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Western Parkland City Authority

First Building - SSDA

Construction Noise and
Vibration Impact
Assessment

wsp

NOVEMBER 2021

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First Building - SSDA Construction Noise and Vibration Impact Assessment

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WSP acknowledges that every project we work on takes place on First Peoples lands.
We recognise Aboriginal and Torres Strait Islander Peoples as the first scientists and engineers and pay our respects to Elders past and present.

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Table of contents

EXECUTIVE SUMMARY	ii
1 INTRODUCTION	1
1.1 Site and project description	1
1.2 Scope of works	1
1.3 Acoustic Engineer Accreditation	2
2 PLANNING REQUIREMENTS	3
2.1 Western Sydney Aerotropolis DCP	3
2.2 Planning Secretary's Environmental Assessment Requirements (SEARs).....	3
2.3 Liverpool Council Advice	4
3 EXISTING NOISE ENVIRONMENT	5
3.1 Sensitive receivers	5
3.2 Existing noise environment.....	6
4 PROJECT CRITERIA.....	8
4.1 Interim Construction Noise Guideline (ICNG).....	8
4.2 Construction traffic noise.....	9
4.3 Construction vibration.....	10
5 ASSESSMENT	12
5.1 Construction noise assessment	12
5.2 Construction traffic noise.....	16
5.3 Construction vibration impact assessment.....	16
6 NOISE AND VIBRATION MANAGEMENT	18
6.1 Construction noise and vibration.....	18
7 CONCLUSION	20

EXECUTIVE SUMMARY

WSP Australia Pty Ltd (WSP) was engaged to undertake a construction noise and vibration impact assessment for the proposed research and development facility (referred to as the First Building) located at 215 Badgerys Creek Road, Bringelly.

The Project forms part of the overall Western Sydney Aerotropolis development and is located within the Bradfield (Aerotropolis core) Precinct.

The construction noise and vibration impact assessment has been undertaken in accordance with the issued *Secretary's Environmental Assessment Requirements* (SEARs), the *Western Sydney Aerotropolis Development Control Plan* (DCP) – Phase 1 (2020) and other relevant standards and guidelines.

Sensitive receivers for both noise and vibration were identified using aerial images of the site and its surroundings. It was identified that the existing nearby residential dwellings will also be developed in the future, however information relating to whether these dwellings will be occupied during the construction of the Project was unknown. For a conservative assessment it has been assumed that these dwellings would be occupied and were included in the assessment.

Due to the COVID-19 lockdowns and the stay at home orders that occurred at the time of preparation of this report, long-term noise monitoring could not be undertaken as part of this assessment. Therefore, historical long term noise monitoring conducted near the project site from publicly available documentation from the proposed Sydney Metro Line was adopted.

Four worst-case construction scenarios were assessed, with all works being undertaken during standard construction working hours. Predictive noise modelling was used to assess the construction noise levels at the worst affected receivers.

For receivers located north, south and east of the site, the predicted noise levels generally complied with Noise Management Levels (NMLs) for all construction scenarios. The predicted noise levels for the sensitive receivers located west of the site exceeded the NMLs during all stages of construction. The exceedances above the NML ranged from 25 to 34 dBA, with two of the receivers identified as being highly noise affected. Based on the predicted noise levels, noise mitigation measures have been outlined in this report to manage the impacts of construction.

Vibration generated by construction activities is predicted to comply with the human comfort and structural vibration criteria determined from the Project.

Based on the findings of this assessment, the construction noise and vibration impacts associated with the Project can be managed to achieve acceptable levels, when the recommendations provided in this report are implemented.

1 INTRODUCTION

WSP Australia Pty Ltd (WSP) has been engaged by Western Parkland City Authority (WPCA) to provide a Construction Noise and Vibration Impact Assessment (CNVIA) for the proposed research and development facility (the Project) located at 215 Badgerys Creek Road, Bringelly.

1.1 Site and project description

The Project site forms part of the planned Western Sydney Aerotropolis that surrounds the future Western Sydney Airport. The Western Sydney Aerotropolis is divided into several precincts, including the Bradfield (Aerotropolis Core), Badgerys Creek, Wianamatta-South Creek, Northern Gateway and Agribusiness.

