
Western Parkland City Authority

Bradfield City Centre
Master Plan Application

Noise and Vibration Impact Assessment Report

Prepared by WSP Australia

October 2023

wpca.sydney

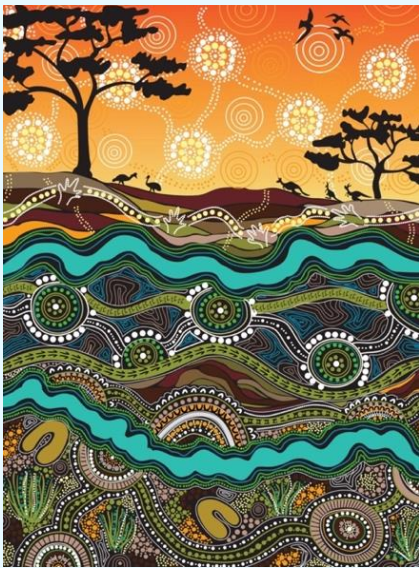
Acknowledgement of Country

Aboriginal people have had a continuous connection with the Country encompassed by the Western Parkland City (the Parkland City) from time immemorial. They have cared for Country and lived in deep alignment with this important landscape, sharing and practicing culture while using it as a space for movement and trade.

We Acknowledge that four groups have primary custodial care obligations for the area: Dharug/Darug, Dharawal/Tharawal, Gundungurra/Gundungara and Darkinjung. We also Acknowledge others who have passed through this Country for trade and care purposes: Coastal Sydney people, Wiradjuri and Yuin.

Western Sydney is home to the highest number of Aboriginal people in any region in Australia. Diverse, strong and connected Aboriginal communities have established their families in this area over generations, even if their connection to Country exists elsewhere. This offers an important opportunity for the future of the Parkland City.

Ensuring that Aboriginal communities, their culture and obligations for Country are considered and promoted will be vital for the future of the Parkland City. A unique opportunity exists to establish a platform for two-way knowledge sharing, to elevate Country and to learn from cultural practices that will create a truly unique and vibrant place for all.



Garungarung Murri Murri Nuru
(Beautiful Grass Country)

Artwork created by Dalmarrri artists Jason Douglas and Trevor Eastwood for the Western Parkland City Authority

Version	Status	Date	Prepared By	Reviewer	Comments
Rev 1	For Client Review	18/02/2022	Ben Ison	Tom Krikke	Initial Draft
Rev 2	For Client Review	29/03/2022	Ben Ison	Tom Krikke	Draft Final
Rev 3	For Client Review	11/11/2022	Ben Ison	Rebecca Warren	Draft Final
Rev 4	TAP Issue Only	25/11/2022	Ben Ison	Rebecca Warren	Draft Final
Rev 5	For Client Review	14/06/2023	Scott Henley	Ben Ison	Draft Final
Rev 6	Draft Final Submission	21/07/2023	Scott Henley	Ben Ison	Draft Final
Rev 7	Final Submission	2/08/2023	Ben Ison	Max Chipchase	Final
Rev 8	For Publishing	17/08/2023		Jason Azucena	Minor updates
Rev 9	For Publishing	13/09/2023		Jason Azucena	Amendment to Table 1
Rev 10	For Publishing	19/10/2023		Hannah Gilvear	Update Lot and DP

Executive Summary

WSP have been commissioned by the Western Parkland City Authority (WPCA) to provide high level master planning input relating to potential noise and vibration impacts for the Bradfield City Centre Master Plan.

Land use planning processes provide the most efficient mechanisms to avoid noise-related land-use conflicts. Incorporating best-practice acoustic design in the built environment can help create communities with healthy levels of environmental noise and reduce the risk of adverse environmental noise exposure. A variety of noise and vibration legislation, standards and guidelines exist to ensure that noise is kept in-balance with the social and economic value of industry to NSW, including the *State Environmental Planning Policy (Precincts – Western Parkland City) 2021* (Western Parkland City SEPP) and relevant Development Control Plan.

The Master Plan considers and protects the Future Infrastructure Corridor as identified in the State Environmental Planning Policy (Transport and Infrastructure) 2021. Future developments will be assessed against the relevant EPI's and relevant agency guidelines to demonstrate that the proposal will not result in adverse noise impacts.

A variety of noise and vibration impacts that may potentially impact upon the core precinct have been considered and reviewed within this report. The following key recommendations have been provided:

Maximise the set-back of residential developments from major transport corridors to reduce traffic noise and vibration at residences

Site commercial buildings along major roads to act as noise barriers for more sensitive land uses

Use Crime Prevention Through Environmental Design (CPTED) principles to minimise anti-social behaviour

Maximise the use of soft surfaces and green spaces to reduce noise reflection and associated noise build-up within urban areas

Group similar land uses to avoid acoustic conflicts

Utilise soundscape design, through active (electronic) or passive (natural) means, to promote a more pleasant and coherent environment through spatial planning and urban design. It is noted that further detail to be undertaken as the Master Plan and development progresses.

An assessment of potential noise and vibration impacts and opportunities for acoustic management and mitigation has been completed for the Masterplan city concept.

This document has considered the Masterplan design and best practice acoustic planning and design principles. Ultimate planning approvals for each development within the core precinct will be assessed and approved on a project by project basis. As such, this report is intended to introduce relevant acoustic legislation in NSW and present planning and design level opportunities for the effective management of noise and vibration within the Bradfield City Centre Master Plan.

Further detailed analysis will be required as more detailed project and design information becomes available to assess the potential noise and vibration impacts. This includes potential road traffic numbers, building designs, etc., and will be undertaken as part of the approvals process for each individual development.

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Glossary of Terms

AS	Australian Standard
Aerotropolis	Western Sydney Aerotropolis
BC Act	Biodiversity Conservation Act 2016
CIV	Capital Investment Value
DA	Development Application
Decibels (dB)	The level of noise is measured objectively using a sound level meter. The range of pressure variations associated with everyday living may span over a range of a million to one. Instead of expressing pressure in this enormous range of unit, it is convenient to condense this range to a logarithmic scale and give it the units of decibels. <i>20db quiet bedroom at night or recording studio</i> <i>30db quiet library or quiet location in the country</i> <i>40db living room</i> <i>50db typical office space or ambience in the city at night</i> <i>60db normal conversational speech</i> <i>70db a car passing by</i> <i>80db kerbside of a busy road</i> <i>90db truck passing by</i> <i>100db nightclub</i> <i>110db rock band or 2m from a jackhammer</i> <i>120db loud construction equipment such as concrete saw or hydraulic rock breaker</i> <i>130db threshold of pain</i> <i>140db 25m from a jet aircraft</i>
dBA: A-weighted decibels	The ear is not as effective in hearing low frequency sounds as it is hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the “a” filter. A sound level measured with this filter switched in is denoted as dB(A). Most environmental noise is measured using the ‘A’ filter.
DP	Deposited Plan
DPE	Department of Planning and Environment
EP&A Act	Environmental Planning and Assessment Act 1979
EP&A Regulation	Environmental Planning and Assessment Regulation 2000
Frequency	The time rate for each wave peak (of a sound or vibration wave) to pass a given point. Frequency is measured in Hertz (Hz).
LEP	Local Environmental Plan
LGA	Local Government Area

Loudness	A 3db increase represents a doubling of the sound pressure, however an increase of about 10db is required before the sound will subjectively appear to be twice as loud. That is, a sound of 85db is twice as loud as a sound of 75db which is twice as loud as a sound of 65db and so on. The smallest change which can be readily heard is approximately 2db. An increase beyond 5db is considered to represent the level at which a change in loudness begins to be clearly perceived.
NSW Government	State Government for NSW
Resonance	The reinforcement or prolongation of sound or vibration by the synchronous vibration of a neighbouring object.
Resonance frequency	A frequency at which resonance occurs.
SEPP	State Environmental Planning Policy
Structure-borne noise	Vibration propagating through solid structures in the form of compression or bending waves, heard as sound.

