 NV14 NV15 NV18 NV19 NV28	Low (10)	• Noise and Vibration CEMP • Biodiversity CEMP • EWMS • Soil and Water CEMP • Induction • Environmental Control Map (ECM) • Complaints Procedure • Community and Stakeholder Engagement Plan

Ref	Activity	Construction Aspect	Environmental Aspect	Potential Impact	Risk level [2] pre-mitigation	Mitigation measure [1]	Risk level [2] post-mitigation	Management tools
12	Earthworks	Material stockpiling	Noise generation	Community disturbance	High (19)	NV01 NV07 NV09 NV10 NV11 NV14 NV15 NV17 NV18 NV19 NV28	Med (15)	• Noise and Vibration CEMP • Biodiversity CEMP • EWMS Soil and Water CEMP • Induction • Environmental Control Map (ECM) • Complaints Procedure • Community and Stakeholder Engagement Plan
13	Earthworks	Import and export of materials from site	Noise generation	Community and local road disturbance	Med (14)	NV01 NV07 NV10 NV11 NV16 NV17 NV20 NV28	Med (15)	• Noise and Vibration CEMP • Biodiversity CEMP • EWMS • Soil and Water CEMP • Induction • Environmental Control Map (ECM) • Complaints Procedure • Community and Stakeholder Engagement Plan

Ref	Activity	Construction Aspect	Environmental Aspect	Potential Impact	Risk level [2] pre-mitigation	Mitigation measure [1]	Risk level [2] post-mitigation	Management tools
14	Culvert construction	Culvert excavation	Noise generation	Community disturbance	Med (14)	NV01 NV07 NV09 NV11 NV15 NV18 NV19 NV28	Low (10)	• Noise and Vibration CEMP • Biodiversity CEMP • EWMS • Soil and Water CEMP • Induction Environmental Control Map (ECM) • Complaints Procedure • Community and Stakeholder Engagement Plan
15	Culvert construction	Culvert compaction	Vibration	Community disturbance	Low (9)	NV01 NV07 NV09 NV11 NV15 NV18 NV19 NV28	Low (6)	• Noise and Vibration CEMP • Biodiversity CEMP • EWMS • Soil and Water CEMP • Induction • Environmental Control Map (ECM) • Complaints Procedure • Community and Stakeholder Engagement Plan

Ref	Activity	Construction Aspect	Environmental Aspect	Potential Impact	Risk level [2] pre-mitigation	Mitigation measure [1]	Risk level [2] post-mitigation	Management tools
16	Bridge construction	Bridge piling	Noise and Vibration	Community disturbance	Low (9)	NV01 NV07 NV09 NV11 NV15 NV18 NV28	Low (6)	• Noise and Vibration CEMP • Biodiversity CEMP • EWMS • Soil and Water CEMP • Induction • Environmental Control Map (ECM) • Complaints Procedure • Community and Stakeholder Engagement Plan
17	Bridge construction	Bridge compaction	Vibration	Community disturbance	Low (9)	NV01 NV07 NV09 NV11 NV15 NV18 NV28	Low (6)	• Noise and Vibration CEMP • Biodiversity CEMP • EWMS • Soil and Water CEMP • Induction • Environmental Control Map (ECM) • Complaints Procedure • Community and Stakeholder Engagement Plan
18	Bridge construction	Steel and concrete cutting	Noise generation	Community disturbance	Low (9)	NV01 NV07 NV08 NV09 NV11 NV15 NV18	Low (6)	• Noise and Vibration CEMP • Biodiversity CEMP • EWMS • Soil and Water CEMP • Induction • Environmental Control Map (ECM)

Ref	Activity	Construction Aspect	Environmental Aspect	Potential Impact	Risk level [2] pre-mitigation	Mitigation measure [1]	Risk level [2] post-mitigation	Management tools
						NV22 NV28		• Complaints Procedure • Community and Stakeholder Engagement Plan
19	Road construction	Milling and excavation of road surface	Noise generation	Community disturbance	High (21)	NV01 NV07 NV08 NV09 NV11 NV14 NV15 NV18 NV19 NV28	Med (18)	• Noise and Vibration CEMP • Biodiversity CEMP • EWMS • Soil and Water CEMP • Induction • Environmental Control Map (ECM) • Complaints Procedure • Community and Stakeholder Engagement Plan
20	Road construction	Compacting materials	Vibration	Community disturbance	Med (13)	NV01 NV07 NV09 NV15 NV18 NV19 NV28	Low (6)	• Noise and Vibration CEMP • Biodiversity CEMP • EWMS • Soil and Water CEMP • Induction • Environmental Control Map (ECM) • Complaints Procedure • Community and Stakeholder Engagement Plan
21	Out of hours works	Works on site border closest to residents	Noise generation	Disturbance to sensitive receivers on Overett Avenue, Kemps Ck, Eaton Road	Med (17)	NV01 NV06 NV09 NV10 NV11 NV12	Med (13)	• Noise and Vibration CEMP • EWMS • Induction • Environmental Control Map (ECM)

Ref	Activity	Construction Aspect	Environmental Aspect	Potential Impact	Risk level [2] pre-mitigation	Mitigation measure [1]	Risk level [2] post-mitigation	Management tools
						NV13 NV15 NV16 NV17 NV18 NV20 NV21 NV22 NV23 NV25 NV26		• Complaints Procedure • Community and Stakeholder Engagement Plan
22	Out of hours works	General works	Noise generation	Disturbance to sensitive receivers in Adams Rd, Luddenham	Med (17)	NV01 NV06 NV09 NV10 NV11 NV12 NV13 NV15 NV16 NV17 NV18 NV20 NV21 NV22 NV23 NV25 NV26 NV27 NV28	Med (13)	• Noise and Vibration CEMP • EWMS • Induction Environmental Control Map (ECM) • Complaints Procedure • Community and Stakeholder Engagement Plan

Ref	Activity	Construction Aspect	Environmental Aspect	Potential Impact	Risk level [2] pre-mitigation	Mitigation measure [1]	Risk level [2] post-mitigation	Management tools
23	Out of hours works	General works	Noise generation	Disturbance to sensitive receivers on Badgerys Rd South and Eaton Road.	Med (17)	NV01 NV06 NV09 NV10 NV11 NV12 NV13 NV15 NV16 NV17 NV18 NV20 NV21 NV22 NV23 NV25 NV26 NV27 NV28	Med (13)	• Noise and Vibration CEMP • Soil and Water CEMP • EWMS • Induction • Environmental Control Map (ECM) • Complaints Procedure • Community and Stakeholder Engagement Plan
24	Out of hours works	Road closures	Noise generation	Community and local road disturbance	Med (17)	NV01 NV07 NV09 NV11 NV12 NV15 NV21 NV22 NV23 NV24 NV25	Med (13)	• Noise and Vibration CEMP • Biodiversity CEMP • EWMS • Soil and Water CEMP • Induction • Environmental Control Map (ECM) • Complaints Procedure • Community and Stakeholder Engagement Plan

Ref	Activity	Construction Aspect	Environmental Aspect	Potential Impact	Risk level [2] pre-mitigation	Mitigation measure [1]	Risk level [2] post-mitigation	Management tools
						NV26 NV27 NV28		
25	Out of hours works	Excavation	Noise generation	Community and local road disturbance	Med (17)	NV01 NV07 NV09 NV11 NV12 NV13 NV14 NV15 NV18 NV19 NV28	Med (13)	• Noise and Vibration CEMP • Biodiversity CEMP • EWMS • Soil and Water CEMP • Induction • Environmental Control Map (ECM) • Complaints Procedure • Community and Stakeholder Engagement Plan
26	Out of hours works	Compaction	Vibration	Damage to residential structures	Med (13)	NV01 NV07 NV09 NV11 NV15 NV18 NV19 NV28	Low (9)	• Noise and Vibration CEMP • Biodiversity CEMP • EWMS • Soil and Water CEMP • Induction • Environmental Control Map (ECM) • Complaints Procedure • Community and Stakeholder Engagement Plan
27	Dewatering	Using diesel pumps	Noise generation	Community disturbance	Med (13)	NV01 NV07 NV09 NV11 NV15	Low (9)	• Noise and Vibration CEMP • Biodiversity CEMP • EWMS

Ref	Activity	Construction Aspect	Environmental Aspect	Potential Impact	Risk level [2] pre-mitigation	Mitigation measure [1]	Risk level [2] post-mitigation	Management tools
						NV21 NV28		• Soil and Water CEMP • Induction • Environmental Control Map (ECM) • Complaints Procedure • Community and Stakeholder Engagement Plan
28	Rail Construction from Elizabeth Drive to Portal	Construction of the rail alignment	Noise generation and vibration	Community disturbance	Med (13)	NV01 NV07 NV09 NV11 NV15 NV21 NV28	Low (9)	• Noise and Vibration CEMP • Biodiversity CEMP • EWMS • Soil and Water CEMP • Induction • Environmental Control Map (ECM) • Complaints Procedure • Community and Stakeholder Engagement Plan
29	Tunnelling and associated works	Construction of the rail alignment	Noise generation and vibration	Community disturbance	Med (13)	NV01 NV07 NV09 NV11 NV15 NV21 NV28	Med (13)	• Noise and Vibration CEMP • Biodiversity CEMP • EWMS • Soil and Water CEMP • Induction • Environmental Control Map (ECM) • Complaints Procedure • Community and Stakeholder Engagement Plan

Ref	Activity	Construction Aspect	Environmental Aspect	Potential Impact	Risk level [2] pre-mitigation	Mitigation measure [1]	Risk level [2] post-mitigation	Management tools
30	Tunnelling and associated works	Tunnel Boring Machine (TBM) launch Cross Passage Works Stub Tunnel Excavation	Noise generation and vibration	Community disturbance and possible impact to buildings depending on launch location)	Med	NV01 NV07 NV09 NV11 NV15 NV21 NV28	Med	• Noise and Vibration CEMP • Biodiversity CEMP • EWMS • Soil and Water CEMP • Induction • Environmental Control Map (ECM) • Complaints Procedure • Community and Stakeholder Engagement Plan
31	Tunnelling and associated works	Construction of tunnel portal	Noise generation and vibration	Community disturbance and possible impact to buildings depending on launch location)	Med	NV01 NV07 NV09 NV11 NV15 NV21 NV28	Low	• Noise and Vibration CEMP • Biodiversity CEMP • EWMS • Soil and Water CEMP • Induction • Environmental Control Map (ECM) • Complaints Procedure • Community and Stakeholder Engagement Plan
32	Rail Corridor and associated works	construction of bored pile wall or similar construction	Noise generation	Community disturbance	Low	NV01 NV07 NV09 NV11 NV15 NV21 NV28	Low	• Noise and Vibration CEMP • Biodiversity CEMP • EWMS • Soil and Water CEMP • Induction • Environmental Control Map (ECM)

Ref	Activity	Construction Aspect	Environmental Aspect	Potential Impact	Risk level [2] pre-mitigation	Mitigation measure [1]	Risk level [2] post-mitigation	Management tools
								• Complaints Procedure • Community and Stakeholder Engagement Plan
33	Stations and associated works, rail systems fitout	Track slab and rail fastening	Noise generation	Community disturbance	Low	NV01 NV07 NV09 NV11 NV15 NV21 NV28	Low	• Noise and Vibration CEMP • Biodiversity CEMP • EWMS • Soil and Water CEMP • Induction • Environmental Control Map (ECM) • Complaints Procedure • Community and Stakeholder Engagement Plan
34	Stations and associated works, rail systems fitout	Rail track installation, fixing and welding	Noise generation	Community disturbance	Low	NV01 NV07 NV09 NV11 NV15 NV21 NV28	Low	• Noise and Vibration CEMP • Biodiversity CEMP • EWMS • Soil and Water CEMP • Induction • Environmental Control Map (ECM) • Complaints Procedure • Community and Stakeholder Engagement Plan
35	Activities required for tunnel and viaduct segment manufacture and storage and	Construction and operation of pre cast facilities	Noise generation	Community disturbance	Low	NV01 NV07 NV09 NV11 NV15	Low	• Noise and Vibration CEMP • Biodiversity CEMP • EWMS • Soil and Water CEMP

Ref	Activity	Construction Aspect	Environmental Aspect	Potential Impact	Risk level [2] pre-mitigation	Mitigation measure [1]	Risk level [2] post-mitigation	Management tools
	temporary haulage roads					NV21 NV28		• Induction • Environmental Control Map (ECM) • Complaints Procedure • Community and Stakeholder Engagement Plan

1 Refer to Table 7-1 for mitigation measures and controls
2 Derived from risk assessment process detailed in the SEMF Appendix G

8. Construction noise and vibration assessment

In order to quantify noise emissions and associated noise impact from the construction activities associated with the proposed Airport and Project, noise modelling will be carried out for works comprising key phases of the development as described in Section 2. The SM CNVS outlines construction noise and vibration assessment standards required as a minimum across all Metro projects.

The noise predictions will be used to determine potential construction noise impacts on the surrounding community. An adaptive management approach will be applied to the implementation of mitigation measures to minimise impacts on the community.

Where required, guidance around modelling requirements/assumptions (as set out in Section 8.1) will be given to Contractors to ensure a consistent approach to assessing noise impacts and industry standard modelling will be required. However, it is likely that different modelling software and therefore different outputs will be used and generated for the construction activities for the proposed Project.

The construction noise guideline level of 75 dB(A) in the Airports (Environment Protection) Regulations 1997 is based on the sound pressure level that is exceeded for 10 per cent of a period of at least 15 minutes (LA10), adjusted to consider of tonal character and impulsive (if any) of the noise. Given the predicted noise levels, based on the LAeq (equivalent continuous sound level), the construction noise guideline of 75dB(A) LA10 is unlikely to be exceeded. A range of mitigation and management measures listed in Section 9 will be adopted to mitigate disturbance to nearby receptors.

Modelling of noise levels at nearby receivers resulting from construction activities should consider the following:

- Aim to predict LAeq(15 minute) noise level
- Consider typical-worst case construction noise levels based on locations of work and sound power levels (SWL) of the expected construction activities within each zone or work area.
- Consider the following:
    - Attenuation of noise source due to distance;
    - Barrier effects from buildings, and other man-made and topographical features;
    - Air absorption;
    - Ground effects; and
    - Meteorological conditions.

In order to determine worst-case predictions, the following assumptions should be applied:

- The construction works are occurring at the nearest point to each receiver and that the receiver is located at the most exposed position;
- The noisiest construction sources are operating simultaneously and continuously for the entire 15- minute period. Note, this may not always occur as equipment will regularly be stood down or idled while other activities are undertaken; and

- A worst-case meteorological Category 6 will be assumed, where the receiver is downwind of the source and the wind speed is >3 m/s.