The Project site is located at 215 Badgerys Creek Road, Bringelly which forms part of the Bradfield Precinct. It is proposed that 215 Badgerys Creek Road is to be subdivided into multiple lots, as outlined in Figure 3.1

The Project involves the construction, fit out and use of an advanced manufacturing research and development facility in Bradfield City Centre. The proposed facility will consist of the following areas:

- Laboratories
 - Open plan workspace
 - Outdoor plaza
 - Community park, and
 - On grade carpark.
-

1.2 Scope of works

This construction noise and vibration assessment comprises of the following elements:

- Review of available data
- Review of historic noise monitoring to evaluate the background noise environment in the vicinity of the works
- Determine site-specific noise criteria for construction
- Noise assessment through predictive noise modelling for identified construction scenarios
- Vibration assessment at the nearest receivers and structures
- Where noise criteria are likely to be exceeded, recommendation of noise mitigation and management measures for construction activities

Preparation of a report detailing background noise levels, noise and vibration impacts and mitigation measures where required.

This assessment has been conducted with consideration to the following guidelines:

- *NSW Noise Policy for Industry (NPfI)* (EPA, 2017)
- *Interim Construction Noise Guideline (ICNG)* (DECCW, 2009)
- *NSW Road Noise Policy (RNP)* (DECCW, 2011)
- *Assessing Vibration: A Technical Guideline (AVaTG)* (Department of Environment and Conservation, 2006)
- Relevant local government policies.

1.3 Acoustic Engineer Accreditation

WSP staff involved with the preparation of this report are 'suitably qualified' through:

- An Engineering degree from an Australian University;
- Membership of the Australian Acoustical Society (AAS); and/or,
- Working for a member firm of the Association of Australasian Acoustical Consultants (AAAC).

2 PLANNING REQUIREMENTS

This report addresses the following planning requirements.

2.1 Western Sydney Aerotropolis DCP

For developments within the Western Sydney Aerotropolis Precinct, the site specific DCP (2020) is applicable. Section 4.5 of the DCP outlines the following requirements relating to noise and vibration:

P01: *The generation of noise and vibration from the development does not cause environmental harm or nuisance to adjoining properties or other noise sensitive land uses.*

Development should:

- a) *be located in appropriate areas;*
- b) *propose best practice design and noise attenuation measures; and*
- c) *propose operational practices that will minimise noise nuisance for adjoining sensitive land uses.*

P02: *Noise sensitive land uses are located to avoid adverse impacts from transport corridors or noise generating developments (e.g. the Airport, entertainment venues, child care centres or industrial zones).*

P03: *Mechanical plant and equipment do not adversely impact on the acoustic and vibration amenity of adjoining sites.*

P04: *The construction phase of the development does not cause adverse acoustic impacts on surrounding sensitive uses/receivers.*

P05: *Industrial development is to be in accordance with Protection of the Environment Operations Act 1997 and NSW Industrial Noise Policy 2000.*

The NSW *Industrial Noise Policy 2000* has since been superseded by the NSW NPfI 2017 which has been adopted for this assessment; as per the transition guidance notes from the NSW NPfI.

It is anticipated that compliance with the NSW ICNG, as per Section 4.1, will satisfy the DCP requirements.

2.2 Planning Secretary's Environmental Assessment Requirements (SEARs)

The SEARS (Application Number: SSD-25452459) requires an Environmental Impact Statement (EIS) to be prepared for the Project. The requirements specific to noise and vibration have been provided below.

Noise and Vibration – a quantitative noise and vibration impact assessment undertaken by a suitably qualified acoustic consultant in accordance with the relevant Environment Protection Authority guidelines and Australian Standards. The assessment must:

- *detail construction and operational noise and vibration impacts (including cumulative impacts, provision of operational noise contours and sleep disturbance assessment) on nearby sensitive receivers and structures*
- *outline the proposed management and mitigation measures that would be implemented.*

It is anticipated that this report, will satisfy the SEARs requirements. This report assesses Construction noise and vibration impacts only. Operational noise and vibration are discussed in the Noise and Vibration Impact Assessment (NVIA) report.

2.3 Liverpool Council Advice

The Liverpool City Council response to the request for SEARs (ref: SSD1-3/2021; dated 10 September 2021), outlines the following requirements

11. Section 8 EIS Technical Studies identifies the technical reports anticipated as being prepared for the EIS. With respect to Environmental Health, the following reports are noted as appropriate for this development:

Phase I Site Investigation,

- Air Quality Impact Assessment,*
- Noise and Vibration Impact Assessment, and*
- Construction and Operational Waste Management Plan*

To improve environmental health outcomes and efficiency during the development assessment process, Liverpool City Council requires development applications to be supported by technical reports prepared by suitably qualified and industry certified environmental consultants.