References

Ref	Title	Author	Date
1	Interim Construction Noise Guideline	Department of Environment and Climate Change	2009
2	Noise Policy for Industry	EPA	2017
3	NSW Road Noise Policy	Department of Environment, Climate Change and Water	2011
4	Rail Infrastructure Noise Guideline	EPA	2013
5	Assessing Vibration: a technical guideline	Department of Environment and Conservation	2006
6	Development near rail corridors and busy roads – Interim guideline	Department of Planning and Environment	2008
7	NSW State Environmental Planning Policy	NSW Government	2021
8	Western Sydney Aerotropolis Development Control Plan – Phase 2	Western Sydney Planning Partnership	2022
9	SEPP (Precincts – Western Parkland City) 2021	Department of Planning and Environment	2021
10	Western Sydney Aerotropolis Plan	NSW State Government	2020
11	Western Sydney Aerotropolis Precinct Plan	Department of Planning and Environment	2023
12	Australian Standard 2021: Acoustics – Aircraft noise intrusion – Building siting and construction	Australian Standards	2015
13	Australian / New Zealand Standard 2107: Acoustics – Recommended design sound levels and reverberation times for building interiors	Australian / New Zealand Standards	2016
14	Apartment Design Guide, Tools for improving the design of residential apartment development	Department of Planning and Environment	2015

1 Introduction

1.1 Purpose of this report

This report accompanies the Master Plan Application for the Bradfield City Centre submitted to the Department of Planning and Environment (DPE).

It considers potential noise and vibration sources within the project area, assesses their potential impacts and provides recommendations and mitigation to minimise any potential land use conflicts.

All matters were considered to have been adequately addressed within the Master Plan Application or in the accompanying appendices.

1.2 The Western Sydney Aerotropolis

The Western Sydney Aerotropolis is an 11,200-hectare region set to become Sydney's third city (the Western Parkland City), and the gateway and economic powerhouse of Western Sydney.

The Aerotropolis comprises of the new Western Sydney (Nancy-Bird Walton) International Airport surrounded by five initial precincts which include the Aerotropolis Core, Wianamatta – South Creek Northern Gateway, Agri-business and Badgerys Creek outlined in **Figure 1** below.

The final Aerotropolis planning package, including the Precinct Plan and State Environmental Planning Policy (SEPP) Amendment, was gazetted by DPE in March 2022 and the Development Control Plan Phase 2 was finalised in November 2022. These documents have been used to inform the preparation of the Bradfield City Centre Master Plan.

The proposed Master Plan Application for the site has also been prepared using the Western Sydney Aerotropolis Master Plan Guideline and Master Plan Requirements.

2 Bradfield City Centre

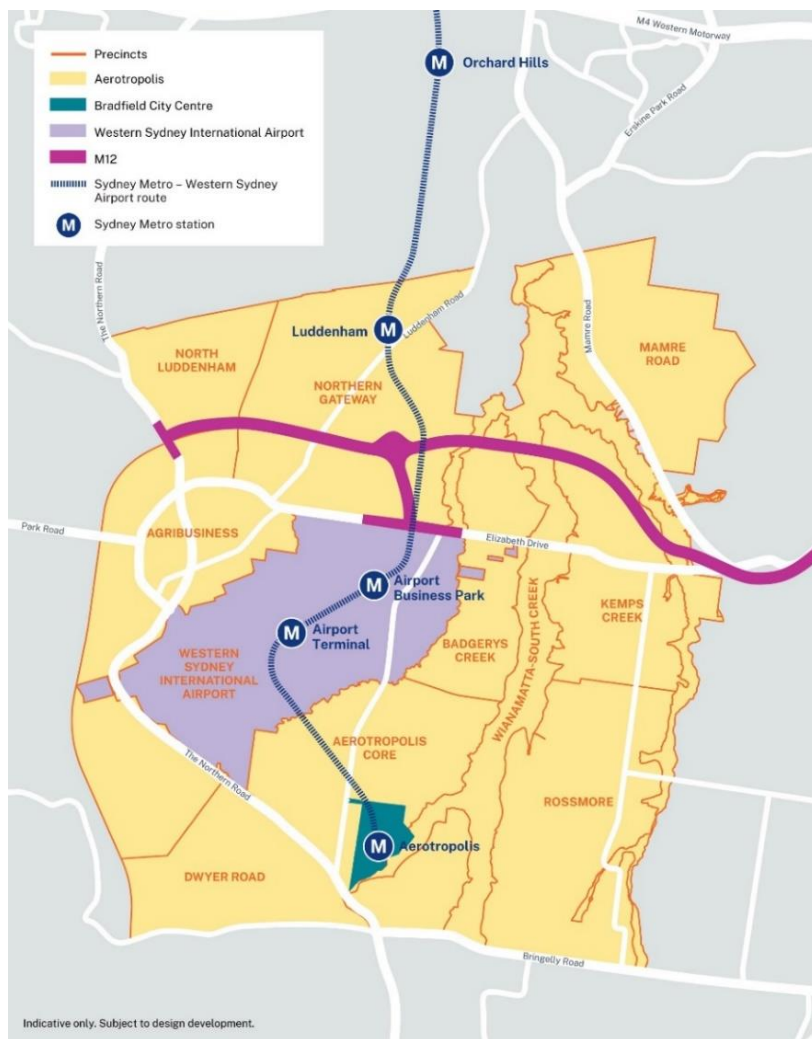
2.1 Strategic Context

The Bradfield City Centre is located to the south-east of the new Western Sydney International (Nancy-Bird Walton) Airport at the intersection of Badgerys Creek Road and The Northern Road (see **Figure 1** below).

The Sydney Metro Western Sydney Airport line runs through the site, providing connections from the key centre of St Marys through to stations at Orchard Hills, Luddenham, Airport Business Park, Airport Terminal and the Aerotropolis which is located within the site. Separate from the Metro, there is a Major Infrastructure Corridor which provides provision for future potential rail infrastructure.

The site is surrounded by several key roads and infrastructure corridors including Bringelly Road, Badgerys Creek Road, Elizabeth Drive, M12 and The Northern Road.

Figure 1 Strategic Context



Set on natural waterways, Bradfield City Centre presents a rare opportunity to showcase the best urban design and to create a thriving, blue and green, connected City in which Australians will want to live, learn and work. The Bradfield City Centre will be a beautiful and sustainable 22nd Century City. It will foster the innovation, industry and technology needed to sustain the broader Aerotropolis and fast track economic prosperity across the Western Parkland City.

2.2 The Master Plan Site

The street address for Bradfield City Centre is 215 Badgerys Creek Road, Bradfield (the Site) within the Liverpool Council Local Government Area (LGA). The site is legally described as Lot 3101 DP 1282964 and has an area of 114.6 hectares, with road access to Badgerys Creek Road located at the north-western corner. The site spans across the Aerotropolis Core and Wianamatta-South Creek Precinct, within Western Sydney Aerotropolis. The Site is outlined in

Figure 2 below.

The Site is predominantly zoned Mixed Use under the Western Parkland City SEPP, with a small portion of Enterprise zoned land located on the north-western corner of the site. The site also includes Environment and Recreation zoned land mostly along Thompson Creek.