8.1. Noise modelling inputs and parameters

A noise model was prepared for the assessment of airborne noise using the SoundPlan V8.2 Industrial Module implementing the Propagation of Noise From Petroleum And Petrochemical Complexes To Neighbouring Communities (CONCAWE, 1981) calculation method.

A three-dimensional representation of the physical environment within the study area was developed. Modelling inputs for each scenario included topography, ground and air absorption, locations of sensitive receivers, noise-generating equipment and buildings surrounding the project.

The following assumptions were used in the modelling:

- all outdoor noise sources modelled at two metres above surface level
- topography for the area has been sourced from NSW Spatial Services at one metre contours
- receiver heights 1.5 metres above ground level, or at the most affected storey
- noise enhancing meteorological conditions, with stability category F and 2 m/s source-to-receiver winds.

Realistic worst case and typical scenarios for noise emissions from construction have been assessed as follows:

- realistic worst case – noisiest equipment are assessed as working within the equipment work area, operating at 100% duty for the 15 minute assessment period
- typical case – all equipment are assessed as working within the equipment work area, operating over a proportion of the 15 minute assessment period based on the expected utilisation.

8.2. Modelled noise source levels

Sound power levels have been sourced from the following documents (note that these have been listed in order of priority):

- Sydney Metro Construction Noise and Vibration Standard (CNVS)
- Australian Standard AS 2436:2010 – Guide to noise and vibration control on construction, demolition and maintenance sites
- Department for Environment, Food and Rural Affairs (United Kingdom), Update of noise database for prediction of noise on construction and open sites – Phase 3: Noise measurement data for construction plant used on quarries (DEFRA noise database)
- consultant data sourced from similar projects.

The nominated equipment for the construction work scenarios and the SWL of each item, and the number of plant items and assumed utilisation for each activity that comprises the assessed scenarios are presented in Appendix B.2 of the SM - WSA EIS (Tech Paper 2 – Noise and Vibration).

8.3. Overview of predicted noise levels (on-airport works)

Construction noise levels were predicted for all on-airport works for each of nine construction work scenarios as outlined in Section 4.3.4 and presented in Appendix B.3 of the SM - WSA EIS (Tech Paper 2 – Noise and Vibration):

- Enabling works
- Tunnelling and associated works
- Earthworks and excavation
- Station construction
- Construction of stabling and maintenance and other ancillary facilities (off-airport)
- Rail systems fitout
- Station fitout, precinct and transport integration works
- Finishing works

No sensitive receivers (located within or in areas immediately adjacent to the airport site) are predicted to experience exceedances of the Airports Regulations specified noise limits.

Limits outlined in Airports Regulations generally align with highly noise affected NMLs (applicable during standard hours) as outlined in the ICNG. The ICNG NMLs could be considered for assessment of impacts during the evening and night periods to gauge community response to on-airport construction noise during these periods. Table 8-1 outlines the outlines the highest noise level experienced at a residential receiver in each NCA for each activity based on ICNG levels for on-airport construction works. No receivers have been identified as highly noise affected (receivers that experience noise levels of greater than 75 dB during standard hours), including the Western Sydney Airport Experience Centre and construction site office.

The predicted noise levels are representative of the ‘typical’ expected noise levels. The predicted noise levels representative of the ‘worst case’ expected noise levels are presented in brackets in Table 8-1.

The noise model includes a conservative list of plant and equipment, as it includes all of the possible construction equipment that may be used during construction, and is therefore considered to represent conservative construction noise impacts. Should the project receive approval, as detailed construction planning continues construction-related noise and vibration impacts and mitigation would be managed in accordance with the CNVS.

During standard hours, NCA10 to NCA12 are predicted to experience exceedances of NMLs during construction work scenarios, with the exception of bridge and viaduct works, and construction of ancillary facilities (Scenarios 3 and 6) in NCA12. During out-of-hours works, exceedances of NMLs and sleep disturbance and awakening screening levels are predicted to occur during tunnelling and associated works, bridge and viaduct works, rail systems fitout works, and station fitout works (Scenarios 2, 3, 7, and 8) at all NCAs, with the exception of bridge and viaduct works in NCA12.

Exceedances within each NCA are predominantly located in the following areas:

- NCA10: receivers located to the north of the airport site along Elizabeth Drive
- NCA11: receivers located to the east of the airport site along Lawson Road
- NCA12: receivers located to the south of the airport site along Badgerys Creek Road, Derwent Road and the northern end of Mersey Road.

The construction noise impacts predicted for receivers in NCA10, 11 and 12 are based on the construction works which are proposed within the airport site. They do not consider the cumulative noise impacts potentially arising from construction works occurring both on-airport and off-airport at the same time.

A limited number of receivers located in areas proximate to the airport site boundary may be potentially impacted by cumulative noise levels associated with both on-airport and off-airport construction works. In most cases the cumulative noise impact experienced at these receivers will be equivalent to the highest construction noise level in each area, or in worst case scenarios up to 3dBA higher than the highest noise level. Only a small number of receivers are likely to experience these cumulative impacts and for limited periods of time when the highest noise generating construction activities in each area are occurring simultaneously.

Table 8-1 Number of residential receivers exceeding ICNG NMLs for on-airport works – typical and (worst case)

NCA	Period	NML	Highest predicted noise level (dB)								
			SC01	SC02	SC03	SC04	SC05	SC06	SC07	SC08	SC09
NCA10 (378 noise sensitive recievers assessed)	SH	45	54 (59)	57 (62)	54 (59)	63 (68)	53 (60)	50 (57)	50 (57)	47 (51)	58 (63)
	OOH - D	40	N/A	54 (59)	54 (59)	N/A	N/A	N/A	47 (50)	N/A	40 (49)
	OOH - E	35	N/A	54 (59)	54 (59)	N/A	N/A	N/A	47 (50)	N/A	40 (49)
	OOH - N	35	N/A	54 (59)	54 (59)	N/A	N/A	N/A	47 (50)	N/A	40 (49)
NCA11 (68 noise sensitive recievers assessed)	SH	49	59 (62)	62 (67)	61 (66)	64 (69)	53 (60)	57 (64)	49 (55)	46 (51)	64 (67)
	OOH - D	44	N/A	61 (66)	61 (66)	N/A	N/A	N/A	48 (53)	N/A	45 (50)
	OOH - E	42	N/A	61 (66)	61 (66)	N/A	N/A	N/A	48 (53)	N/A	45 (50)
	OOH - N	35	N/A	61 (66)	61 (66)	N/A	N/A	N/A	48 (53)	N/A	45 (50)
NCA12 (396 noise sensitive recievers assessed)	SH	48	59 (62)	56 (61)	N/A	57 (63)	51 (58)	N/A	48 (53)	45 (49)	45 (51)
	OOH - D	43	N/A	60 (64)	N/A	N/A	N/A	N/A	48 (53)	N/A	45 (50)
	OOH - E	40	N/A	60 (64)	N/A	N/A	N/A	N/A	48 (53)	N/A	45 (50)
	OOH - N	39	N/A	60 (64)	N/A	N/A	N/A	N/A	48 (53)	N/A	45 (50)

Notes

1. ICNG standard hours includes Monday to Friday 7am to 6pm and Saturday 8 am to 1pm, Out of Hours Day any time within 1pm to 6pm Saturday and 8am to 6pm Sunday, and outside standard hours, Out of Hours – Evening any time from 6pm to 10pm & Out of Hours – Night at all other times

2. Yellow cells indicate an exceedance of NMLs between 0 and 10 dB for typical construction works; Orange cells indicate an exceedance of NMLs between 10 and 20 dB for typical construction works; Red cells indicate an exceedance of NMLs >20dB for typical construction works;

3. Results in brackets indicate noise level predictions assuming full utilisation of plant (i.e. realistic worst case).

8.4. Noise catchment area assessment (on-airport works)

During construction, construction noise levels could significantly impact the closest receivers, predominantly during standard hours, with limited exceedances during out-of-hours works. These impacts include exceedance of NMLs, and potential sleep disturbance and awakening. Where exceedances have been predicted to occur during the worst case 15 minute periods (when all machinery is operating at full utilisation), these impacts are indicative of highest likely noise levels that may occur. Typical construction noise levels would be expected throughout most of the construction and would be lower than the worst case periods.

A summary of the main findings from the construction noise assessment results are provided below.

8.4.1. NCA10 - Luddenham, north of Elizabeth Drive

The location of the Western Sydney International Stage 1 Construction Impact Zone relative to NCA10 is shown below in Figure 8-1.

A total of 378 noise sensitive receivers were assessed for NCA10 which is located to the north of the airport site. The predicted NML exceedances within NCA10 are presented in Table 8-2. The number of receivers exceeding NMLs have been separated into bands grouping the magnitude of predicted exceedances across day, evening, and night periods.

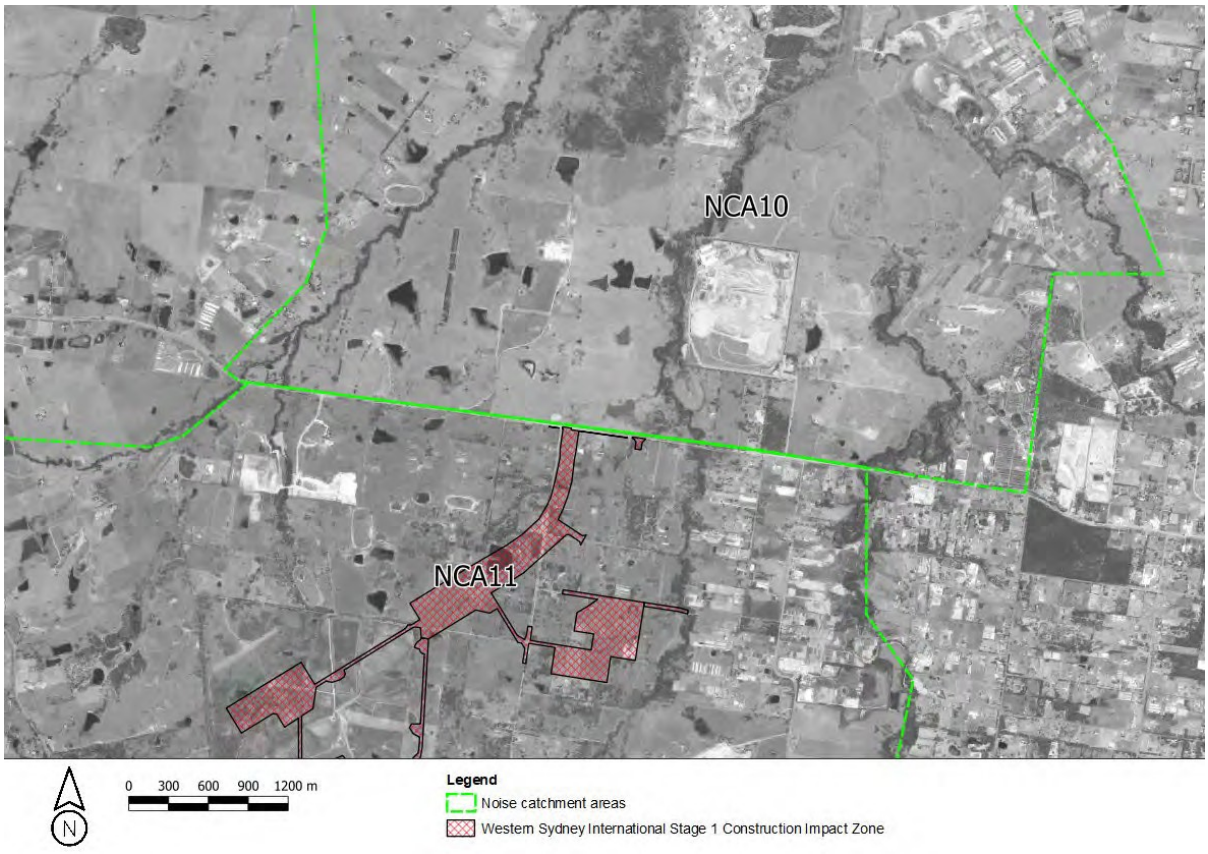


Figure 8-1 NCA10 relative to Western Sydney International Stage 1 Construction Impact Zone

Table 8-2 NCA11- overview of NML exceedances at residential receives- typical and worst case

Activity	Exceedances of sleep disturbance and awakening screening levels	Number of receivers exceeding NML – typical and (worst case)											
		Standard hours			Out-of-hours - day			Out-of-hours - evening			Out-of-hours - night		
		0-10	10-20	20+	0-10	10-20	20+	0-10	10-20	20+	0-10	10-20	20+
SC01 - Enabling works	N/A	25 (40)	0 (3)	0 (0)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SC02 - Tunnelling and associated works	60	43 (28)	7 (30)	0 (0)	28(8)	30(47)	0 (4)	16 (7)	42(41)	0 (11)	5 (6)	31 (7)	25(47)
SC03 - Bridge and viaduct construction	46	38 (24)	4 (23)	0 (0)	25(5)	22(38)	0 (4)	13 (5)	34(32)	0 (10)	1 (2)	25 (5)	21(38)
SC04 - Earthworks and excavation	N/A	42 (23)	12 (34)	0 (0)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SC05 - Station construction	N/A	15 (34)	0 (3)	0 (0)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SC06 - Construction of stabling and maintenance and other ancillary facilities	N/A	32 (30)	0 (14)	0 (0)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SC07 - Rail systems fitout	38	1 (28)	0 (0)	0 (0)	9(17)	0 (0)	0 (0)	15(24)	0 (1)	0 (0)	30(20)	4 (15)	0 (0)
SC08 - Station fitout, precinct and transport integration works	N/A	0 (4)	0 (0)	0 (0)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SC09 - Finishing works	3	30 (14)	17 (34)	0 (0)	1(20)	0 (0)	0 (0)	1 (28)	0 (0)	0 (0)	12(42)	1 (14)	(0)

Notes Where more exceedances of NMLs are predicted in an exceedance range (e.g. 0-10dB) during typical scenarios over worst-case, this is because predicted worst case impacts are higher than the typical impacts at a receiver, and therefore some number of receivers may move up into the higher exceedance ranges.

Where more exceedances of NMLs are predicted in an exceedance range (e.g. 0-10dB) during typical scenarios over worst-case, this is because predicted worst case impacts are higher than the typical impacts at a receiver, and therefore some number of receivers may move up into the higher exceedance ranges.

Summary of standard construction hours results

The most affected receivers are predicted to be located along Lawson Road. Some of the highest impact works occur during:

- Tunnelling and associated works and bridge and viaduct works (Scenarios 2 and 3) - predicted noise levels are most influenced by the use of multiple concrete vibrators
- Excavation and earthworks (Scenario 4) – predicted noise levels are most influenced by the use of hydraulic hammers and excavators
- Finishing works (Scenario 9) – predicted noise levels are most influenced by the use of hydraulic hammers

Most residential receivers are predicted to be affected during excavation and earthworks (Scenario 4). The highest construction noise during this scenario is a result of the use of excavators during rail embankment works along the on-airport construction corridor, and hydraulic hammers at the Airport business Park, exceeding NMLs by up to 16 dB to 20 dB. Figure 8-5 shows the distribution of NML exceedances during this activity for residential receivers within NCA11.

The excavators may be used over a period of around 12 months, and hydraulic hammers may be used intermittently over a period of around 6 months. When the hydraulic hammers are not in use, the predicted noise levels and corresponding NML exceedances are predicted to reduce by around 3 dB.

Summary of out-of-hours construction results

During out-of-hours construction works, NCA11 experiences exceedances of NMLs and sleep disturbance and awakening screening levels during tunnelling and associated works, bridge and viaduct construction, rail fitout works, and finishing works (Scenarios 2, 3, 7 and 9).

Residential receivers are predicted to be most affected during tunnelling and associated works (Scenario 2). The exceedances of NMLs are as a result of the use of concrete vibrators during tunnel segment casting at the Airport construction site, exceeding NMLs by up to 25 to 30 dB.

Figure 8-6 shows the distribution of NML exceedances during tunnelling and associated works (Scenario 2) for residential receivers within NCA11.

The concrete vibrators are expected to be in use for a period of around 18 months.

The worst case exceedances of the sleep disturbance and awakening screening levels occur during tunnel segment casting as part of tunnelling and associated works (Scenario 2), and are because of use of the concrete batch plant, exceeding by up to 14 dB.

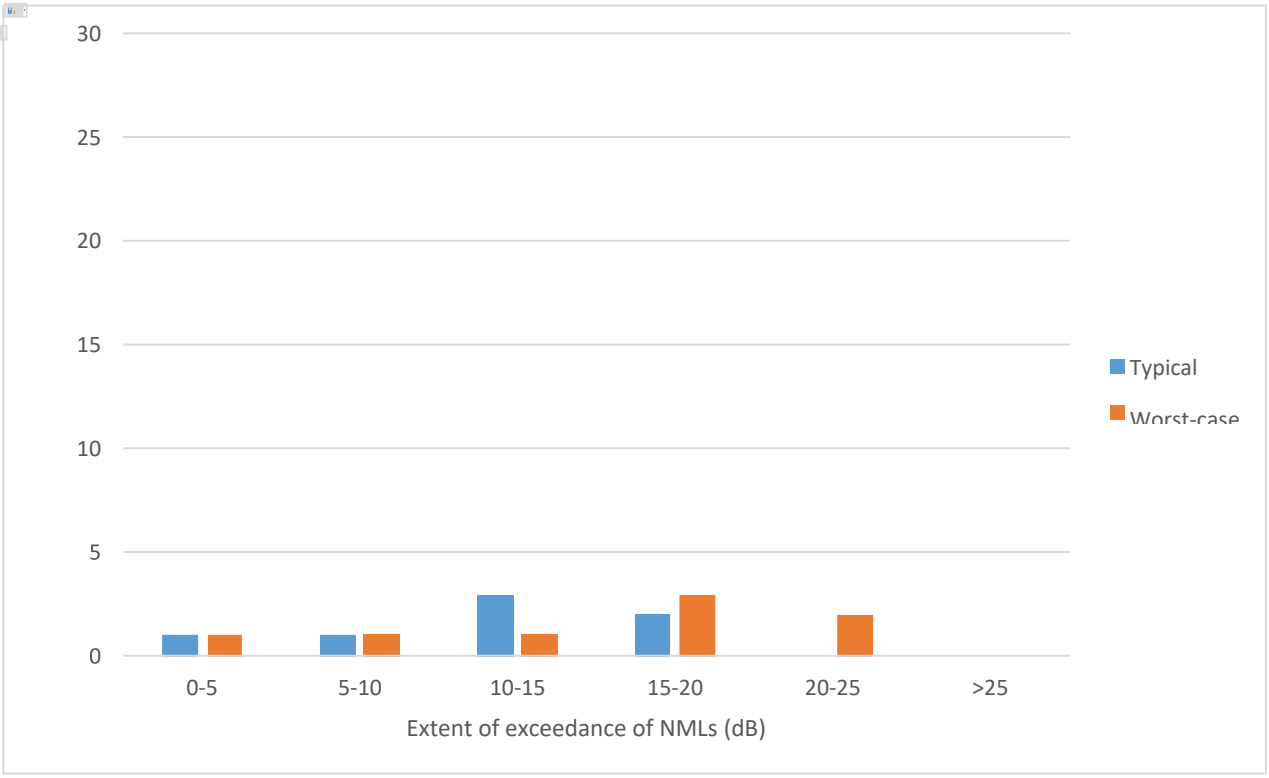


Figure 8-2 NCA11 NML exceedances – standard hours – tunnelling and associated works

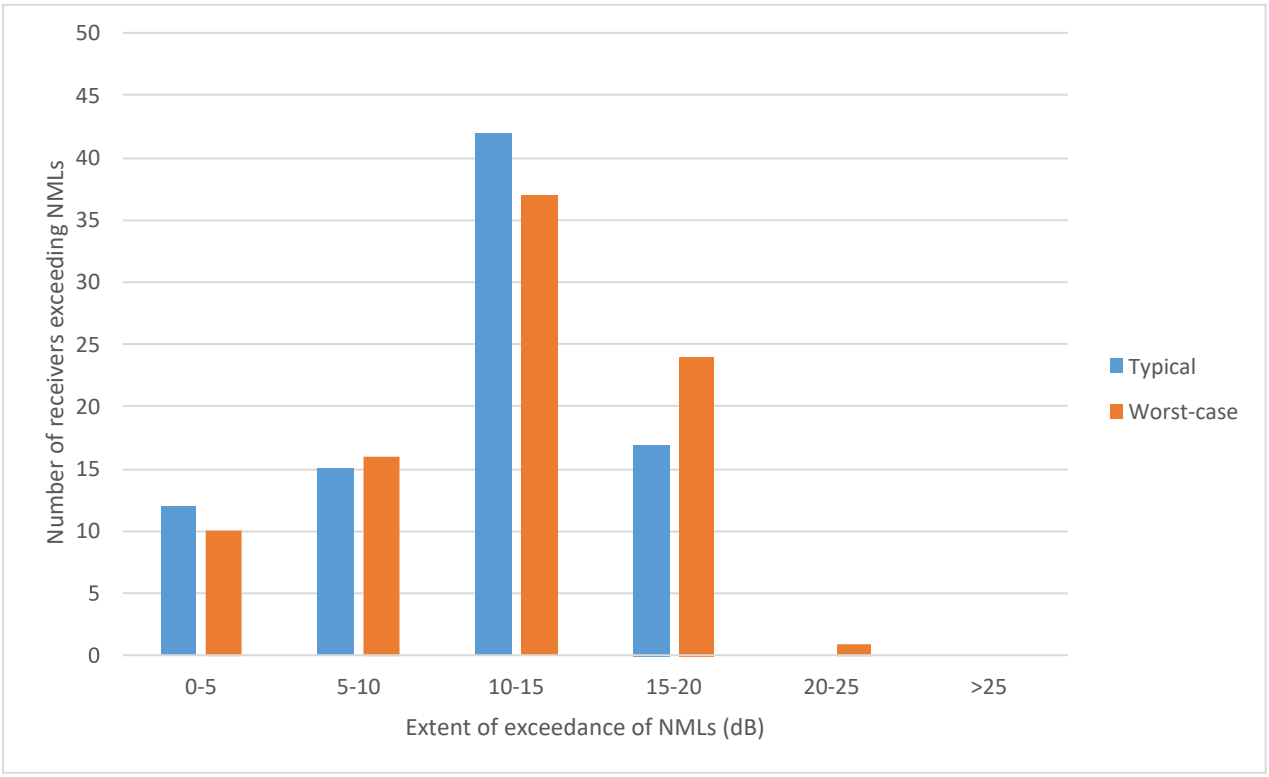


Figure 8-3 NCA11 NML exceedances – out-of-hours – tunnelling and associated works

Mitigation and management

These exceedances will be managed through the standard mitigation as outlined in the CNVS. Project specific mitigation would include consideration of acoustic sheds with suitable noise attenuation, which mat reduce the number of exceedances of NMLs by around 30 to 50%.

8.4.2. NCA12 - Bringelly

The location of the Western Sydney International Stage 1 Construction Impact Zone relative to NCA12 is shown below in Figure 8-7.

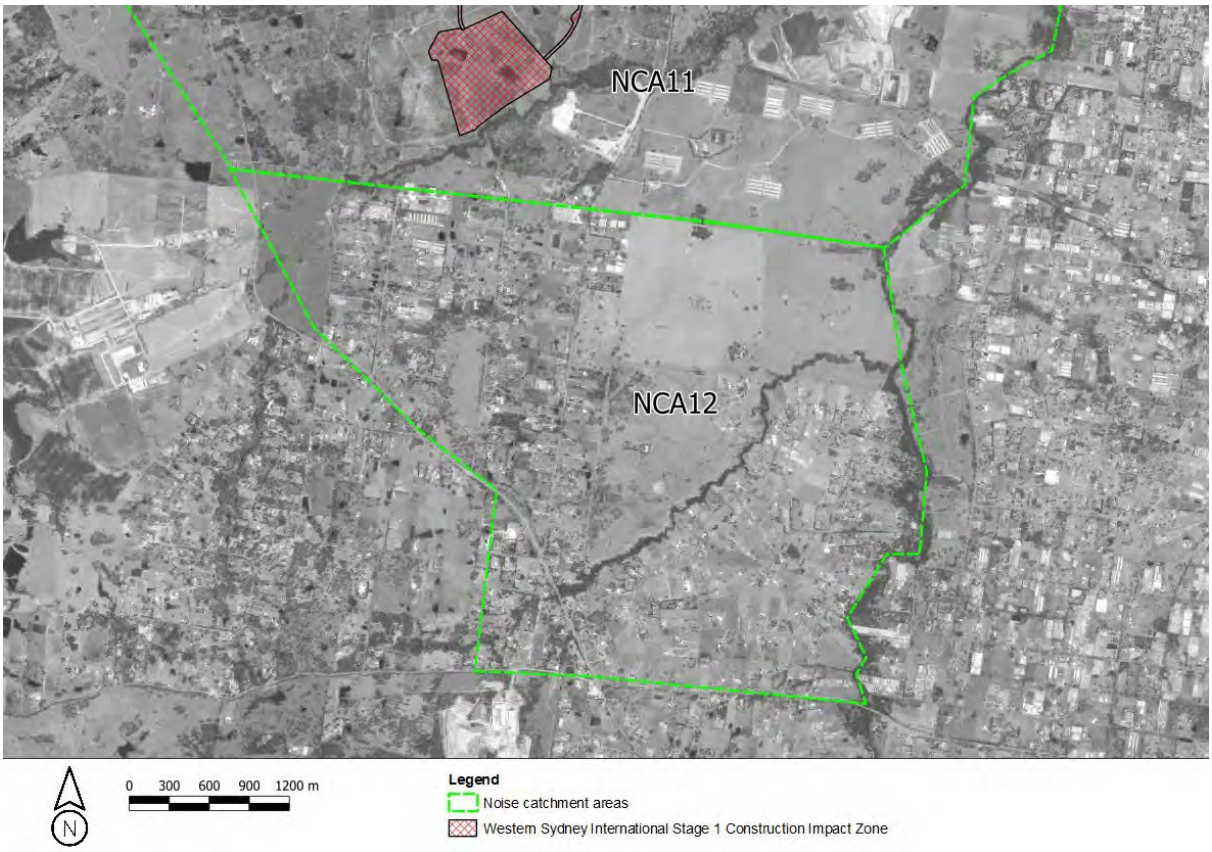


Figure 8-4 NCA12 relative to Western Sydney International Stage 1 Construction Impact Zone

A total of 396 noise sensitive receivers were assessed for NCA12 which is predominantly located to the south of the airport site. The predicted NML exceedances within NCA12 are presented in Table 8-4. The number of receivers exceeding NMLs have been separated into bands grouping the magnitude of predicted exceedances across day, evening, and night periods.

Table 8-3 NCA12- overview of NML exceedances at residential receivers- typical and worst case

Activity	Exceedances of sleep disturbance and awakening screening levels	Number of receivers exceeding NML – typical and (worst case)											
		Standard hours			Out-of-hours - day			Out-of-hours - evening			Out-of-hours - night		
		0-10	10-20	20+	0-10	10-20	20+	0-10	10-20	20+	0-10	10-20	20+
SC01 - Enabling works	N/A	60 (59)	2 (15)	0(0)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SC02 - Tunnelling and associated works	69	13 (14)	0 (7)	0(0)	53(44)	25(36)	0 (0)	33(28)	51(59)	0 (0)	27(26)	59(61)	0 (1)
SC03 - Bridge and viaduct construction	0	0 (0)	0 (0)	0(0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
SC04 - Earthworks and excavation	N/A	14 (13)	0 (10)	0(0)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SC05 - Station construction	N/A	7 (14)	0 (1)	0(0)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SC06 - Construction of stabling and maintenance and other ancillary facilities	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SC07 - Rail systems fitout	6	0 (15)	0 (0)	0(0)	12(52)	0 (0)	0 (0)	23(56)	0 (10)	0 (0)	30(58)	0 (13)	0 (0)
SC08 - Station fitout, precinct and transport integration works	N/A	0 (3)	0 (0)	0(0)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SC09 - Finishing works	0	0 (11)	0 (0)	0(0)	6(36)	0 (0)	0 (0)	17(57)	0 (1)	0 (0)	26(58)	0 (5)	0 (0)

Notes: Where more exceedances of NMLs are predicted in an exceedance range (e.g. 0-10dB) during typical scenarios over worst-case, this is because predicted worst case impacts are higher than the typical impacts at a receiver, and therefore some number of receivers may move up into the higher exceedance ranges.

Summary of standard construction hours results

The most affected receivers are predicted to be located to the north of Derwent Road and Mersey Road. The highest impact works occur during enabling works as a result of dozers during site establishment at the permanent spoil area, exceeding NMLs by up to 11 dB to 24 dB. Figure 8-8 shows the distribution of NML exceedances during this activity for residential receivers within NCA12. The dozers may be used over a period of around 18 months.