Figure 2 Master Plan Site



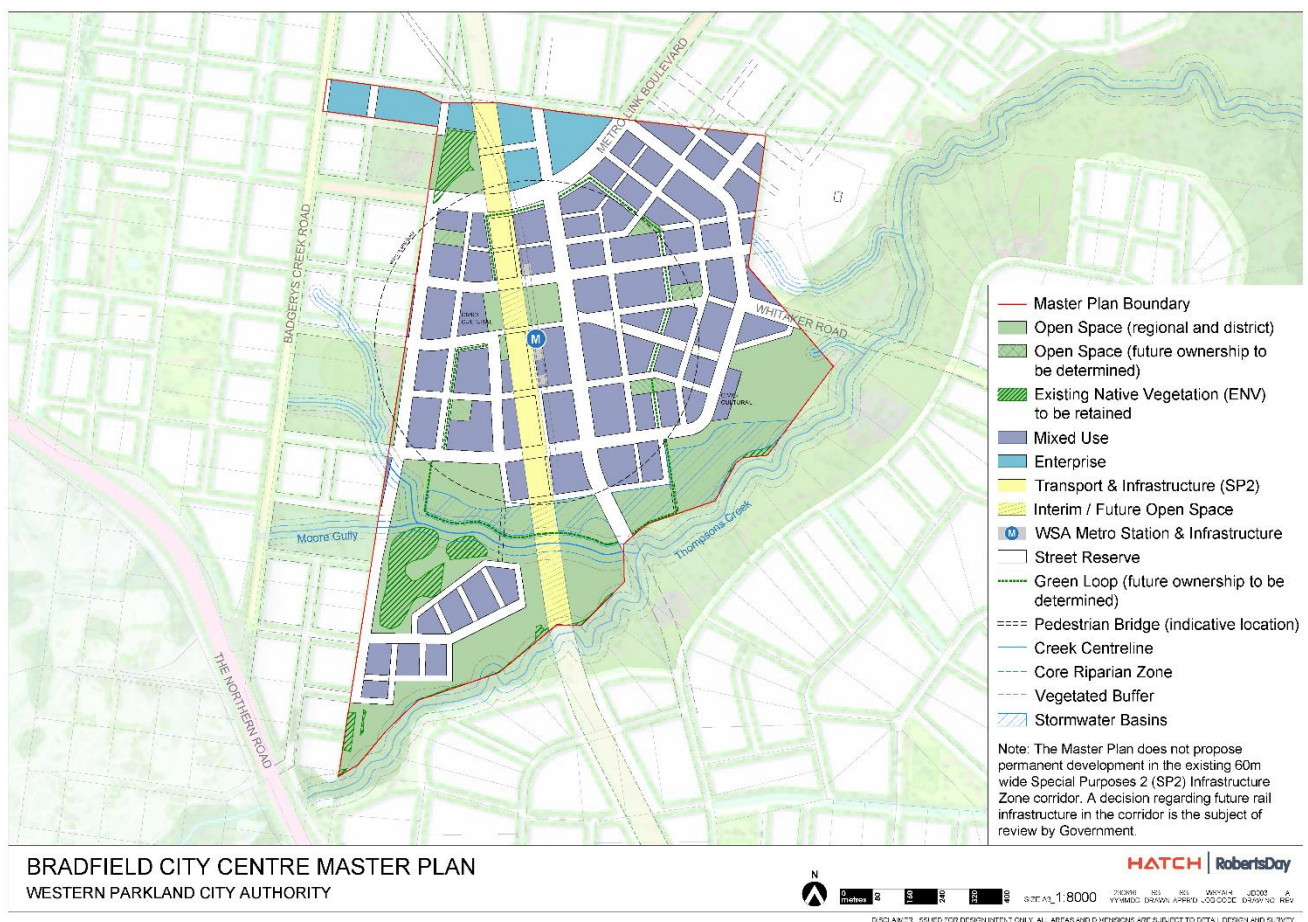
2.3 The Bradfield City Centre Master Plan

The Western Parkland City Authority has prepared a Master Plan (Figure 4 below) in accordance with the DPE Master Plan Requirements.

The Master Plan sets out a framework for future development within the Bradfield City Centre which includes:

- Road network, key connectors to adjoining land and the regional road network (existing and future)
- Block structure
- Indicative open space network
- Sustainability strategy
- Social and infrastructure strategy
- Arts and culture strategy
- Infrastructure servicing strategy

Figure 3 Master Plan



2.4 The Proposal

The Bradfield City Centre Master Plan is intended to facilitate the growth of the centre over time. The Master Plan has established the following three planning horizons for technical assessments.

Table 1 - Planning & Development Horizons

Phase	Indicative Timeframe	Estimated employment	Estimated residential population	Estimated Gross Floor Area (cumulative)
Immediate	2026	1,000 - 1,200 jobs	0 residents	48,500 sqm
Medium-term	2036	8,000 - 8,300 jobs	3,000 - 3,100 residents	341,000 sqm
Long-term	2056	20,000 – 24,000 jobs	15,000 – 15,200 residents	1,258,000 sqm

Note: The table above is an estimate of the population and employment forecast used for the purposes of modelling only.

The master plan has the capacity to accommodate ~10,000 residential dwellings. In accordance with NSW Government policy a proportion of the residential dwellings will be affordable housing. The timing and delivery of residential dwellings will be subject to market demand and future master plan reviews that consider the impact of additional population on the scope and timing of social and physical infrastructure.

3 Baseline investigations

This section outlines the main considerations within Stage 1 of the Bradfield City Centre Masterplan for the management of noise and vibration.

3.1 Technical baseline site consideration

A variety of noise and vibration sensitive receivers are proposed within the Stage 1 precinct. The proposed areas for these sites are presented in **Figure 3** and may include:

- Residential properties (including retirement homes)
- Educational facilities (including libraries and childcare facilities)
- Medical and research facilities
- Hotels / accommodation
- Open space (active and passive recreational areas)
- Community centres
- Offices, commercial, industrial premises
- Highly vibration sensitive receivers such as medical or electronic facilities

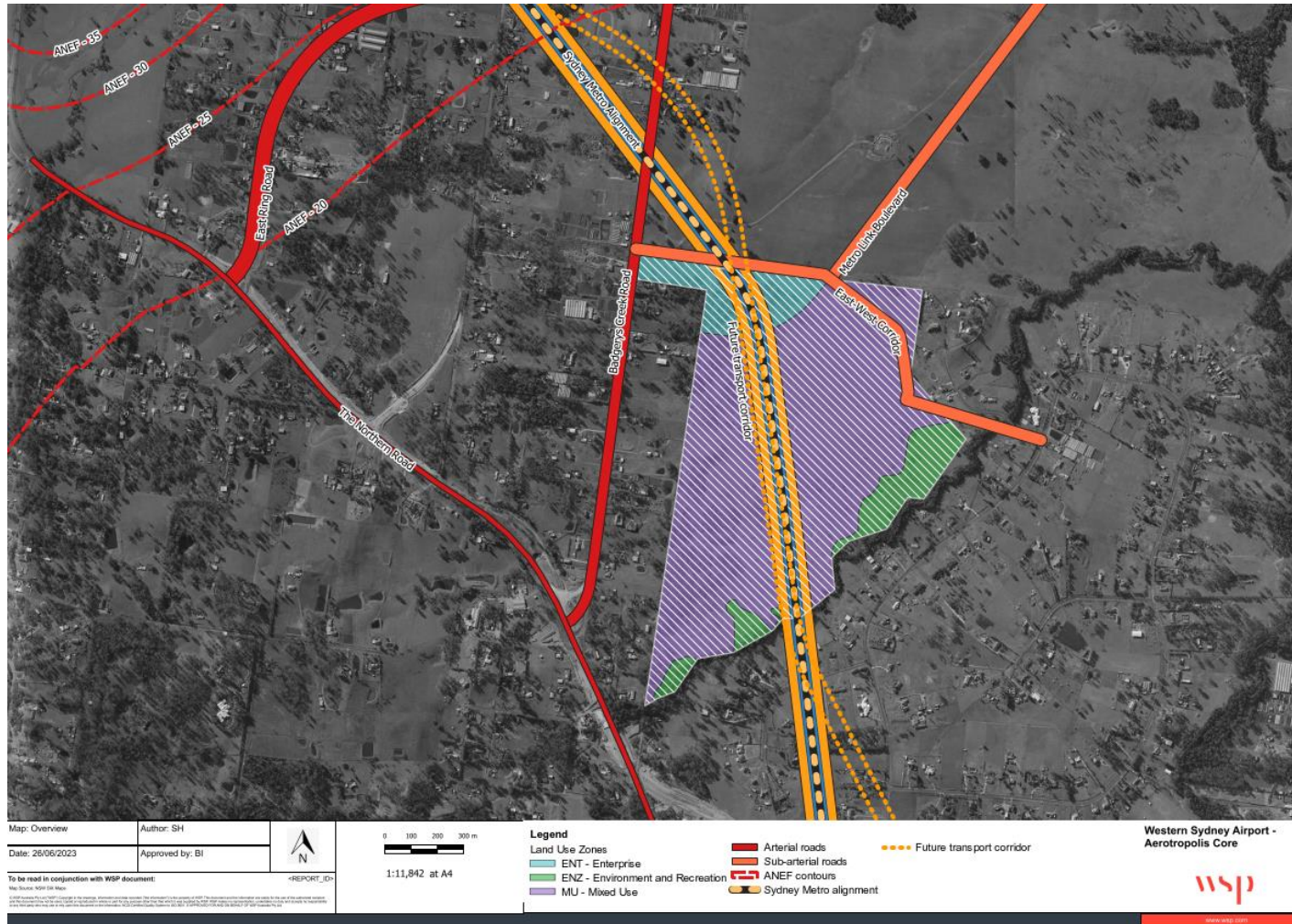
The receiver types will be known at detailed design and assessed against the relevant noise objectives at DA. Any future development is to comply with the Rail Infrastructure Noise Guidelines.