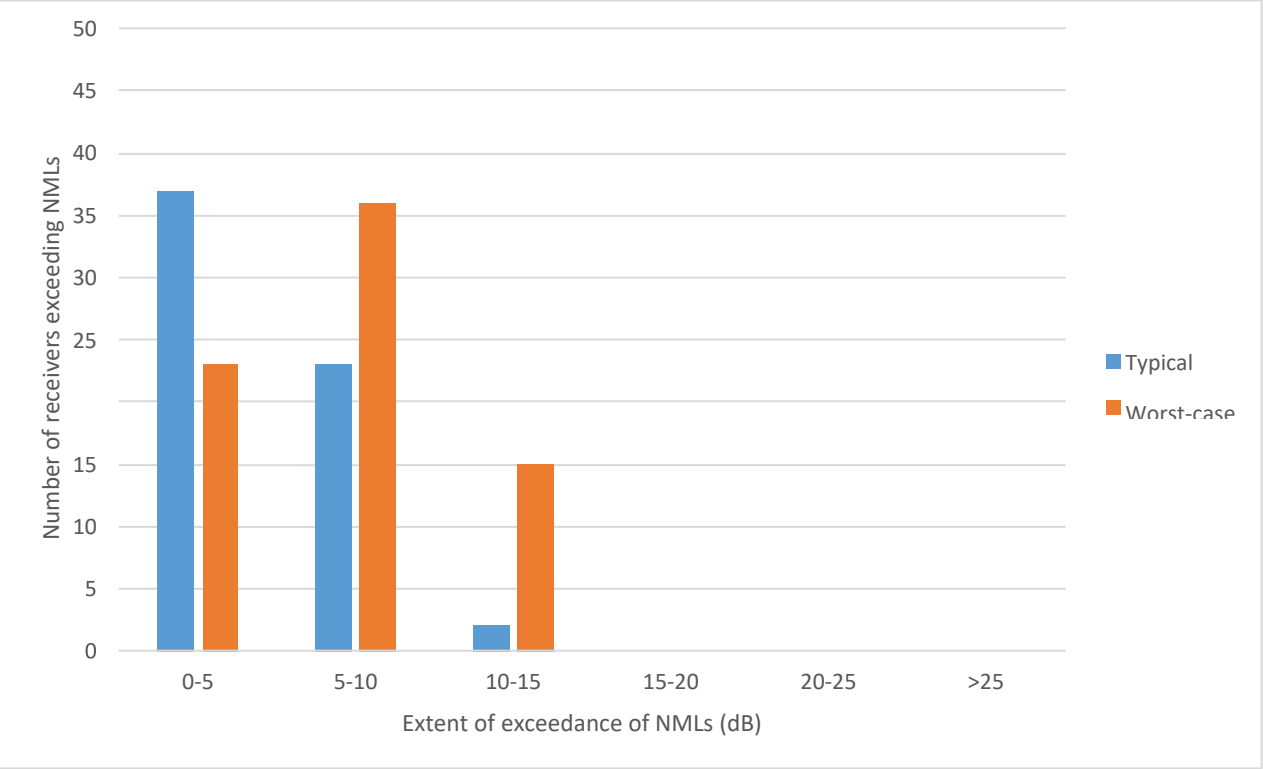


Figure 8-5 NCA12 NML exceedances – standard hours – tunnelling and associated works

Summary of out-of-hours construction results

During out-of-hours construction works, NCA12 experiences exceedances of NMLs and sleep disturbance and awakening screening levels during tunnelling and associated works, rail fitout works, and finishing works (Scenarios 2, 7 and 9).

Residential receivers are predicted to be most affected during tunnelling and associated works (Scenario 2). The exceedances of NMLs are as a result of the use of dozers at the permanent spoil area, exceeding NMLs by up to 20 to 21 dB. Figure 8-9 shows the distribution of NML exceedances during tunnelling and associated works (Scenario 2) for residential receivers within NCA12. These dozers may be used over a period of around 18 months.

The worst case exceedances of the sleep disturbance and awakening screening levels occur as part of tunnelling and associated works (Scenario 2), and are as a result of use of dozers at the permanent spoil area, exceeding by up to 3 dB.

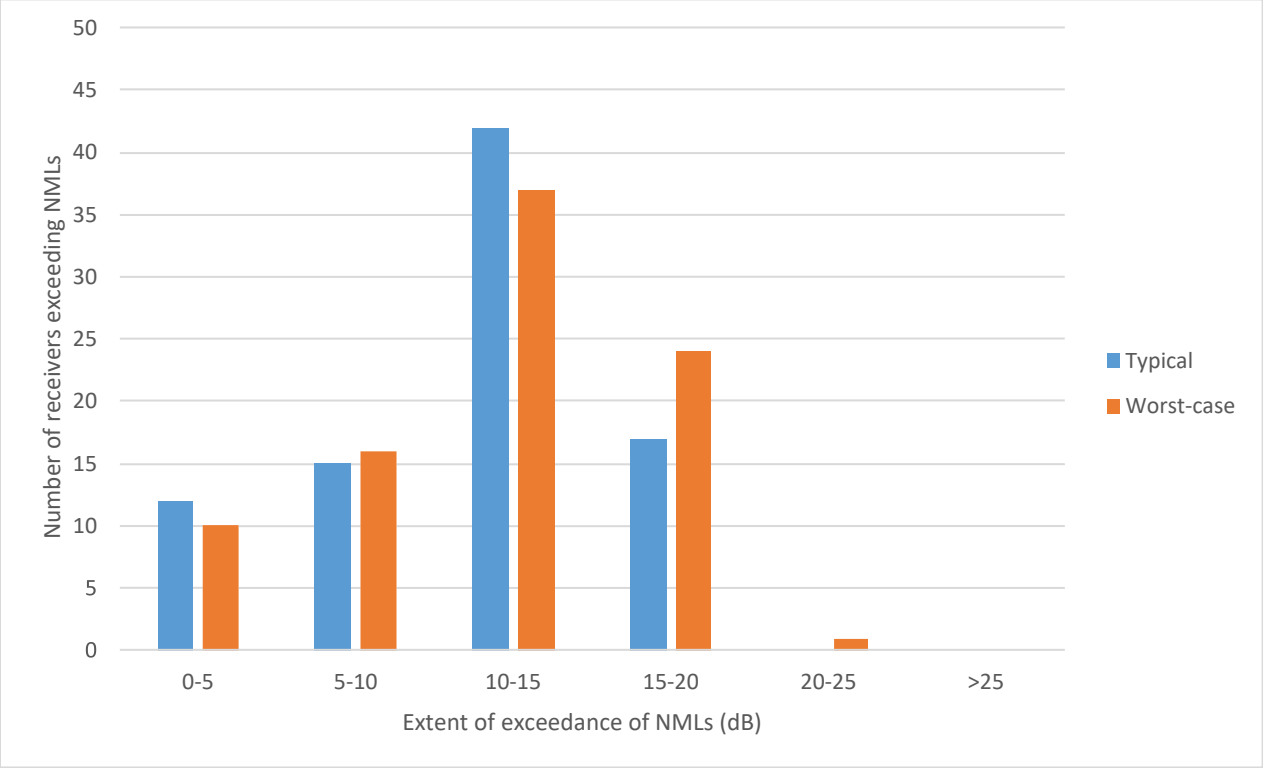


Figure 8-6 NCA12 NML exceedances – out-of-hours – tunnelling and associated works

Mitigation and management

These exceedances will be managed through the standard mitigation as outlined in the CNVS. Project specific mitigation would include consideration of acoustic sheds with suitable noise attenuation, which mat reduce the number of exceedances of NMLs by around 30 to 50%.

8.5. Summary of potential noise impacts

8.5.1. Material Importation

If required, prior to the commencement of out of hours work for material importation, the process set out above which will include detailed noise modelling. Initial modelling indicates that noise generated from unloading of material is unlikely to generate noise that is significantly over the NML at the closest receiver. It is noted that material will only be unloaded at night and not levelled / incorporated into the stockpile.

8.5.2. Construction traffic noise SM WSA On-Airport outside Stage 1

The forecast peak construction year (2023/2024) traffic volumes were compared to limiting noise criteria for each period and used to predict the relative increase of road traffic noise on affected roads as a result of project related construction traffic volumes, with respect to the nearest identified receiver.

The results of the assessment are presented in Table 4-30 of Technical Paper 2 (Noise and vibration) of the SM WSA EIS. The assessment indicates that construction road traffic noise levels are not predicted to exceed relevant RNP noise criteria at the majority of project affected roads. Based on the assessment, it is considered that no additional noise mitigation or

management measures are required at these locations. Figure 8-10 shows the road network modelled and indicative predicted impacts.

Exceedances of relevant RNP criteria and relative increase criteria have been identified at the closest representative receiver on Kent Road (south of the M4 Western Motorway) and Badgerys Creek Road (between The Northern Road and Western Sydney International). At Kent Road, construction traffic noise levels of up to 58 dBA are predicted during the night period (10pm to 7am), exceeding the RNP criterion by three dBA, and resulting in a relative increase of 3.8 dBA, exceeding the screening criteria of 2 dBA.

Exceedances are expected to occur at all residential receivers located within 40 metres of Kent Road, resulting in around five residential properties with predicted noise levels above criteria levels. Noise levels up to 64 dBA and 62 dBA during the day and night periods respectively are predicted at the nearest receiver on Badgerys Creek Road, south of the Western Sydney International. These levels exceed relevant RNP criteria by up to 4 dBA and 7 dBA during the day and night-time periods, and present increases of 3 dBA and 5 dBA respectively.

Exceedances are expected to occur at all residential receivers located within 60 metres of Badgerys Creek Road, resulting in 31 residential properties exceeding criteria levels. This is a conservative assessment for Badgerys Creek Road based on the assumption that all spoil from within the Western Sydney International would be taken to external disposal locations. If the permanent spoil placement area within Western Sydney International is used to accommodate spoil from tunnelling then spoil traffic volumes on the external roads such as Badgerys Creek Road and Elizabeth Drive would be significantly reduced.

Construction traffic noise would be reassessed during construction planning and design development to confirm results and if required mitigation options would be identified to address exceedances of RNP criteria. Mitigation would be considered, as outlined in the CNVS including planning traffic flow, parking and loading/unloading areas, to reduce construction road traffic noise impacts to meet RNP criteria where reasonable and feasible.

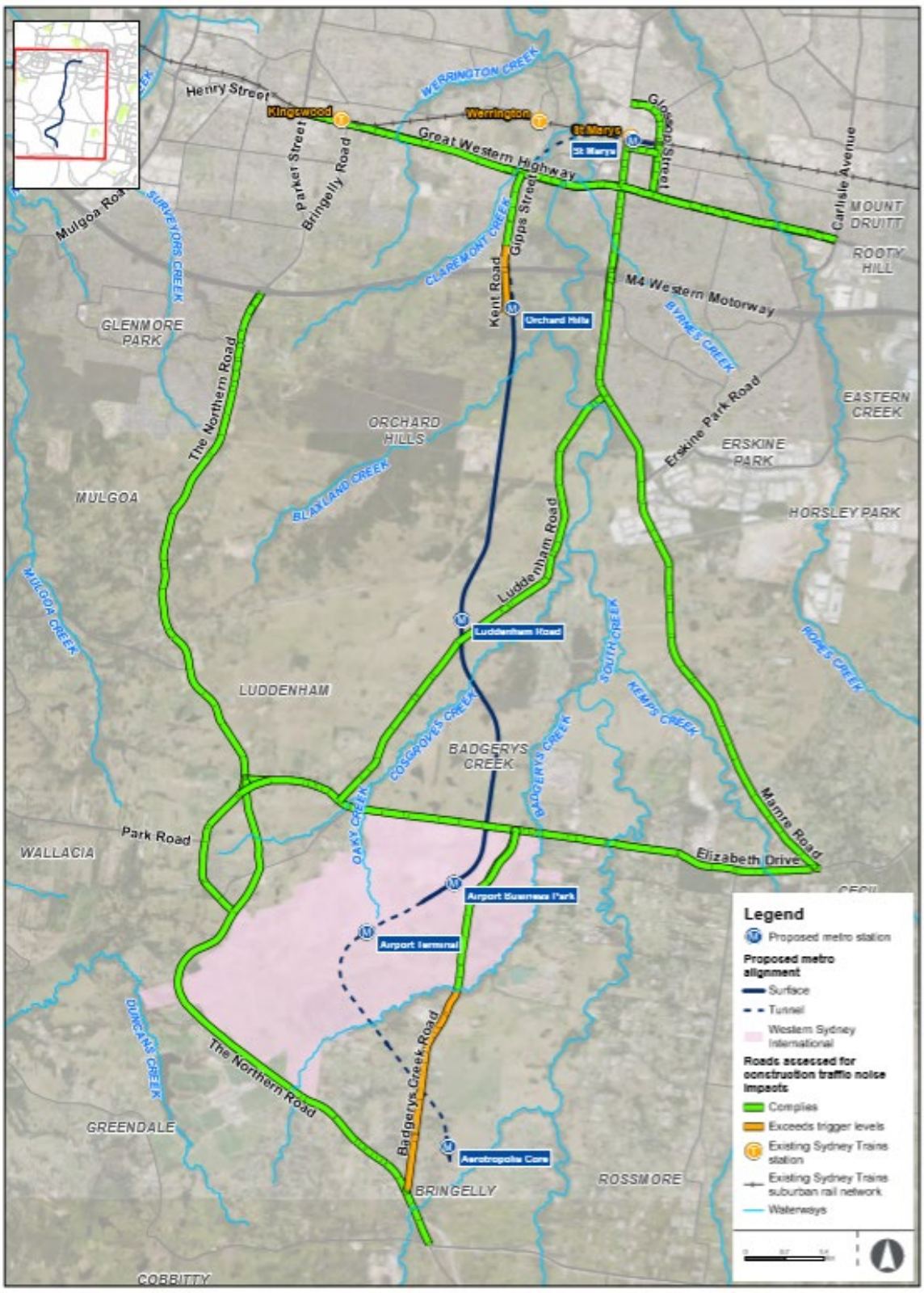


Figure 8-7 Indicative exceedances as per modelling for SM WSA EIS traffic noise levels (Sydney Metro Western Sydney Airport Technical Paper 2: Noise and vibration)

8.6. Construction vibration assessment

Where vibration intensive works are required to be undertaken within the specified minimum working distances, vibration monitoring should be undertaken to ensure acceptable levels of vibration are satisfied.

In relation to human comfort, the minimum working distances relate to continuous vibration. For most construction activities, vibration emissions would be intermittent in nature and for this reason, higher vibration levels, occurring over shorter periods may be allowed.

Table 8-5 presents the recommended minimum working distances for vibration intensive plant.

Table 8-4 recommended minimum working distances for vibration interview plant

Plant item	Rating / description	Minimum working distance – Cosmetic damage (BS7385)	Minimum working distance – Human response (DECC 2006)
Vibratory roller	< 50 kN (Typically 1-2 tonnes)	5 m	15 m to 20 m
	< 100 kN (Typically 2-4 tonnes)	6 m	20 m
	< 200 kN (Typically 4-6 tonnes)	12 m	40 m
	< 300 kN (Typically 7-13 tonnes)	15 m	100 m
	> 300 kN (Typically 13-18 tonnes)	20 m	100 m
	> 300 kN (> 18 tonnes)	25 m	100 m
Small Hydraulic Hammer	(300 kg - 5 to 12t excavator)	2 m	7 m
Medium Hydraulic Hammer	(900 kg – 12 to 18t excavator)	7 m	23 m
Large Hydraulic Hammer	(1600 kg – 18 to 34t excavator)	22 m	73 m
Vibratory Pile Driver	Sheet piles	2 m to 20 m	20 m
Pile Boring	≤ 800 mm	2 m (nominal)	4 m
Jackhammer	Hand held	1 m (nominal)	2 m

8.6.1. Material importation

Review of the material importation scope, it is considered that there is very limited risk of vibration impacts. As shown in Figure 7-3, the stockpile location of imported material is well away from the edge of the site and the nature of the works are unlikely to generate vibration.

8.6.2. Bulk Earthworks

Vibration represents a low risk of impact to the surrounding community, considering the distance between sources and receivers. Equipment with the greatest potential for vibration would be vibratory rollers operating in fill sites. With reference to Table 27, a minimum working distance for a vibratory roller (>18 tonnes) would be 25 metres for cosmetic damage and 100 metres to prevent human comfort.

Figure 8-11 illustrates the minimum safe working distances from the project boundary for cosmetic damage and human comfort.

One receiver is located within the human comfort minimum working distance on Elizabeth Drive (adjacent to the East work area). Works in the vicinity of this receiver should consider human comfort impacts and utilise lower levels of vibration where possible.

No receivers are within the cosmetic damage minimum work distance, hence damage to structures is not likely from the works.

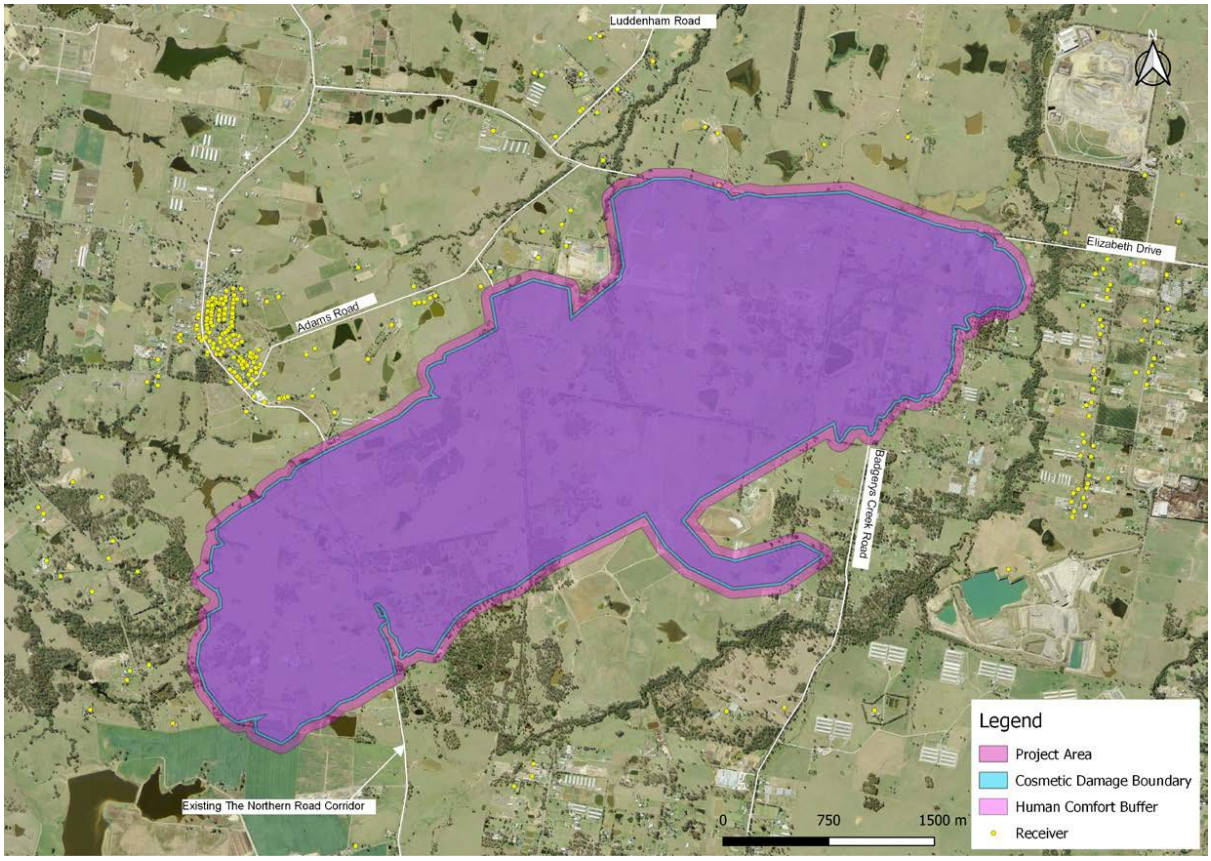


Figure 8-8 Vibration safe working distances during bulk earthworks

9. Environmental Control Measures

Mitigation and management measures that will be implemented during construction are detailed in Table 9-1 and are consistent with those provided in Table 23 of the WSA NVCEMP, as per Condition 6.3 and 6.4 (Section 3.11.2) of the Airport Plan and Tables 8-1, 8-2 and 8-3 of the SM - WSA EPBC Act Final EIA. The relevant control measures will be included in the site-specific Environmental Work Method Statement (EWMS) and Environmental Control Map (ECM) – refer to Sections 3.6 of the CEMF for further details.

Table 9-1 Noise and vibration management and mitigation measures

ID	Measure / Requirement	When to implement	How to implement	Responsibility for Implementation	Reference
GENERAL					
NV01	Training will be provided to all project personnel, including relevant sub-contractors on noise and vibration requirements from this plan through inductions, toolboxes and targeted awareness training. Noise and vibration training requirements will be as per Section 13 of this plan.	Pre-construction, construction	All personnel will be inducted before commencing works.	All Contractors	Good Practice
NV02	Public address systems used at any construction site will not be used outside normal construction hours, except where prior consultation has been undertaken with potentially affected residents or in the case of emergency. Public address systems would be designed to limit noise spillage off- site.	Construction	All personnel will be aware of the normal construction hours.	All Contractors	Good Practice
NV03	Work compounds and their associated layout, parking areas, equipment and material stockpile sites will be positioned away from noise-sensitive locations.	Construction	Site compound details provided in ECM	All Contractors	Good Practice
NV04	Site entry and exit points will be located as far as possible from sensitive receivers where possible, considering the importance of safe access.	Construction	Site compound details provided in ECM	All Contractors	Good Practice
NV05	Where possible, the compounds, refuelling areas and areas near potentially noise and vibration sensitive receivers, will be designed to promote one-way traffic so that vehicle reversing movements are minimised.	Construction	The traffic management plan is designed to comply with this.	All Contractors	Good Practice
NV06	Site training / tool-box talks will reinforce expected behavioural practices on site such as no swearing or unnecessary shouting or loud stereos/ radios on site, no dropping materials from height where practicable, no throwing of items and no slamming of doors.	Construction	All personnel will undertake inductions and receive ongoing site training.	All Contractors	Good Practice

ID	Measure / Requirement	When to implement	How to implement	Responsibility for Implementation	Reference
NV07	Where possible, work will be undertaken within the standard construction hours of: 7am – 6pm, Monday to Friday; 8am – 1pm Saturday No work on Sunday or public holidays unless approved through the out of hours process which is described in section 10 of the Noise and Vibration CEMP. Where complaints are received in response to high noise activities (eg. Rock breaking) respite periods will be applied (e.g. 3 hours of work with 1 hour of no high noise work). Work generating high noise and/or vibration levels would be scheduled during less sensitive time periods.	Construction	All personnel will undertake inductions. Planning will be undertaken to program works. Approved hours to be included on the ECM OOHW Permit	All Contractors	Good Practice SM - WSA EIA Table 8-3 NV4
NV08	Construction Planning will provide for adequate respite periods for Sensitive Receptors from noise and vibration associated with construction activities (refer to environmental control NV_30 and Figure 8-11 with regards to respite for noise activities) No blasting activity shall be undertaken during the hours of 5 pm to 9 am on weekdays, on weekends (other than 9 am to 1 pm Saturdays) and on public holidays.	Construction	Planning will be undertaken to program works No blasting will be required for the Project.	All Contractors	Airport Plan Condition 6(4) (Section 3.10.2)
NV09	Where acoustic sheds are installed, the internal lining and type of material used in the construction of the sheds would be considered during design development and construction planning to ensure appropriate attenuation is provided	Pre-Construction	Acoustics shed design to meet requirements of sensitive receivers	SBT	SM - WSA EIA Table 8-3, NV1
PLANT AND EQUIPMENT					
NV10	Undertake saw-cutting operations during standard work hours wherever possible to minimise noise impacts	Construction	Works planning and assessment to be undertake prior to commencing.	All Contractors	Good Practice

ID	Measure / Requirement	When to implement	How to implement	Responsibility for Implementation	Reference
NV11	Plant or machinery will not be permitted to 'warm-up' before the nominated working hours.	Construction Plant located near receivers	All personnel will undertake inductions, which will be reiterated through ongoing site training. Detailed on ECM	All Contractors	Good Practice
NV12	Avoiding queueing and switching off engines when equipment is not in use for extended periods (ie 30 minutes).	Construction	All personnel will undertake inductions and reiterated through ongoing site training.	All Contractors	Traffic and Access CEMP
NV13	Where possible, the occurrence of consecutive noisy works within the same locality, and/or noisy plant/equipment working close together in the same locality will be avoided or otherwise minimised.	Construction	Works will be scheduled ahead of time, where possible.	All Contractors	Good Practice
NV14	Where possible high noise generating work (such as use of a concrete saw or hydraulic hammer) will be undertaken during standard construction hours, even in the event of an out-of-hour works approval.	Construction	Works will be scheduled ahead of time, where possible.	All Contractors	Good Practice
NV15	Manually adjustable or ambient noise sensitive or 'quacker' type reversing alarms on plant and/or flashing lights will be used at night.	Construction	All vehicles on site will be tested and fitted with appropriate controls before commencing works.	All Contractors	Good Practice
NV16	Where possible, work will be undertaken away from noise sensitive receivers.	Construction	Works will be scheduled ahead of time, where possible.	All Contractors	Good Practice
NV17	All construction plant and equipment used on the site will be, in addition to other relevant requirements: • Fitted with properly maintained noise suppression devices in accordance with the manufacturer's specifications. • Maintained in an efficient condition. • Operated in a proper and efficient manner	Construction	All vehicles on site will be tested and fitted with appropriate controls before commencing works.	All Contractors	Good Practice

ID	Measure / Requirement	When to implement	How to implement	Responsibility for Implementation	Reference
NV18	Loading and unloading will be carried out as far as practical away from sensitive receivers. When loading trucks, materials are to be placed into trucks as far as practical, rather than dropped from a height.	Construction	Works will be scheduled ahead of time, where possible. Workers will be trained accordingly on unloading.	All Contractors	Good Practice
NV19	Truck movements will be kept to a minimum, i.e. that trucks are sufficiently utilised for each trip. Travel will be via internal haul routes where practicable and not queue near residential dwellings.	Construction	Works will be scheduled ahead of time, where possible.	All Contractors	Traffic and Access CEMP
NV20	Noisy and vibration generating plant working simultaneously close together will be avoided to the greatest extent practical adjacent to noise affected / vibration sensitive receivers.	Construction	Works will be scheduled ahead of time, where possible, and in combination with the location of sensitive receivers.	All Contractors	Good Practice
NV21	Where practical, at the end of shifts, excavation and/or ripping plant will be taken from their work areas and left overnight away from the immediate vicinity of sensitive receivers. Warming up of the plant will then be conducted away from such receivers.	Construction	Machinery storage points will be determined in combination with the location of sensitive receivers.	All Contractors	Good Practice
NV22	Truck will limit compression braking as far as practicable.	Construction	All truck drivers will undertake induction that informs them of the appropriate measures.	All Contractors	Good Practice
NV23	Where possible, noise generating equipment will be strategically positioned to take advantage of natural screening from geographical features, earthwork features (e.g. stockpiles) or other structures to reduce the transmission of noise between work sites and receiver locations.	Construction	The locations of noise generating equipment will be in combination with the location of geographical features and structures.	All Contractors	Good Practice
NV24	Construction activities which are predicted to exceed any noise management levels will be identified.	Pre-construction, Construction	Predicted exceedances will be through work planning prior to starting and verified through monitoring.	All Contractors	Good Practice

ID	Measure / Requirement	When to implement	How to implement	Responsibility for Implementation	Reference
NV25	Selection of less noisy plant and equipment and less noise emitting construction methods, where feasible.	Construction	Works planning and assessment to be undertake prior to commencing. Equipment would be selected with consideration of their maximum noise levels.	All Contractors	SM – WSA EIA Table 8-1 CEMF4
NV26	Structures (site sheds, stockpiles / bunds, hoarding) will be used where possible to shield residential receivers from noise.	Construction	Works planning and assessment to be undertake prior to commencing.	All Contractors	Good Practice
CONSULTATION AND COMPLAINTS MANAGEMENT					
NV27	All complaints received will be managed in accordance with the Community Communications Strategy.	Construction	A Community Communications Strategy has been written for SM	Sydney Metro Community Engagement Manager All Contractors	Good Practice
NV28	Affected receivers will receive notifications for construction activities likely to affect their amenity through noise and vibration.	Pre-construction, Construction	Noisy construction activities are to be pre-determined. The CCS outlines methodology for actively notifying and engaging community stakeholders.	Sydney Metro Community Engagement Manager All Contractors	Good Practice SM – WSA EIA CEMF 4
NV29	Maintain positive, cooperative relationships with schools, childcare centres, local residents and building owners.	Pre-construction, Construction	The CCS outlines methodology for actively notifying and engaging community stakeholders.	Sydney Metro Community Engagement Manager All Contractors	Good Practice SM – WSA EIA CEMF 4