3.2 Area of Focus

The Stage 1 and the wider Bradfield City Centre area are potentially impacted by a range of regional and local noise sources. The primary external noise sources that may impact receivers within the precinct are presented in **Figure 4** and include:

- Western Sydney (Nancy-Bird Walton) Airport
- Take-off and landing / Fly-overs
- Arterial and sub arterial roads including:
 - The Northern Road
 - Eastern Ring Road
 - East - West connection
- Sydney Metro – Western Sydney Airport (including stations and service facilities)
- Future Transport corridors
- Local roads / car parks
- Entertainment / active recreational areas

Figure 4 Overview of the Bradfield Precinct and external major noise and vibration sources (source: WSP Australia, 2022)



4 Assessment Requirements and Policy Context

4.1 Master Plan Requirements

The DPE have issued Master Plan Requirements (MPRs) to the Authority for the preparation of a Master Plan for Bradfield City Centre. This report has been prepared to address the following MPRs.

Table 2 - Master Plan Requirements

Reference	Master Plan Requirement	Where addressed
18	Noise and vibration The Master Plan must include a noise and vibration assessment, prepared in accordance with the relevant Environment Protection Authority guidelines, detailing any noise and vibration impacts on sensitive receivers within the Master Plan site and surrounding area, and outline any required management and mitigation measures.	Section 6
Part B – dot point #2	Noise and vibration assessment (prepared by a suitably qualified person and in line with policies and guidelines).	Whole Report

4.2 National and State Government Plans/Policies

No National Plans or Policies apply to this development.

The following state policies apply to the management of noise and vibration impacts within and arising from, this development.

Table 3 – Relevant State noise policies

Acoustic Aspect	Description	Guideline
Airborne noise	Assessment of road noise	<i>NSW Road Noise Policy</i> (DECCW, 2011)
	Assessment of industrial noise	<i>NSW Noise Policy for Industry</i> (EPA, 2017)
	Assessment of transport and infrastructure noise	<i>NSW State Environmental Planning Policy (Transport and Infrastructure)</i> (NSW Government, 2021)

4.3 Western Sydney Aerotropolis

4.3.1 Western Sydney Aerotropolis Development Control Plan Phase 2

Noise generation can be expected within any urban area, and it is important that impacts are managed appropriately to ensure that sensitive uses have high levels of amenity and employment uses can continue to operate without undue restrictions. The Western Sydney Aerotropolis Development Control Plan – Phase 2 (Western Sydney Planning Partnership, 2022) (Aerotropolis DCP Phase 2) provides controls to guide the preparation of Master Plans and Development Applications.

Performance outcomes relevant to noise and vibration have been outlined in each subject matter section of the Aerotropolis DCP Phase 2 and are replicated below in Table 5.

Table 4 – Aerotropolis DCP performance outcomes

Numeric Section	Subject matter	Performance outcome	Benchmark solution	Master Plan consideration and comment
2.4.2 O	Native vegetation and biodiversity	Noise and light adjacent, and near, conservation areas does not result in any disturbance to wildlife	... 3. Manage light spill and noise producing activities where wildlife impacts are likely to arise from the proposed development and where development is adjacent to avoided land. Measures shall include appropriate noise treatment barriers along major roads and other light and noise mitigation measures. 4. Ensure that any residual noise impacts on wildlife arising from development are appropriately mitigated.	Land use and site layout within the Masterplan has considered potential noise and vibration generation and impacts on adjoining land uses in accordance with the Aerotropolis DCP Phase 2 and all other relevant guidelines and standards. The assessment of potential impacts is outlined in Section 7 and management / mitigation solutions are presented in Section 8.
3.3.3 PO1	Building siting and design. Landscape setbacks	To provide functional areas of planting that enhance the presentation of a building, provide amenity, cooling and shade, and contribute to overall streetscape character.	...6. Developments adjoining existing sensitive receivers (e.g. educational establishments) shall be designed to mitigate impacts on sensitive receivers such as through generous buffer zones and landscaping, and locating noise generating activities away from the sensitive interface, as well as traffic management measures to improve safety and minimise conflicts...	High level mitigation has been recommended to minimise any potential land use conflicts have been effectively incorporated into Section 7 of this masterplan. These will be delivered and refined through detailed design and future Development
2.10.2 PO1	Airport safeguarding	Development within the ANEC 20 and above contours (including extensions to existing development) is constructed to achieve indoor design sound levels as per the Indoor Design Sound Levels for Determination of Aircraft Noise Reduction in AS 2021 – Acoustics Noise Intrusion – Building Siting and Construction.	1. Residential development is constructed in accordance with Table 3 OR 2. An acoustic report is provided which specifies the construction standards required to achieve the specified indoor design sound levels. Note: Residential development within the ANEC 20 and above contours will only be permitted where provided under clause 19(4) of the Aerotropolis SEPP or existing use rights apply. Development of residential accommodation will have the option of either incorporating the specified construction standards or provide an acoustic report. All other noise sensitive development specified within Table 4 of AS2021 will be required to be accompanied by a report prepared by a suitably qualified and experienced acoustic engineer.	

Numeric Section	Subject matter	Performance outcome	Benchmark solution	Master Plan consideration and comment
2.16 O6	Waste management and recovery	Waste management systems minimise negative impacts on the streetscape, public domain, building presentation or amenity of pedestrians, occupants and neighbouring sites.	...2. Collection points and systems are designed to minimise noise for occupants and neighbours during operation and collection.	Applications for each individual project. Land use and site layout within the Masterplan has considered potential noise and vibration generation and impacts on adjoining land uses in accordance with the Aerotropolis DCP Phase 2 and all other relevant guidelines and standards. The assessment of potential impacts is outlined in Section 7 and management / mitigation solutions are presented in Section 8. High level mitigation has been recommended to minimise any potential land use conflicts have been effectively incorporated into Section 7 of this masterplan. These will be delivered
3.7 PO1	Noise and Amenity	To ensure noise and vibration do not adversely impact human health and amenity. To ensure building design adequately protects workers and surrounding receivers from noise and vibration.	1. Any machinery or activity considered to produce noise emissions from a premise shall be adequately sound-proofed so that noise emissions are in accordance with the provisions of the Protection of the Environment Operations Act 1997. 2. Noise should be assessed in accordance with Noise Policy for Industry (EPA, 2017) and NSW Road Noise Policy (Department of Environment, Climate Change and Water, 2011). 3. An Acoustic Report by a qualified acoustical engineer must be submitted where proposed development, including traffic generated by that development, will create noise and/or vibration impacts, either during construction or operation, that impacts on adjoining developments or nearby rural-residential areas. The Acoustic Report NOVEMBER 2022 Aerotropolis Phase 2 DCP 70 Performance Outcome Benchmark Solution should outline the proposed noise amelioration strategies and management methods. 4. Acoustic Reports for individual developments must assess cumulative noise impacts, including likely future noise emissions from the development and operation of the Precinct. The consultant should liaise with the relevant	