ID	Measure / Requirement	When to implement	How to implement	Responsibility for Implementation	Reference
SURVEY, MONITORING AND REPORTING					
NV30	Noise and vibration monitoring will be undertaken in accordance with Section 12.2. The program for construction noise and vibration monitoring indicates monitoring frequency, location, how the results of this monitoring are recorded and, procedures that are followed where significant exceedances of relevant noise and vibration goals are detected.	Construction	Monitoring and record keeping to be undertaken in accordance with this plan. Contractor required to undertake monitoring for construction activities. Monitoring will be undertaken to ensure achievement of performance levels as per the SM - WSA EIA	Sydney Metro Community Engagement Manager All Contractors	Good Practice
NV31	Quantitative noise and vibration impact assessments will be carried out prior to construction. Where a potential exceedance of the construction noise and vibration management levels is identified, additional mitigation measures (such as individual briefings, letter box drops, phone calls, emails and specific notifications to affected sensitive receivers) would be considered.	Construction	Monitoring and community consultation	All Contractors	SM - WSA EIA Table 8-3, CNVS1
NV32	All complaints handling would be in accordance with the Sydney Metro Overarching Community Communications Strategy and Construction Complaints Management System and in consultation with Western Sydney Airport.	Construction	Monitoring and record keeping being undertaken in accordance with this plan.	All Contractors	SM - WSA EIA Table 8-3, CNVS5
NV33	Noise monitoring would be carried out where a potential exceedance of the construction noise management levels has been identified.	Pre-construction, Construction	Monitoring and record keeping being undertaken in accordance with this plan.	All Contractors	SM - WSA EIA Table 8-3, CNVS2
NV34	Vibration monitoring would be carried out at the nearest affected receiver where it is anticipated that an item of plant would exceed the cosmetic damage or human response/ground-borne noise criteria.	Construction	Monitoring and record keeping being undertaken in accordance with this plan.	All Contractors	SM - WSA EIA Table 8-3, CNVS3

ID	Measure / Requirement	When to implement	How to implement	Responsibility for Implementation	Reference
RESPITE FROM NOISY ACTIVITIES					
NV35	For work activities considered to be noisy (eg. hammering, grinding etc – excluding blasting), where noise levels at the receiver are above LA10,15min 75 dB(A), adopt an 8.30 am start and a 5 pm finish with two one-hour respite periods starting at 11.30am and 2pm respectively. Saturday works will commence at 8am and finish at 1pm with a one-hour respite period starting at 11am.	Construction	Monitoring and record keeping being undertaken in accordance with this plan.	All Contractors	AEPR Condition 6
NV36	There is to be no blasting activity during the hours of 5 pm to 9 am on weekdays, on weekends (other than 9 am to 1 pm Saturdays) and on public holidays.	Construction	There will be no blasting on the Project.	All Contractors	AEPR Condition 6
NV37	Project specific mitigation would include consideration of acoustic sheds with suitable noise attenuation, which mat reduce the number of exceedances of NMLs by around 30 to 50%.	Pre-Construction Construction	Consider location of and duration activities in proximity to sensitive receptors.	All Contractors	CEMF

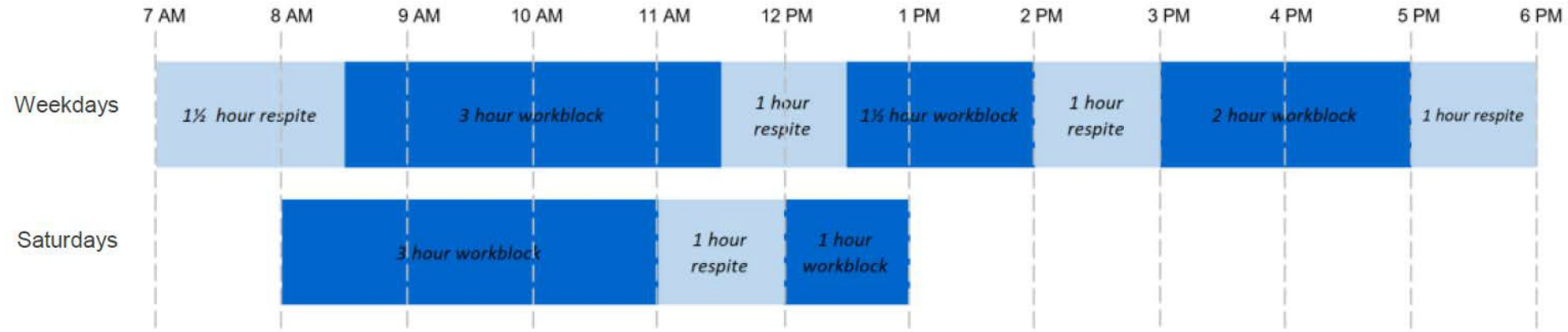


Figure 9-1 Respite periods

9.1.1. Construction Noise and Vibration Management Plans

A Construction Noise and Vibration Management Plan (CNVMP) sets out how noise and vibration impacts will be mitigated and managed. These may also include a Noise & Vibration Monitoring Program, which typically outlines how noise and vibration monitoring will be undertaken, how the results of monitoring will be reported and procedures to identify and implement additional mitigation measures as necessary.

9.1.2. Construction Noise and Vibration Impact Statements

A Construction Noise and Vibration Impact Statement (CNVIS) assesses and documents the anticipated noise and vibration impacts at receivers of proposed construction activities. In accordance with the CSSI planning approvals, a CNVIS is to be prepared for each construction site before construction noise and vibration impacts commence and include specific mitigation measures identified through consultation with affected sensitive receivers.

9.1.3. Detailed Noise and Vibration Impact Statement

A Detailed Noise and Vibration Impact Statement (DNVIS) is a document developed by Contractors which clarifies assumptions made in the EIS. A DNVIS:

- allows the Contractor to provide more detailed quantitative assessments of the EIS due to their better understanding of the exact equipment list and construction methodology they will be using to complete the scope of works
- are typically written with a focus on specific activities or locations and consider works carried out inside and outside of standard work hours. Working outside of standard construction hours

9.2. Project requirements

Standard construction hours are:

- 7am – 6pm Monday to Friday;
- 8am – 1pm Saturday; and
- No work on Sunday or public holidays unless approved through the out of hours process.

9.3. Out of Hours works

Project related out-of-hour works (OOHW) may include:

- Deliveries of oversized plant or structures;
- Responsive activities to protect people, property, and the environment in the event of an emergency such as a fire or structural failure;
- Other activities undertaken in accordance with relevant noise and vibration guidelines, or which have no material noise or other impacts on residences;
- Work that relies on third party authorisation;
- Work that would otherwise be a safety risk to project employees or the general public.

- tunnelling and ancillary support activities (excluding cut and cover tunnelling and surface works not directly supporting tunneling) that are permitted 24 hours a day, seven days a week;
- delivery of material that is required to be delivered outside of standard construction hours to directly support tunnelling activities, except between the hours 10:00 pm and 7:00 am;
- haulage of spoil generated through tunnelling is permitted 24 hours per day, seven days per week except between the hours of 10:00 pm and 7:00 am;
- works within an acoustic enclosure are permitted 24 hours a day, seven days a week where there is no exceedance of noise levels or intermittent vibration levels under Low impact circumstances identified in Condition E41(b) of the CSSI MCoA; and
- tunnel and underground station box fit out works are permitted 24 hours per day, seven days per week.

9.4. Out of hours works procedure

An out-of-hours works procedure (Appendix A) to assess and permit works outside of the standard construction hours will be used to:

- Identify works that are proposed outside of the standard construction hours;
- Assess proposed out of hours works in accordance with Project approvals
- Notify the Community; and
- Permit out of hours works in accordance with the process and Project Approval

Due to the highly variable nature of construction activities and the likelihood of work outside the standard construction hours on Sydney Metro projects, some exceedances of the construction noise and vibration management levels are likely to be unavoidable. Where there is a potential exceedance of the construction noise and vibration management levels, a number of additional measures to mitigate such exceedances – primarily aimed at pro-active engagement with affected sensitive receivers – would be explored and have been included in below. The additional mitigation measures to be applied are outlined in Table 10-1.

Table 9-2 Additional Management Measures

Measure	Description	Abbreviation
Alternative accommodation	Alternative accommodation options may be provided for residents living inclose proximity to construction works that are likely to incur unreasonably high impacts over an extended period of time. Alternative accommodation will be determined on a case-by-case basis.	AA
Monitoring	Where it has been identified that specific construction activities are likely to exceed the relevant noise or vibration goals, noise or vibration monitoring may be conducted at the affected receiver(s) or a nominated representative location (typically the nearest receiver where more than one receiver have been identified). Monitoring can be in the form of either unattended logging or operator attended surveys. The purpose of monitoring is to inform the relevant personnel when the noise or vibrationgoal has been exceeded so that additional management measures may be implemented.	M

Measure	Description	Abbreviation
Individualbriefings	Individual briefings are used to inform stakeholders about the impacts of high noise activities and mitigation measures that will be implemented. Communications representatives from the contractor would visit identifiedstakeholders at least 48 hours ahead of potentially disturbing constructionactivities. Individual briefings provide affected stakeholders with personalised contact and tailored advice, with the opportunity to commenton the project.	IB
Letter box drops	For each Sydney Metro project, a newsletter is produced and distributedto the local community via letterbox drop and the project mailing list. These newsletters provide an overview of current and upcoming works across the project and other topics of interest. The objective is to engageand inform and provide project-specific messages. Advanced warning of potential disruptions (e.g. traffic changes or noisy works) can assist in reducing the impact on the community. Content and newsletter length is determined on a project-by-project basis. Most projects distribute notifications on a monthly basis. Each newsletter is graphically designedwithin a branded template.	LB
Project specific respite offer	The purpose of a project specific respite offer is to provide residents subjected to lengthy periods of noise or vibration respite from an ongoingimpact.	RO
Phone calls and emails	Phone calls and/or emails detailing relevant information would be made to identified/affected stakeholders within 7 days of proposed work. Phonecalls and/or emails provide affected stakeholders with personalised contact and tailored advice, with the opportunity to provide comments on the proposed work and specific needs etc.	PC
Specific notifications	Specific notifications would be letterbox dropped or hand distributed to identified stakeholders no later than 7 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.	SN

Prior to the commencement of OOHW a detailed noise impact assessment shall be carried out. Mitigation measures shall be determined based on potential exceedances of the relevant NML.

In circumstances where following application of the standard mitigation measures, the LAeq(15minute) construction noise and vibration levels are still predicted to exceed the Noise Management Level, the relevant Additional Mitigation Measures (AMM) are considered to determine any offset strategies for these impacts (Table 10-1).

The following steps need to be carried out to determine the Additional Mitigation Measures to be implemented:

- Determine the duration (time period) when the work is to be undertaken.
- Determine the level of exceedance above the NML.

From the AMM table, identify the additional mitigation measures to be implemented (abbreviation codes are explained in Table 10-1).

Table 9-3 Additional Mitigation Measures – Airborne Construction Noise

Mitigation measure	Time Period	Predicted LAeq (15minute) noise level Above NML			
		0 to 10 dB	10 to 20 dB	20 to 30 dB	> 30 dB
Standard	Mon-Fri (7.00 am - 6.00 pm)	-	LB	LB, M, SN	LB, M, SN
	Sat (8.00 am - 1.00 pm)				
	Sun/Pub Hol (Nil)				
OOHW (Evening)	Mon-Fri (6.00 pm - 10.00 pm)	LB	LB, M	LB, M, SN, RO	LB, M, SN, IB, PC, RO
	Sat (1.00 pm - 10.00 pm)				
	Sun/Pub Hol (8.00 am - 6.00 pm)				
OOHW (Night)	Mon-Fri (10.00 pm - 7.00 am)	LB	LB, M, SN, RO	LB, M, SN, IB, PC, RO, AA	LB, M, SN, IB, PC, RO, AA
	Sat (10.00 pm - 8.00 am)				
	Sun/Pub Hol (6.00 pm - 7.00 am)				

Table 9-4 Additional Mitigation Measures – Ground Borne Construction Noise

Time Period		Predicted LAeq (15minute) noise level Above NML		
		0 to 10 dB	10 to 20 dB	> 20 dB
Standard	Mon-Fri (7.00 am - 6.00 pm)	No NML for GBN during standard hours, refer to Table 18		
	Sat (8.00 am - 1.00 pm)			
	Sun/Pub Hol (Nil)			
OOHW (Evening)	Mon-Fri (6.00 pm - 10.00 pm)	LB	LB, M, SN	LB, M, SN, IB,PC, RC
	Sat (1.00 pm - 10.00 pm)			
	Sun/Pub Hol (8.00 am - 6.00 pm)			
OOHW (Night)	Mon-Fri (10.00 pm - 7.00 am)	LB, M, SN	LB, M, SN, IB,PC, RO, AA	LB, M, SN, IB,PC, RC AA
	Sat (10.00 pm - 8.00 am)			
	Sun/Pub Hol (6.00 pm - 7.00 am)			

Table 9-5 Additional Mitigation Measures - Ground-borne Vibration

Time Period		Mitigation Measures
		Predicted Vibration Levels Exceed Maximum Levels
Standard	Mon-Fri (7.00 am - 6.00 pm)	LB, M, RO
	Sat (8.00 am - 1.00 pm)	
	Sun/Pub Hol (Nil)	
OOHW (Evening)	Mon-Fri (6.00 pm - 10.00 pm)	LB, M, IB, 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)	LB, M, IB, PC, RO, SN, AA

Time Period		Mitigation Measures
		Predicted Vibration Levels Exceed Maximum Levels
(Night)	Sat (10.00 pm - 8.00 am)	
	Sun/Pub Hol (6.00 pm - 7.00 am)	

9.5. Community notification

Sydney Metro will notify the potentially affected sensitive receivers a minimum of seven days prior to proposed works by letterbox drop for work outside of the standard construction hours. The notification shall include:

- A diagram that clearly identifies the location of the proposed out-of-hours works in relation to nearby cross streets and local landmarks or geographical features;
- Details of the timing, nature, scope and duration of the proposed works and activities;
- Detail of why the proposed works and activities are being undertaken outside of standard construction hours;
- Details of the predicted noise and vibration impacts of the works on identified sensitive receivers;
- Details of all proposed mitigation measures, including respite periods and proposed scheduling;
- Details of the types of plant and equipment that will be used to undertake the work;
- Details of how complaints may be lodged, and additional information obtained about the work; and
- Contact details in community languages relevant to the locality; and include notification of any upcoming project community meetings / forums

Where work is required out of standard hours within the seven day period, a phone call and/or email, and/or doorknock will occur with the potentially affected sensitive receivers. This will be conducted a minimum 48 hours prior to the proposed work.

10. Environmental roles and responsibilities

The key environmental management roles and responsibilities for the construction phase of the work are detailed in Section 3.15 of the CEMF.

Sydney Metro will ensure enough resources are allocated on an ongoing basis to ensure effective implementation by both Sydney Metro and the responsible contractors.

10.1. Noise and Vibration Consultant

The appointed noise and vibration consultant will review and update the construction noise and vibration modelling undertaken as part of the EIS. The consultant is also providing an accessible noise model to allow flexible planning and quick and accurate assessment of impacts by the construction team, ensuring that construction methodologies can be optimised to minimise noise and vibration impact outside of the site boundary. The noise and vibration consultant will also provide training to the construction team on noise monitoring and will assist in the development of Construction Noise and Vibration Impact Statements (CNVISs) for activities predicted to exceed Noise Management Levels.