Numeric Section	Subject matter	Performance outcome	Benchmark solution	Master Plan consideration and comment
			consent authority to determine acceptable amenity goals for individual industrial developments and background noise levels. 5. The use of mechanical plant and equipment may be restricted in areas close to sensitive receivers, such as adjoining rural-residential development and educational establishments. 6. Building design is to incorporate noise amelioration features. Roof elements are to control potential breakout noise, having regard to surrounding topography. 7. Boundary fences are to incorporate noise amelioration features and control breakout noise having regard to developments adjoining rural-residential areas	and refined through detailed design and future Development Applications for each individual project. Land use and site layout within the Masterplan has considered potential noise and vibration generation and impacts on adjoining land uses in accordance with the Aerotropolis DCP Phase 2 and all other relevant guidelines and standards. The assessment of potential impacts is outlined in Section 7 and management / mitigation solutions are presented in Section 8. High level mitigation has been recommended to minimise any potential land use conflicts have been effectively incorporated into Section 7 of this masterplan.
6.2 PO2	Night-time economy uses	Night-time uses are designed to have minimal adverse impacts on the comfort and safety of patrons, nearby residents and the broader community while balancing the choice to reside as part of the urban lifestyle within centres.	... 2. Night-time uses shall include noise mitigation measures to manage any land use conflicts...	
6.3 PO1	Animal boarding or training establishments	Development does not impact the amenity of adjacent neighbours	... 6. An acoustic report demonstrates relevant acoustic measures have been implemented to mitigate noise impact on adjoining properties and the public domain	

Numeric Section	Subject matter	Performance outcome	Benchmark solution	Master Plan consideration and comment
6.4 PO2	Tourist and visitor accommodation	Tourist and visitor accommodation provide adequate amenity for the purpose of short term stays only	... 3. Any noise generating activities and areas that cause exposure to sensitive uses on neighbouring site are restricted between 10pm - 7am.	These will be delivered and refined through detailed design and future Development Applications for each individual project.
Appendix D.28	Noise and vibration reports	-	The following documents (where relevant) must be considered when preparing an acoustic report for submission: a. NSW EPA Noise Policy for Industry (NPfI); b. NSW EPA Noise Guide for Local Government; c. NSW EPA Road Noise Policy; d. NSW Department of Planning, Development Near Rail Corridors and Busy Roads – Interim Guideline; e. NSW Department of Environment and Climate Change, Interim Construction Noise Guideline; and f. All relevant and applicable Australian Standards relating to acoustics and noise generated by different sources (or any subsequent editions of the documents listed above).	Land use and site layout within the Masterplan has considered potential noise and vibration generation and impacts on adjoining land uses in accordance with the Aerotropolis DCP Phase 2 and all other relevant guidelines and standards. The assessment of potential impacts is outlined in Section 7 and management / mitigation solutions are presented in Section 8. High level mitigation has been recommended to minimise any potential land use conflicts have

Numeric Section	Subject matter	Performance outcome	Benchmark solution	Master Plan consideration and comment
				been effectively incorporated into Section 7 of this masterplan. These will be delivered and refined through detailed design and future Development Applications for each individual project.

Future development will be the subject of determination by the consent authority and will require assessment against the relevant EPIs including noise and vibration DCP requirements to ensure measures are put in place to mitigate potential impacts. Detailed assessment will be undertaken which includes noise impacts on sensitive receivers within the city and noise generated from the future development including plant.

4.3.2 Western Parkland City SEPP

The State Environmental Planning Policy (Precincts – Western Parkland City) 2021 (Western Parkland City SEPP) applies to Bradfield. Relevant development controls in the Aerotropolis SEPP have been reproduced below:

(...)

Part 4.3 Development controls – Airport safeguards

4.17 Aircraft noise

(...)

2 Development consent must not be granted to noise sensitive development if the development is to be located on land that is in an ANEF or ANEC contour of 20 or greater.

(...)

4 Despite subclause (2), development consent may be granted to development for the purposes of dwelling houses on land that is in an ANEF or ANEC contour of 20 or greater if –

a immediately before the commencement of this Policy –

i there were no dwellings on the land, and

ii development for the purposes of dwelling houses was permitted on the land, and

b the consent authority is satisfied that the development will meet the indoor design sound levels.

5 Development consent must not be granted to noise sensitive development on the following land unless the consent authority is satisfied the development will meet the indoor design sound levels –

a land shown on the Land Application Map that is not in an ANEF or ANEC contour of 20 or greater,

b land shown on the Obstacle Limitation Surface Map.

(...)

The proposed Master Plan has been developed in accordance with the requirements of this SEPP.

4.3.3 Western Sydney Aerotropolis Plan

The WSAP sets out 11 objectives to shape decision-making across the four themes of the Greater Sydney Region Plan: productivity, sustainability, infrastructure and collaboration, and liveability. These objectives are supported by landscape, urban design and planning principles.

The WSAP outlines a number of requirements that are relevant to reducing noise impacts within the Aerotropolis Core precinct. These are summarised below:

- Safeguard the 24-hour airport
 - Development that will impact upon the aviation operations of the Airport will not be supported. New residential and other noise sensitive development will not be located within the ANEC/ANEF 20 and above contours
- Precinct planning: Aerotropolis Core Precinct
 - Residential communities and other noise sensitive land uses will be located outside the ANEC/ANEF 20 and above contours and within 800 metres or a 10-minute walk of the Metro station.
- Planning Principles:
 - PR8: reduce aircraft noise impacts and prohibit intensification of residential development within the ANEC/ANEF 20 and above contours.

4.3.4 Western Sydney Aerotropolis Precinct Plan

The Precinct Plan provides the place-based objectives and requirements to guide development in the Aerotropolis in a consistent and sustainable manner over time. This Plan sets out the finer grain detail to support the land use zoning and other provisions of the Aerotropolis SEPP.

The following relevant noise objectives and requirements are contained in the Precinct Plan:

- Precinct Vision and Plan Objective
 - Precinct plan 04: Protect Airport operations, including 24-hour operations, and protect future communities from aircraft noise.
- Aerotropolis Core Additional Precinct Objective
 - Additional Precinct Objective 06: Enable residential development as part of a diverse mixed use sub-precinct in areas that are not impacted by airport noise and that benefit from proximity to Wianamatta-South Creek and Thompsons Creek
- Urban Structure - Development adjacent to protected transport corridors
 - Requirement PC1: Development adjacent to corridors identified on the Transport and Infrastructure SEPP and the Aerotropolis SEPP is to be designed to orient noise sensitive elements (for example habitable rooms) away from the noise source.

4.4 Other Relevant Technical Standards

Development Near Rail Corridors and Busy Roads – Interim Guideline (NSW Department of Planning, 2008)

Rail Infrastructure Noise Guideline (NSW Environmental Protection Authority, 2013) (RING)

Assessing Vibration: A Technical Guideline (NSW Department of Environment and Conservation, 2006) (AVaTG)

Australian Standard 2021:2015 Acoustics – Aircraft noise intrusion – Building siting and construction (AS 2021)

Australian / New Zealand Standard 2107:2016 – Acoustics – Recommended design sound levels and reverberation times for building interiors (AS/NZS 2107)

Apartment Design Guide, Tools for improving the design of residential apartment development (NSW Department of Planning and Environment, 2015)

The proposed Master Plan has been developed in accordance with these relevant technical standards.

4.5 Summary of Key Implications for Master Plan

Land use and site layout within the Masterplan will consider potential noise and vibration generation and impacts on adjoining land uses in accordance with the Aerotropolis DCP Phase 2 and all other relevant guidelines and standards.

The assessment will consider potential impacts in accordance with the Protection of the Environment Operations Act 1997 and *NSW Noise Policy for Industry 2017* and other relevant guidelines.

Recommendations and mitigation to minimise any potential land use conflicts will be effectively incorporated into the Masterplan.

Potential construction phase impacts will be considered on a project-by-project basis during the standard planning approvals process.

More detailed assessments will be conducted during the planning approvals process for each individual project.

5 Technical Approach/ Framework

Table 5 provides a high-level summary of the noise and vibration aspects with the potential to impact on future developments within the Masterplan. Sections 6 and 7 provide more detailed assessments of each aspect.