11. Environmental inspection, monitoring, auditing and reporting

Monitoring, inspection, and auditing will be undertaken to measure effectiveness and facilitate continuous improvement of noise and vibration management.

General environmental monitoring, inspection, auditing and reporting requirements are summarised in Section 6 of the CNVS, Section 3.16 of the CEMF.

A summary of the environmental inspection, monitoring and auditing requirements is provided below, with details of how they apply to noise and vibration management where applicable.

11.1. Environmental inspections

11.1.1. Sydney Metro environmental inspections

Environmental site inspections at active, exposed work areas will be undertaken by the environmental team, Sydney Metro Environment Manager (or delegate) on a weekly basis to evaluate the effectiveness of environmental controls implemented by the contractor.

The weekly site inspection is to include a visual inspection of general construction activities and any noise and vibration mitigation measures and or controls including but not limited to the following:

- Observation of noise emissions from specific plant and equipment;
- Noise hoarding / containment measures if required, and their effectiveness;
- Noise and vibration loggers are installed and operational if and as required;
- Observation with regards to construction activities and compliance with the nominated construction hours; and
- General observation with regards to the construction noise levels.

The findings of the Sydney Metro site environmental inspection will be recorded on a Sydney Metro Site Environmental Inspection Checklist with an accompanying photographic style inspection report.

11.1.2. Contractor environmental inspections

Weekly site inspections will be undertaken to monitor compliance with this plan at active, exposed work sites. Inspection results will be recorded, and the inspection log made available to the Infrastructure Department upon request. Any exceedance of noise monitoring criteria will be reported in the monthly report and discussed at the Environmental Coordination meeting.

More frequent site inspections by the person accountable for noise and vibration management will be conducted onsite when activities with a high potential to produce noise and vibration impacts are being carried out.

The Contractor's Environmental Manager (or delegate) will undertake inspections in accordance with the Contractor Environmental Management Framework. The Contractor's Environmental Coordinators will record inspection findings on an inspection checklist form.

If any maintenance and/or deficiencies in environmental controls or in the standard of environmental performance are observed, they will be recorded on the checklist form. Records will also include details of any maintenance required, the nature of the deficiency, any actions required and an implementation priority.

11.1.3. Pre-start inspection

Prior to the commencement of works on each shift, an informal inspection will be carried out by the relevant contractor and will include a check of relevant environmental controls and resources required to ensure effective operation and maintenance. This is to include an inspection of relevant noise and vibration management mitigation measures and controls where applicable. Works are not to commence unless inspections are found to be satisfactory.

11.2. Noise and vibration monitoring

General environmental monitoring requirements are set out in the AEPR and include the following:

- Monitoring must take place under the direction of an appropriately qualified person; and
- The results of the monitoring must be kept in a written record.

Specific noise and vibration monitoring requirements, including timing and responsibilities, are included in Table 12-1.

12-1 Noise and vibration monitoring requirements

Reference	Requirement	Timing	Responsibility
Noise Monitoring			
NV_M_01	Noise monitoring in accordance with AS1055 will be conducted at the nearest sensitive receptor locations to determine the effectiveness of mitigation measures against predicted impacts. During construction monitoring of new activities or new location will be completed within the first two shifts to confirm noise levels are within predicted levels and mitigation measures are appropriate. Further monitoring will be offered in response to a complaint.	Pre-construction and during construction	Principal contractor
NV_M_02	An inspection log will be prepared following each monitoring event and will made available to DIRDC upon request.	As required	All Contractors
NV_M_03	Where complaints are received, additional noise monitoring may be undertaken at sensitive receptors to determine if the actual construction noise generated exceeds the predicted 'worst case' construction noise levels.	During construction	All Contractors
NV_M_04	Noise monitoring may be carried out for the purpose of refining construction methods or techniques to minimise noise.	During construction	All Contractors

Reference	Requirement	Timing	Responsibility
NV_M_05	Ongoing spot checks of noise intensive plant and equipment will be undertaken throughout construction to ensure compliance with manufactures specifications.	During construction	All Contractors
NV_M_06	The frequency of site inspections will be increased by the person accountable for onsite noise and vibration issues when activities with a high potential to result in elevated noise emissions are undertaken near residential receptors.	During construction	All Contractors
NV_M_07	Where actual noise levels are found to exceed the predicted worst-case levels, the source of excessive noise generations will be identified, and any additional feasible and reasonable measures available will be implemented to either reduce noise emissions or reduce the impacts on receptors.	During construction	All Contractors
NV_M_08	Where it has been identified that specific construction activities are likely to exceed the relevant noise or vibration goals, noise or vibration monitoring may be conducted at the affected receiver(s) or a nominated representative location (typically the nearest receiver where more than one receiver have been identified). Monitoring can be in the form of either unattended logging or operator attended surveys. The purpose of monitoring is to inform the relevant personnel when the noise or vibrationgoal has been exceeded so that additional management measures may be implemented.	OOHW	All Contractors
Vibration Monitoring			
NV_M_09	For the protection of buildings, monitoring will be carried out at the commencement of vibratory compaction work within 50 metres of buildings to ensure that safe vibration levels specified in Section 6 are not exceeded and to confirm safe working distances.	During construction	All Contractors
NV_M_10	When vibration intensive activities such as tunnel boring machines, roadheaders or rockbreakers are required, vibration monitoring will be carried out within the established buffer zones, or where there is a risk that levels may exceed the relevant structural damage goals.	During construction	All Contractors
NV_M_11	Vibration monitoring may be carried out in response to complaints, exceedances, or for the purpose of refining construction methods or techniques to minimise vibrations.	During construction	All Contractors
NV_M_12	Vibration monitoring will continue throughout construction, where appropriate, at nominated sensitive receptor locations to determine the effectiveness of mitigation strategies.	During construction	All Contractors

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

Acoustic instrumentation employed in the noise monitoring surveys will comply with the requirements of AS1259.2-1990 Acoustics – Sound Level Meters, Part 2: Integrating – Averaging and carry appropriate NATA (or manufacturer) calibration certificates.

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

Vibration monitoring will be carried out in accordance with:

- For structural damage vibration – German Standard DIN 4150 and BS 7385: Part 2 – 1993; and
- For human exposure to vibration – the evaluation criteria presented in the Environmental Noise Management Assessing Vibration: A Technical Guideline (DECC 2006).

Where a non-conformance is detected, or monitoring results are outside of the expected range, the non-conformance process described in the CEMF Section 8 will be implemented.

11.2.1. WSA Stage 1 development Noise monitoring program

In addition to the targeted noise monitoring as required under monitoring requirement NV_M_01 (refer to Table 27), WSA continues to implement a concurrent program of noise monitoring / logging at representative locations which have been identified in consultation with the NSW EPA. Noise monitoring has been undertaken since October 2017 up until the present at the Airport Site for the purpose of obtaining noise data. Baseline noise monitoring data includes monitoring from the WSA EIS and before September 2018. Details of the methodology and sampling locations are provided in the sections below.

The current locations of the noise loggers for the WSA noise monitoring program are shown in Figure 12-1. However, it should be noted that these locations are subject to change and will be dependent on the staging of the construction activities. Any changes in monitoring locations will be in consultation with the NSW EPA and the AEO and will be reflected in the next revision of CEMP documentation.

The WSA noise monitoring is being undertaken using the Svantek SV200 or equivalent noise monitoring stations. The noise monitoring stations are programmed to accumulate 15-minute period of LA90, LA10, LAeq and LAmax sound pressure levels continuously over the entire monitoring period. At monthly intervals (or in response to complaints), the noise monitoring data will be downloaded and analysed. The noise monitoring data will be filtered to exclude any anomalous data and data potentially affected by adverse weather conditions including wind speeds greater than 5 m/s and rain above 0.2 mm/h. The onsite meteorological station located at the southern site will be used for this analysis. A calibration check will be performed remotely on a daily basis using an actuator, which provides a stimulus single of 94.0 dB(A) at 1 kHz. This is to ensure the microphone is recording sound pressure levels within the acceptable tolerance of ± 0.5 dB(A). The noise monitoring sites and monitoring network are considered adequate for monitoring the WSA Development works including bulk earthworks.

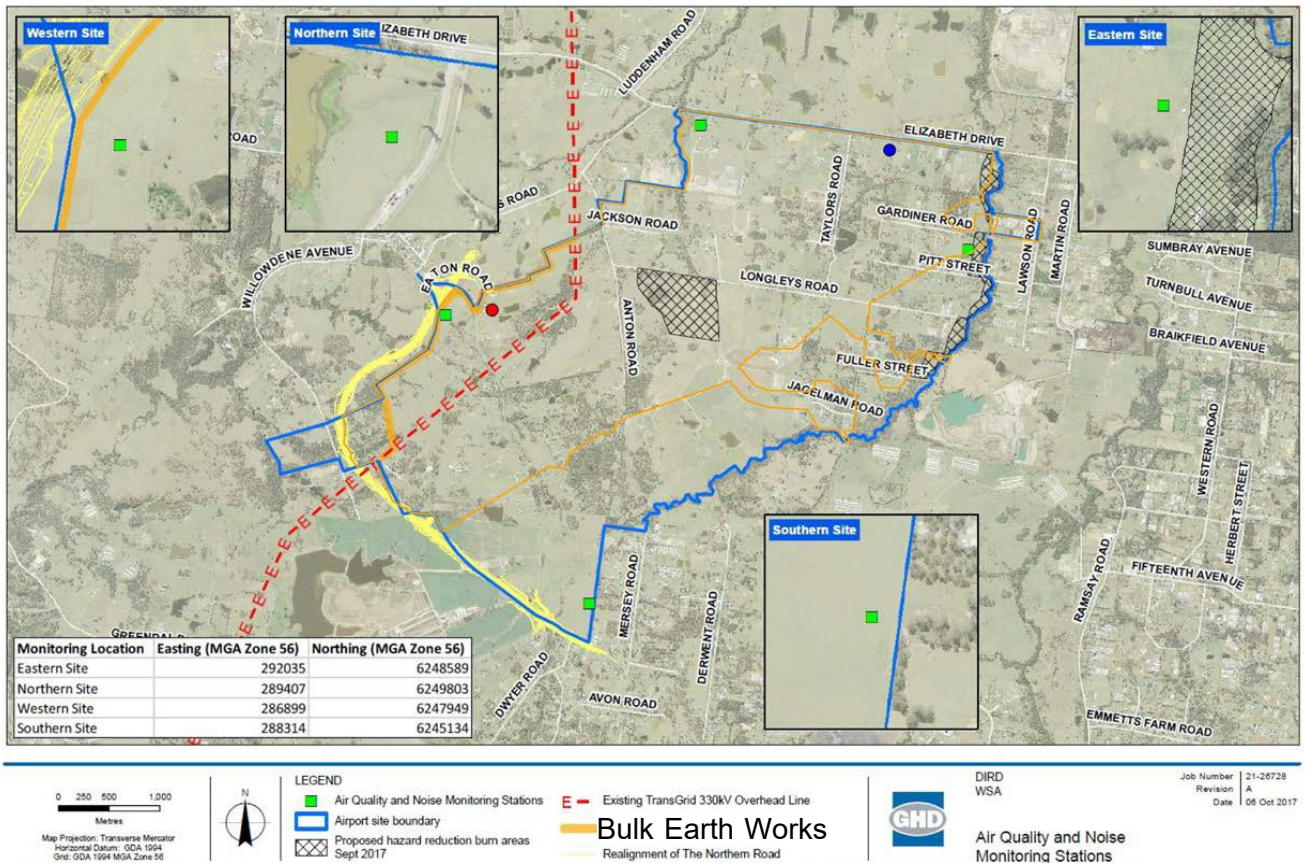


Figure 11-1 WSA Original Noise monitoring locations

11.2.2. Contractor noise monitoring program

Noise monitoring in accordance with AS1055 will be conducted by each contractor at the nearest sensitive receptor locations to determine the effectiveness of mitigation measures against predicted impacts. Noise monitoring to be conducted and results catalogued and subsequently provided must be to Australian Standards 1055 Acoustics - Description and measurement of environmental noise.

During construction monitoring of new activities or new location will be completed within the first two shifts to confirm noise levels are within predicted levels and mitigation measures are appropriate. The locations will be determined by the Contractor Environmental Manger and based on the Contractors noise modelling. Further monitoring will be offered in response to a complaint.

Contractor is to provide Sydney Metro with a monthly summary of all Noise and Vibration monitoring undertaken and advise of compliance with criteria.

11.3. Environmental auditing

Refer to Section 3.16 of the CEMF for environmental auditing requirements, including internal Sydney Metro audits, independent audits and audits to be undertaken by contractors. Auditing and subsequent reporting will be undertaken annually to ensure compliance with this SWCEMP and Airport Plan Conditions of Approval 40.4, 40.5, 40.6 Independent audits about compliance with conditions as identified in Section 4 of this CEMP. Sydney Metro will also undertake periodic audits of the Principal Contractor's Environment and Sustainability Management Systems (E&SMS) and compliance with the environmental aspects of contract documentation, including this NVCEMP.

11.4. Environmental reporting

General environmental reporting requirements are detailed in Section 3.18 the CEMF. In addition, a summary of reporting requirements required under this NV CEMP (including environmental reporting requirements under the Airport Plan specific to this Noise and Vibration CEMP) is provided in Table 35.

Table 12-1 Noise and vibration reporting requirements

Action	Scope	Timing / Frequency	Responsibility
Annual reporting	Unless otherwise agreed in writing by an Approver, an annual report will be prepared in relation to compliance with the Noise and Vibration CEMP (Condition 39). Unless otherwise agreed in writing by an Approver, Sydney Metro will publish each of the annual reports on its website within three months of the end of the period in respect of which the report was prepared, with evidence providing proof of the date of publication to the Infrastructure Department with a copy to the Environment Department. The report must remain on the website for a period of at least 12 months (Condition 39).	Annually	Contractor to provide information to Sydney Metro Environment Manager
Monitoring compliance reporting	Undertaking monitoring as required by this Noise and Vibration CEMP. Contractor is to provide Sydney Metro with a monthly summary of all Noise and Vibration monitoring undertaken and advise of compliance with criteria.	Monthly	All Contractors
Complaints reporting	Recording of complaints and stakeholder interactions.	As required	Sydney Metro Environment Manager Sydney Metro Community and Stakeholder Manager All Contractors

Action	Scope	Timing / Frequency	Responsibility
Pollution and or excessive noise reporting	In accordance with the AEPR, Sydney Metro must give an airport environment officer for the airport, within 14 days, a written report in the event that monitoring results indicate pollution, or excessive noise, occurring as a result of the undertaking of the works associated with the Stage 1 development. The trigger for a 'pollution event' as per the Airports (Environment Protection) Regulations 1997 is provided in the relevant schedules of the AEPR.	As required	Contractor to provide information to Sydney Metro Environment Manager
Reporting of non-conformances and improvement opportunities	The management and reporting requirements of environmental non-conformances and improvement opportunities will be in accordance with Section 3.17 of the CEMF.	As required	Contractor to provide information to Sydney Metro Environment Manager
Environmental Site Register (required under the 6.02(3) of the AEPR)	Environmental Site Register to be kept and maintained to include written record of environmental conditions of the Airport and its environmental management generally. The register is to include the results of monitoring required under section 10.2 and a record of any exceptional incidents that cause excessive pollution and the action taken to resolve the situation	Include in Annual report	Contractor to provide information to Sydney Metro Environment Manager

11.5. Review of approved plans

Sydney Metro will review each approved plan at least every five years (from the date of approval) as required by the Airport Plan. A review will also be completed annually to ensure that it continues to meet the approval criteria. Details of the review will be included in the annual report (refer to Section 8.3 of the CEMF). If the review identifies areas where the plan does not continue to meet the approval criteria for that plan, a variation to the approved plan will be prepared and submitted for approval. Once the reviewed plan is approved by the Approver, this reviewed plan will be the Approved Plan.