Table 5 – High-level summary of noise and vibration impacts to the Bradfield Masterplan

Acoustic Aspect	Description	Guideline
Technical Assessment		
Aircraft noise	Sleep disturbance from 24/7 airport operations or fly-overs	Low Due to the large separation distance, any noise impact on residences is considered to be minimal and outside the control of master planning.
Major Roads	Noise impact from Badgerys Creek Road and The Northern Road.	Medium Ensure fit-for-purpose developments along major transport corridors. Use commercial buildings sited along major roads to act as a noise barrier.
Sydney Metro	Noise emissions from patrons and building services around the Station precinct. Anti-social behaviour also a risk.	Medium-low Ensure fit-for-purpose development located immediately adjacent to metro station
Future Rail Corridor	Unclear at this stage	Low-High Ensure fit-for-purpose development along major transport corridors.

Acoustic Aspect	Description	Guideline	
Noise Impacts from Within the Precinct			
(Major) Roads Within the Precinct	Noise impact from the proposed East-West and North-South spines.	Medium	Ensure fit-for-purpose development along major transport corridors. Use commercial buildings sited along major roads to act as a noise barrier.
Car Parking	Short term noise from car doors, engines and speed control devices. Anti-social behaviour also a risk within car parks.	Medium	Use CPTED to minimise anti-social behaviour
Entertainment Noise/ Activity Areas	Night-time noise from entertainment venues resulting in sleep disturbance to residences. Anti-social behaviour also a risk.	Medium	Create activity (noisy) zones and quiet zones
Vibration Impacts into The Precinct			
Sydney Metro	Ground-borne noise and vibration impacts to residences and commercial venues with vibration sensitive equipment (e.g., laboratories, robotics, etc.). It is noted that encroaching development can be designed for the level of impact expected and the requirement of such development to be built fit-for-purpose.	High	Future developments will be assessed against the relevant EPI's to ensure measures are put in place to mitigate potential impacts
Future Rail Corridor		Low-High	

6 Technical Assessment

6.1 External Noise Impacts into the Precinct

6.1.1 Aircraft noise

Australian Standard 2021:2015 Acoustics – Aircraft noise intrusion – Building siting and construction (AS 2021) provides guidance on assessing the suitability of a building type in relation to an airport through the use of Australian Noise Exposure Forecast (ANEF) contours. The ANEF is defined as ‘a single number index for predicting the cumulative exposure of aircraft noise in communities near aerodromes during a specified time period (normally one year)’.

AS 2021 states that areas outside the ANEF 20 contour are acceptable for all types of development and that there is typically no need for the building construction to provide protection specifically against aircraft noise. However, it does not imply that aircraft noise will be unnoticeable in areas outside the ANEF 20 or that noise impacts are not possible.

The Bradfield precinct is located approximately 5 km away from the runways of the future Western Sydney Airport. The final flight paths and therefore ANEF contours have yet to be finalised, however preliminary studies and the location of the Bradfield precinct indicate that it will be located outside the ANEF 20 contour.

Take-off and Landing

WSP has conducted a high-level aircraft noise assessment for take-off and landing in accordance with the methodology described in AS 2021. The expected maximum noise level is from a Boeing 777 / 747 departure. This noise level is modelled to be 47 dBA L_{Smax} from the proposed Stage 1 runway (opening 2026). Noise levels for the proposed 2nd runway (around 2050) are modelled to be 52 dBA L_{Smax} .

Table 3.3 from AS 2021 provides indoor design sound levels for various building types and activities to assess aircraft noise. For the most sensitive areas, such as residential sleeping areas, an indoor design sound level of 50 dBA is recommended. At these predicted noise levels, based on currently available aircraft noise data, airport departure and arrival operations are unlikely to cause significant impacts at receivers, and standard building constructions are likely to be sufficient to ensure internal noise levels are acceptable to building occupants.

Flyovers

It is noted that the flight paths for the future Western Sydney Airport have not been confirmed at the time of writing this report. Similarly, it is unclear which aircraft will be used at the time of opening the airport. Once the flight paths are finalised, a new Environmental Impact Statement for the Western Sydney Airport will assess potential flight noise impacts in further detail.

Aircraft noise is not expected to generate greatly varying noise impacts across the precinct and therefore does not need to be a major consideration in the master planning of the precinct. Individual developments should be capable of designs that meet all applicable Australian Standards and Guidelines.

6.1.2 Major Roads

Major existing roads that may impact noise levels within the precinct include Badgerys Creek Road and The Northern Road. These impacts will affect noise levels in the west and south of the precinct, particularly at properties directly exposed to the road corridors.

The level of traffic noise generated along a road alignment is dependent upon a variety of factors including traffic speed, traffic composition and the road surface.

Road noise will decrease along the transmission path to the receiver, being primarily affected by distance and screening. In the Aerotropolis precinct, this screening is expected to be provided primarily by buildings along the road corridor and potentially strategic, isolated noise barriers where required.

As traffic studies and designs for the precinct are at a preliminary stage, any assessment of potential road traffic noise impacts must be based on some high-level assumptions. **Table 6** presents the assumptions used for the following discussion.

Table 6 – Expected noise levels from road traffic noise external to the precinct

Parameter	Assumption	Notes
Traffic volumes	600 vehicles per lane per hour	This is generally less than the busiest Sydney CBD roads and represents a conservative volume of traffic
Road surface	Dense Graded Asphalt	Typical construction type - no noise correction

Any development within proximity of the corridor will require the applicant to consider relevant EPI's and guidelines to address the noise impacts of the future transport corridors. It is noted that encroaching development can be designed for the level of impact expected and the responsibility of such development to be built fit-for-purpose as proposed and assessed under future DA.

Any future development is to comply with the Rail Infrastructure Noise Guidelines.

In order to minimise potential impacts from road traffic, consideration has been given to the positioning of large buildings along these road alignments to act as passive noise barriers. These structures will reduce the transmission on noise and are expected to minimise the need for further noise mitigation.

It is recommended that further assessment of potential traffic noise impacts be carried out in accordance with the *NSW Road Noise Policy* as further planning and design information becomes available.

6.1.3 Sydney Metro

The Sydney Metro alignment runs through the precinct from the central north to the south of Aerotropolis. The Metro has a tunnel section from the airport business park to the Aerotropolis (Bradfield) and cut-and-cover topology station above previously approved under State Significant Infrastructure 10051.

In addition, noise associated with the Metro station itself may impact surrounding areas. Future development will be assessed against the relevant noise and vibration requirements, ensuring appropriate mitigation measures are implemented to protect the amenity of the surrounding locality.

Land that is to be developed that trigger legislation in the first or second corridor protection reserves will be required to comply with Sydney Metro Corridor Protection Technical Guidelines and demonstrate that their proposal will not adversely impact the Sydney Metro infrastructure. Future development may consider vibration isolation of building foundations which would be the subject of detailed design and future approval.

In order to minimise the effect of these potential impacts, it is recommended that fit-for-purpose development is positioned around the Sydney Metro station. The development should be designed for the level of impact expected and respond to ensure appropriate mitigation is identified and implemented to mitigate potential impacts.

All potential impacts will be assessed by the relevant consent authority during the approval process, ensuring appropriate mitigation measures are implemented to protect the amenity of the surrounding locality.

6.1.4 Future Rail Corridor

An alignment has been identified which may be used for a future rail corridor. The nature of this corridor is not confirmed at this stage.

The Master Plan considers and protects the Future Infrastructure Corridor as identified in the State Environmental Planning Policy (Transport and Infrastructure) 2021.

Future development will be the subject of Development Applications and require assessment against the relevant EPIs to ensure measures are put in place to mitigate potential impacts.

Any building adjacent to rail corridor is to assume elevated rail structures and to be designed to achieve acoustic and vibration attenuation in accordance with the relevant standards.

Any future development is to comply with the Rail Infrastructure Noise Guidelines.

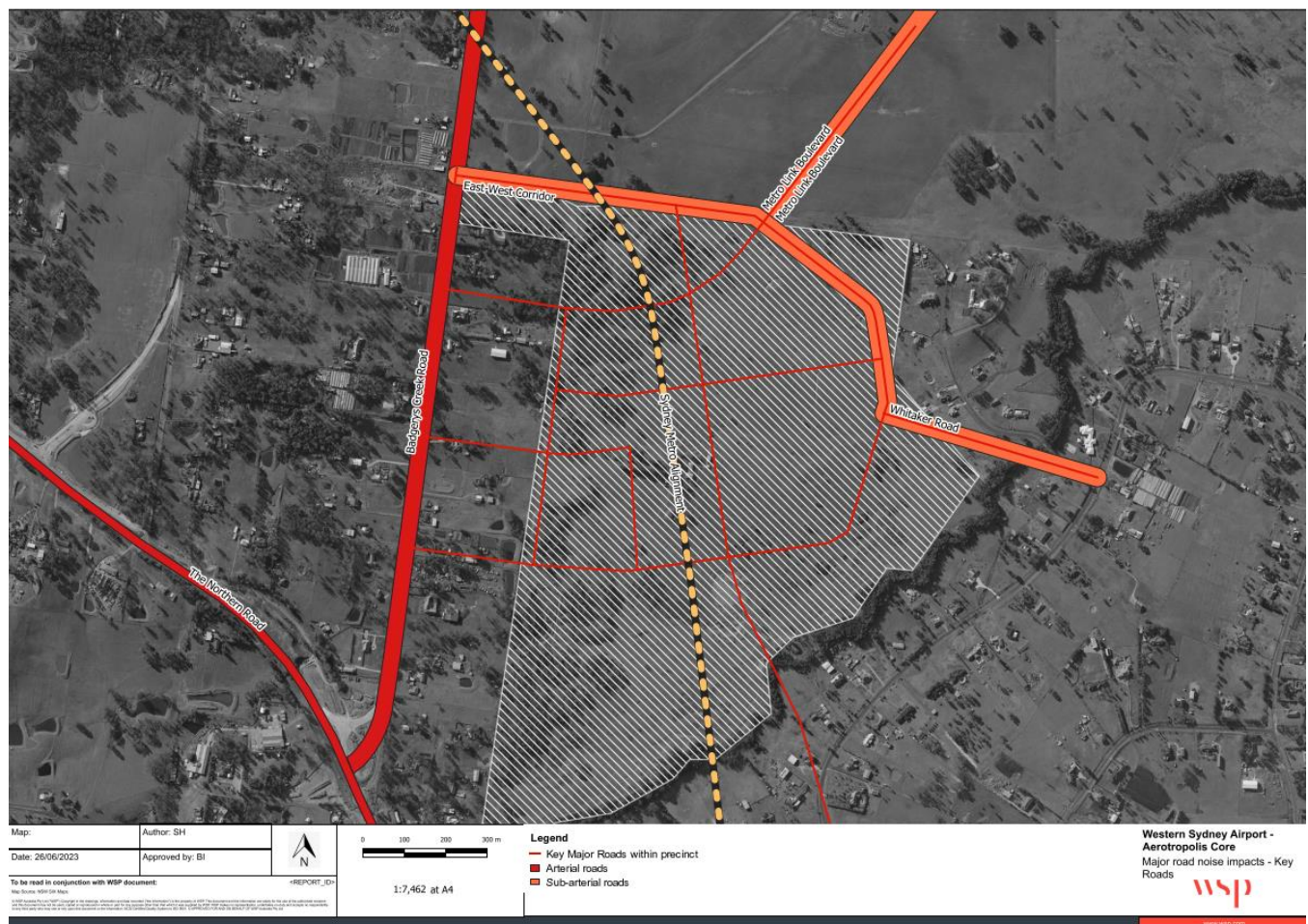
6.2 Noise Impacts from Within the Precinct

6.2.1 (Major) Roads Within the Precinct

The precinct will be serviced by a variety of local and sub arterial roads. As road speed limits and traffic volumes are likely to be substantially lower than those on major roads, any future noise impacts will also be reduced.

Figure 5 presents the current draft Masterplan internal major road network.

Figure 5 Key major roads within the precinct (source: WSP Australia, 2022)



As traffic studies and designs for the precinct are at a preliminary stage, any assessment of potential road traffic noise impacts must be based on some high-level assumptions.

Table 7 presents the assumptions used for the following discussion.

Table 7 – Expected noise levels from road traffic noise within the precinct

Parameter	Assumption	Notes
Traffic volumes	2-300 vehicles per hour (Metro Link Boulevard, Whitakar Road and the Transit Corridor)	This is generally less than the typical Sydney arterial roads and represents a conservative volume
Road surface	Dense Graded Asphalt	Typical construction type - no noise correction

Any development within proximity of the corridor will require the applicant to consider relevant EPI's and guidelines to address the noise impacts of the future transport corridors.

The calculations show that road traffic noise impacts from major roads within the precinct may extend into the site from each road alignment. Within these areas, residential buildings would require architectural noise treatment or the consideration of other noise attenuation. Additionally, natural ventilation may not be suitable for developments within this distance.

In order to minimise these potential impacts, consideration should be given to the positioning of large buildings along these road alignments to act as passive noise barriers. Where this can be done effectively, the need for traditional road noise barriers or acoustic treatment of buildings will be minimised. The Master Plan considers and implements the recommendations through the urban design and built form massing.

It is recommended that further assessment of potential traffic noise impacts be carried out in accordance with the *NSW Road Noise Policy* as further planning and design information becomes available.

6.2.2 Car Parking

Various car parking buildings are proposed around the periphery of the Core. Carparking has the potential for disturbance to adjacent residential areas due to carpark operation noise, but also by anti-social behaviour.

Where possible, 'best practice' crime prevention through environmental design (CPTED) should be implemented in carpark buildings to minimise disturbance to surrounding residential areas.

6.2.3 Entertainment Noise/ Activity Areas

Entertainment noise is typically a major source of complaint in major city entertainment district areas, such as Darlinghurst and Pyrmont (The Star) within the City of Sydney Council area. Local councils with inner city entertainment districts (e.g., City of Sydney and City of Parramatta) are developing their own night-time economy Development Control Plans (DCPs) with noise management measures to be implemented for entertainment venues. A 24-Hour Economy Strategy Summary Statement supports the Master Plan submission, and it is anticipated that WPCA will work with Council to develop the strategy and all entertainment venues would need to comply with the noise targets as part of the NSW Office of Liquor and Gaming Regulation liquor licensing criteria.

Noting the above, there are high level planning measures that should be considered during early master planning stages to avoid unnecessary restrictions on potential future entertainment venues. Considerations for the Bradfield city precinct planning include:

- Locate entertainment venues as far away as practical from residential developments.
- Create activity (noisy) zones and quiet zones. And market this as such to future residents of the area.
- Include measures to minimise the potential for anti-social behaviour via design measures

6.3 Vibration Impacts into The Precinct

6.3.1 Sydney Metro

The potential impacts of ground-borne vibration in buildings fall into three main categories: human comfort, impacts on building contents and structural damage.

Any assessment of areas potentially affected by ground-borne vibration will be based on the methodology detailed in *Development Near Rail Corridors and Busy Roads – Interim Guideline* (Department of Planning, 2008).

In order to minimise the effect of these potential impacts, it is recommended that fit-for-purpose development is positioned around the Sydney Metro corridor. It is noted that the CSIRO and AMRF may contain highly vibration sensitive land uses, however, are located outside of this area. More detailed consideration of potential commercial land uses will be required during the detailed planning of these areas.

Development should be designed for the level of impact expected and respond to ensure appropriate mitigation is identified and implemented to mitigate potential impacts.

It is recommended that further assessment of potential Sydney Metro vibration impacts be carried out in accordance with the *NSW Rail Infrastructure Noise Guideline* as further planning and design information becomes available.

6.3.2 Future Rail Corridor

Any development within proximity of the corridor will require the applicant to consider relevant EPI's and guidelines to address the noise impacts of the future transport corridors.

In order to minimise the effect of these potential impacts, it is recommended that fit-for-purpose development is positioned around the Sydney Metro corridor. It is noted that the CSIRO and AMRF may contain highly vibration sensitive land uses, however, are located outside of this area. More detailed consideration of potential commercial land uses will be required during the detailed planning of these areas.