The annual review process will include consideration and review of the implemented background noise levels with regards to the accuracy and currency in light of any significant changes in the receiving/background environment. In the event that the background levels are considered to be inaccurate and or out of date, specialist input will be engaged to assess the background levels of the current environment accordingly. Any changes to the background levels will be reflected in a revised CEMP.

Sydney Metro may initiate reviews of Approved Plans at other times in response to improvement opportunities, non-conformances, and changes to scope of work or construction methodology or alterations to legal or contractual requirements. If there is a material change to a WSA CEMP which impacts on an area of the RCIZ, then SM - WSA will review their CEMPs

to reflect that change addressed by the WSA review. Any changes identified and implemented through the variation and review process identified above will be communicated to relevant contractors through re-issue of the revised Sydney Metro Approved Plan and subsequent training and awareness (refer to refer to Section 3.4 of the CEMF).

11.6. Environmental Incidents and complaints management

The management and reporting of environmental incidents shall be undertaken by the appropriate person as detailed in Section 3.12 of the CEMF.

All communications and complaints management will be implemented and managed in accordance with Section 4.2 of the CEMF and the Community Communications Strategy.

12. Competence, training and awareness

To ensure this Noise and Vibration CEMP is effectively implemented, each level of management is responsible for ensuring that all personnel reporting to them are aware of the requirements within. The Sydney Metro Environment Manager will coordinate the necessary and relevant environmental training in conjunction with other training and development activities.

All competence, training and awareness requirements will be implemented as detailed in Section 3.11 of the CEMF.

13. References

Commonwealth Department of Infrastructure and Regional Development, 2016. Airport Plan (December 2016)

Commonwealth Department of Infrastructure and Regional Development, 2016. Western Sydney Airport Environmental Impact Statement, 2016

CONCAWE: May 1981 - The propagation of noise from petroleum and petrochemical complexes to neighbouring communities

Department of Environment and Climate Change (DECC) 2009, Interim Construction Nosie Guideline

NSW Department of Environment and Climate Change, 2006. Environmental Noise Management Assessing Vibration: A Technical Guideline.

Standards Australia 2001. Australian and New Zealand environmental management international standard (AS/NZS ISO 14001).

The Construction Noise and Vibration Standard (CNVS) https://icentral.tdocs.transport.nsw.gov.au/otcs/cs.exe/app/nodes/272123288

Appendix A – Out-of-hour works procedure

A.1 Overview

This work procedure has been developed to assist with compliance of environmental legislation, projectobligations and to effectively manage potential environmental impacts associated with noise during construction of the Project. It is prepared in accordance with the Conditions of the Airport Plan, Environmental Impact Statement (EIS) management measures, and the Noise and Vibration Construction Environmental Management Plan (Noise and Vibration CEMP).

A.2 Objectives

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

Specific objectives include:

- Identify and assess all works proposed outside of the project's standard construction hours;
- Minimising potential adverse noise impacts to the community;
- Identify sensitive receivers and ensure appropriate noise control measures are implementedduring construction activities;
- Ensure appropriate measures are implemented to comply with all relevant legislation and otherrequirements as described in the Noise and Vibration CEMP; and
- Information required by the Contract.

A.3 Project requirements

The project's general construction hours are:

- 7am to 6pm Mondays to Fridays;
- 8am to 1pm Saturdays; and
- Generally, no work on Sundays and other public holidays.

A.4 Out-of-hours work process

The responsible engineer for the out-of-works is to initiate the process when identifying potential works outside of the standard construction hours by populating the relevant sections of the Out-of-Hours Works Permit (Attachment 1) and submitting the permit application to the WSA Environmental Manager.

To provide sufficient time for community notifications, including approval of consultation material, the permit should be initiated up to four (4) weeks prior to critical works (works involving road occupancy licences).

The WSA Environmental Manager will oversee the noise and vibration assessment of the proposed works to determine the predicted level of noise or vibration impact. If proposed out-of-hours works do not comply with the project conditions, the works cannot be undertaken.

A noise and vibration assessment and vibration review shall be completed for all proposed out ofhours works to support the OOHW Permit.

The noise assessment will include:

- details of the nature and scope of each activity and work, including details of times, vehicles, plant, and equipment to be used to undertake that activity or work;
- justification of the scheduling and duration of each activity and work outside the standard construction hours, including considering:
- the predicted impact on noise sensitive receivers of any activities and works undertaken outside the hours; and
- the preference that high noise impact works be undertaken during the day.
- justification of the use of the selected construction and work methods, plant and equipment compared to alternatives taking into consideration noise and vibration impacts;
- a table showing details of the noise and vibration mitigation measures for each activity and work, including respite periods, proposed to be adopted to minimise noise and vibration impacts on surrounding noise sensitive receivers in each locality;
- for Category D and E works:
    - the address of each of the affected noise sensitive receiver;
    - the background noise level for each of the noise sensitive receivers;
    - noise management levels as described in Section 4 of the ICNG (DECC, 2009); and
    - the predicted LAeq (15 min) noise level, incorporating any 5 dB(A) correction for particularly annoying activities as listed on page 16 of the ICNG (DECC, 2009).
- details of the specific noise mitigation measures to be adopted in respect of any activity or work predicted to generate noise levels at any noise sensitive receiver exceeding the noise affected LAeq(15minute) level of background plus 5 dB(A) outside the standard hours;
- the location of noise and vibration monitoring locations in relation to each of the most affected noise sensitive receivers for each activity and work in each noise catchment;
- the EM will document the assessment required by this condition in a report that includes all maps and analyses relied upon in making its determination of:
- whether the proposed activity or work may be undertaken pursuant to project conditions;
- the scheduling of each proposed activity and work;

- the construction methods, plant and equipment used in each activity and work;
- the noise and vibration impact mitigation measures adopted for each activity and work; and
- the location of each noise and vibration monitoring location.

A.4.1 Noise monitoring

Out of hours works monitoring will be completed in accordance with the Section 12 of the WSA Noise and Vibration CEMP. Monitoring will be completed for audible (Categories B to E) that will be ongoing for three or more nights.

Additional noise monitoring based on complaints for periods less than three nights or out of hours on the weekend/public holiday should also be available as needed.

A.4.2 Community notification

WSA will notify the community in accordance with the Community and Stakeholder Engagement Plan.

A.5 Complaints

Any complaints received because of the OOH works are to be managed in accordance with the Noise and Vibration CEMP. OOH works will be monitored for compliance with the approved Noise and Vibration CEMP.

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

All community complaints are managed by the WSA Community Manager.

A.6 Record keeping

All OOHWs applications are recorded electronically and documented with a unique identification number. Each application is entered the OOHW register which will be managed and tracked by the WSA Environment Manager.

All attended noise monitoring results will be recorded as per AS1055 and using “Noise Monitoring FieldSheet” and data entered into the noise monitoring database as required. A summary of the Contractors noise monitoring results will be provided to WSA Environment Manager on a monthly basis.

Appendix B- Example Out-of-hour works permit

Title/Activity:	
Application Date:	
Person Requesting the work:	
Justification why OOHW required:	
Supervisor details:	

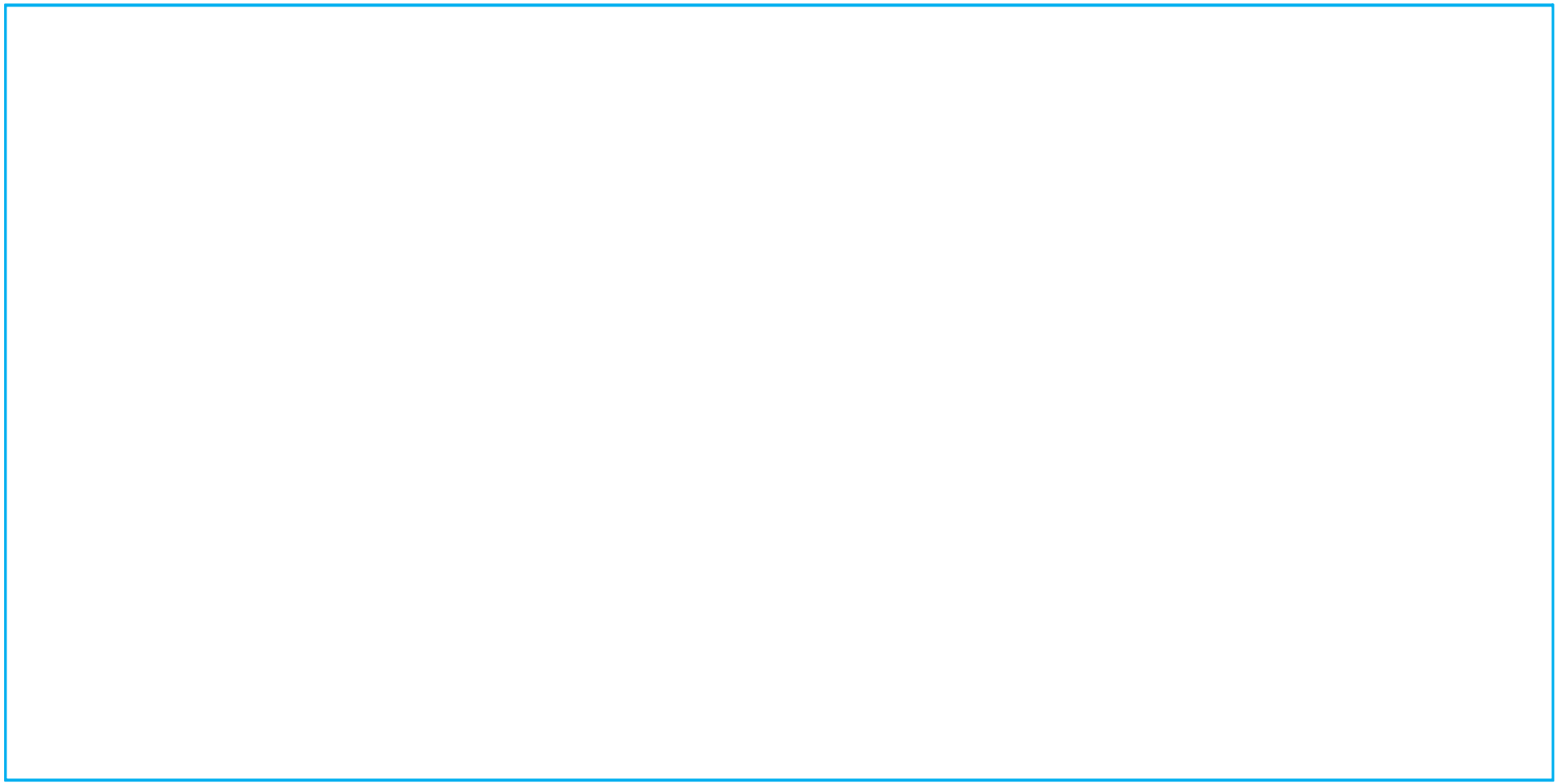
Out of Hours Works Assessment Table 1		
Item	**Description**	**Information/Comments**
1.	Proposed Dates/duration:	
2.	Start Time:	
3.	Finish Time:	
4.	Description of the works:	
	Details on any concurrent constructionactivities being undertaken adjacent/ inclose proximity to the proposed works:	
5.	Plant and equipment to be used: (list all plant and noise generating equipment to be used during the workactivities) e.g. hand tools, generators, crane etc	Complete Table 1
	Are alternative, more quiet/less vibration intensive equipment optionsfeasible for the activity? If yes, why are these not being used?	Yes ☐ No ☐
6.	Names of Forman supervising thework:	
7.	Location of Work: Attach a map of the work area (Figure1)	
	Distance to Nearest ResidentialReceiver:	

Traffic Management		
8.	Will the work require traffic control orimpact on local public roads (y/n)	
	If yes, consider this in the noiseassessment and notification	
	Include the location of traffic impact onmap	
9.	Will lighting be required for the work?(y/n) Angle lighting away from receivers	Yes ☐ No ☐
Noise and Vibration Assessment		
Complete Table 2 to describe the activities and include the predicted noise levels		
10.	Noise Management Level (NML):	
10.1	Sleep disturbance level (night only):	
10.2	Overall Predicted noise (Leq / LA10):	
11.	Acoustic assessment prepared todetermine if works are above RBL +5dB(A) at closest receiver	Category A: no exceedance of NML (RBL +5dB(A)) Category B: 1 –5 above NML Category C: 6 – 15 above NML Category D: 16 – 25 above NML Category E: >25 above NML
12.	What measures are being taken toreduce noise impacts?	
13.	Noise monitoring required?[1]	Yes No Category B – E affecting sensitive receiver occurring for more than 2 consecutive nights or following a complaint
14.	Are vibration impacts expected/isvibration monitoring required?[2]	Yes No
15.	Community notification required for allworks for Category B - E	

Category D and E Works				
16.	Address(es) of theaffected residentialreceivers and their associated RBL	Address	RBL	NML

Table 1 Details of nature and scope of work

Activity No.	Program Activities	Location (e.g. Chainage)	Date & Time	Vehicles, Plant & Equipment Required	Predicted noise level	Sleep Screening (Y/N)	Justification
1							
2							



Map illustrating location of works, affected sensitive receivers and notification area

APPLICANT DETAILS
I certify that the details provided in this application are true and accurate for the work to beperformed. NAME: ..... SIGNATURE: ..... DATE: .....

APPROVALS		
1	SM - WSA Environment Manager	NAME: ..... SIGNATURE: ..... DATE: .....
2	SM - WSA Community Manager	Consultation requirements: NAME: ..... SIGNATURE: ..... DATE: .....

Hard copy to be maintained by foreman on site during works