Any building adjacent to rail corridor is to assume elevated rail structures and to be designed to achieve acoustic and vibration attenuation in accordance with the relevant standards. Future development will be the subject of Development Applications and require assessment against the relevant EPIs to ensure measures are put in place to mitigate potential impacts.

6.4 Summary of identified acoustic impacts

Table 8 summarises the preliminary assessments carried out in this report and any identified noise or vibration impacts.

Table 8 – Summary of identified noise and vibration impacts

Acoustic impact source	Notes
Noise impacts	
Aircraft noise	The site is located outside the preliminary ANEF 20-25 contours and is therefore considered to be suitable for all types of developments.
Major roads	Road traffic noise impacts from The Northern Road and Badgerys Creek Road may extend to areas within the site and impacts managed in accordance with relevant planning policies and guidelines.
Sydney Metro	Noise impacts from the Sydney Metro Aerotropolis Station will be managed during detailed design and considered in assessment of planning approvals. 3.
Future transport corridor	Potential noise impacts from the Future transport corridor are expected to be minimal at this current point in time and will be assessed as part of future planning approvals.
Noise sources within the precinct	

Acoustic impact source	Notes
Major roads within the precinct	Road traffic noise impacts from major roads within the precinct may extend into the site and will be assessed at relevant approval stage.
Car parking	Where noise impacts are considered and assessed during the project design phase, no impacts are predicted.
Entertainment noise / activity areas	Any noise impacts will be managed through building design and operating conditions considered during the development approval and licencing stage for both specific entertainment and residential developments. Detailed Development Control Plans around the night-time economy should be considered by the Authority.
Vibration impacts	
Sydney Metro	
Future transport corridor	Vibration impacts from the Sydney Metro Aerotropolis Station will be managed during detailed design and considered in assessment of planning approvals.

7 Recommendations

7.1 Land use planning

Land use planning processes provide the most efficient mechanism to avoid noise-related land use conflicts. The greenfield nature of the Bradfield city provides a rare opportunity to create a built environment that reduces future land use conflicts and allows the passive management of noise impacts, reducing environmental noise effects and the need for retrofitting noise controls at the receiver.

7.2 Design Considerations

Following the consideration of potential noise and vibration impacts during preliminary and detailed land use planning phases of development, smaller scale noise mitigation and management measures may be implemented to further reduce any residual impacts.

These measures will typically be implemented on a project-by-project basis and considered as part of the noise and vibration assessment process during the planning phase of a development.

It is important that potential noise and vibration impacts from (or into) any development are assessed in accordance with the relevant NSW guidelines during the planning approvals stage of each project, and suitable noise management measures are implemented to control any predicted noise impacts.

These noise and vibration assessments must:

- Be carried out by a competent person as defined in the *Approved Methods for the measurement and analysis of environmental noise in NSW* (EPA, 2022)

- Consider cumulative noise and vibration impacts on receivers, including from noise generating activities being carried out (or to be carried out) both inside and outside the proposed project area as per the *Noise Policy for Industry* (EPA, 2017) (NPfI). The master plan should put in place provisions to ensure that a precinct noise management approach can be implemented as per section 2.4.2 of the NPfI

- Be undertaken in accordance with (as relevant and not limited to):

- *Interim Construction Noise Guideline* (Department of Environment and Climate Change, 2009)
- *Noise Policy for Industry* (EPA, 2017)
- *NSW Road Noise Policy* (Department of Environment, Climate Change and Water, 2011)
- *Rail Infrastructure Noise Guideline* (EPA, 2013)
- *Assessing Vibration: a technical guideline* (Department of Environment and Conservation, 2006)

- *Development near rail corridors and busy roads – Interim guideline* (DPE, 2008).

The recommendations applicable to Table 10 summarises the recommendations relating to noise and vibration, and applicable timeframes and responsibilities for the project.

Table 9 – Summary of recommendations and responsibilities for the project

Ref	Recommendation	Timeframe	Responsible
Land use planning noise and vibration recommendations			
1	Grouping similar land uses to avoid acoustic conflicts and reduce the risk of noise nuisance	Prior to relevant Master Plan Stage	WPCA
2	Designing green spaces to minimise event and active recreational noise at sensitive receivers	Prior to relevant Master Plan Stage	WPCA
3	The inclusion of water features or other natural sounds to mask unwanted urban noise	Prior to relevant Master Plan Stage	WPCA
4	Ensure fit-for-purpose developments along primary transport routes or adjacent to other major noise sources.	Prior to relevant Master Plan Stage	WPCA
5	Ensure fit-for-purpose developments to avoid impacts at vibration sensitive land uses along major transport routes	Prior to relevant Master Plan Stage	WPCA
6	Locating the rear, or less sensitive, boundaries of lots towards major transport routes or other noise sources	Prior to relevant Master Plan Stage	WPCA

Ref	Recommendation	Timeframe	Responsible
Land use planning noise and vibration recommendations			
7	Parks / urban green spaces provide open space for relaxation, recreation and socialising. They also provide relief from the noise and activity of an urban environment.	Prior to relevant Master Plan Stage	WPCA
8	The needs of vibration sensitive land uses should be considered during planning stages. These premises may be susceptible to vibration generated by the Sydney Metro line.	Prior to relevant Master Plan Stage	WPCA
9	Soundscape design, through active (electronic) or passive (natural) means.	Prior to relevant Master Plan Stage or individual planning approvals	WPCA
10	Adopting the Green Star, WELL or other ESD tools.	Prior to relevant Master Plan Stage	WPCA
Design noise and vibration			
11	Building designs, layouts and constructions, including sound attenuation measures, are to take into account the impacts of noise between the different uses within a building and from surrounding areas.	Prior to individual project planning approval	Relevant Consent Authority
12	Any proposed residential buildings would be required to include a consideration of acoustic treatment to ensure that internal noise levels are in accordance with recommended levels outlined in AS/NZS2107.	Prior to individual project planning approval	Relevant Consent Authority
13	Noise / vibration impacts associated with any future development would be assessed in accordance with the relevant NSW guidelines,	Prior to individual project planning approval	Relevant Consent

Ref	Recommendation	Timeframe	Responsible
Land use planning noise and vibration recommendations			
	and suitable noise management measures would be implemented to control any predicted impacts.		Authority
14	Consider construction noise and ground vibration impacts during planning stages of demolition, remediation and construction.	Prior to individual project planning approval	Relevant Consent Authority
15	Consideration may be given to the creation of a network of soundscapes to generate a coherent, acceptable noise environment. The installation of pleasant noise sources, such as water features throughout the precinct will mask less desirable noise sources such as industry, aircraft and road traffic.	Prior to individual project planning approval	Relevant Consent Authority
16	The General guidelines and 'good practice' as per the <i>Development Near Rail Corridors and Busy Roads – Interim Guideline</i> should be implemented to be used as a minimum requirement for noise mitigation. Available here: https://www.rms.nsw.gov.au/business-industry/partners-suppliers/documents/planning-principles/guideto-infrastructure-development-near-rail-corridors-busy-roads.pdf	Prior to individual project planning approval	Relevant Consent Authority
17	Buildings with concrete/brick/glazed facades and pavements are acoustically reflective. Introduction of 'green' areas/facades and soil in urban areas that scatter noise would result in less noise build up compared to high build up areas (such as the Sydney CBD).	Prior to individual project planning approval	Relevant Consent Authority

8 Conclusion

Land uses and site layouts within the Masterplan have considered potential noise and vibration generation and impacts on adjoining land uses in accordance with the Aerotropolis DCP Phase 2 and all other relevant guidelines and standards.

The assessment considered potential impacts in accordance with the Protection of the Environment Operations Act 1997 and NSW *Noise Policy for Industry 2017* and other relevant guidelines.

Recommendations and mitigation to minimise any potential land use conflicts have been effectively incorporated into the Masterplan.

Potential construction phase impacts will be considered on a project-by-project basis during the normal planning approvals process.

More detailed assessments will be conducted during the planning approvals process for each individual project. Any future development is to comply with the Rail Infrastructure Noise Guidelines and/ or other relevant NSW noise and vibration guidelines.

Appendix 1 – Aircraft noise impacts

(SOURCE: WSP AUSTRALIA, 2023)