Liverpool City Council currently recognizes environmental consultants with the following qualifications, membership and/or certifications;

(...)

b) Acoustic Reports

- A member of the Australian Acoustical Society*
- Employed by an Association of Australasian Acoustical Consultants (AAAC) member firm*

It is anticipated that this report, will satisfy the requirements as set out by Liverpool City Council.

3 EXISTING NOISE ENVIRONMENT

This section provides an overview of the existing noise environment surrounding the site.

3.1 Sensitive receivers

The Project has the potential to adversely impact nearby properties that are considered sensitive to noise and vibration. Receivers potentially sensitive to noise and vibration, as defined in the NPfI, have been identified in the area surrounding the Project.

The most affected receivers are the residential dwellings located to the west of the Project site.

It is noted that the nearby properties are located within the future Aerotropolis Core Precinct and will potentially be developed in the future. However, the nearby properties may not be acquired or demolished prior to the commencement of works.

For the purpose of this assessment, it is assumed that the nearby residential dwellings will be occupied and therefore should be considered in the construction noise and vibration assessment.

Sensitive receiver locations are identified in Figure 2.1. A summary of assessed residential receivers is presented in Table 3.1.

No vibration-sensitive heritage items or areas containing vibration-sensitive equipment have been identified in the Project area.

Table 3.1 Identified nearest noise sensitive receivers

RECEIVER/ LOCATION	ADDRESS	TYPE OF RECEIVER (AS PER NSW NPfI)	APPROXIMATE DISTANCE FROM PROJECT SITE (m) ¹
R1	145 Badgerys Creek Road, Bringelly	Residential	60
R2	155 Badgerys Creek Road, Bringelly	Residential	40
R3	175 Badgerys Creek Road, Bringelly	Residential	60
R4	475 Badgerys Creek Road, Bringelly	Residential ²	1500
R5	25 The Retreat, Bringelly	Residential	660
R6	11 Medich Place, Bringelly	Residential	1200

- (1) Noted distances are approximate and for illustrative purposes only. Noise modelling to be undertaken based on actual distances from noise source to receiver.
- (2) The sensitive receiver located at 475 Badgerys Creek Road is a mixed use receiver containing both residential and industrial premises. For a conservative assessment the receiver at 475 Badgerys Creek Road has been assessed as a residential receiver.

3.2 Existing noise environment

3.2.1 Impact of Covid-19

Due to current Stay-At-Home orders to reduce the spread of COVID-19, noise monitoring was not able to be conducted at the time of preparing this report. It is expected that current noise levels will be considerably lower than normal levels, due to reduced traffic and pedestrian activity, and they therefore cannot be considered representative for the noise environment at the affected receivers.

WSP has adopted publicly available existing noise measurement data from past developments in the vicinity of the proposal site. This method has previously been accepted by the NSW EPA and TfNSW where site-specific measurements were unable to be completed.

Noise monitoring data was adopted from the noise assessment that was previously undertaken by WSP for the *Sydney Metro – Western Sydney Airport Noise and Vibration Assessment* (Sydney Metro Report)¹.

3.2.2 Historical long term monitoring

Long term noise monitoring was conducted as part of the Sydney Metro Report. The noise monitoring location identified as NM13 in the Sydney Metro Report was located at 80 Mersey Road, Bringelly. The noise logger was located approximately 2km west of the Project site as shown in Figure 3.1. Monitoring was undertaken between Thursday 27 February and Tuesday 10 March 2020.

It is considered that in the absence of site-specific data, the adoption of these 2020 noise levels is suitable for the purpose of this assessment, and that the measured noise levels in 2020 are representative of the current noise environment.

It is anticipated that background noise levels at the receivers near the Project would be influenced by traffic noise along Badgerys Creek Road and distant traffic noise from The Northern Road.

As a result, it is considered that the background noise levels adopted from NM13 provides a conservative estimate of background noise levels at Project affected receivers, which are likely to experience lower background noise levels

The adopted background noise levels (rating background levels) are summarised in Table 3.2.

Table 3.2 Summary of attended noise monitoring results

LOCATION	RATING BACKGROUND LEVEL, (RBL) ² dBA			AMBIENT NOISE LEVEL, dBA L _{EQ, 15MIN} ³		
	DAY	EVENING	NIGHT	DAY	EVENING	NIGHT
NM13 - 80 Mersey Road, Bringelly	38	35	34	58	52	51

- (1) All values expressed as dBA and rounded to nearest 1 dBA.
- (2) RBL – Rating Background Level - based the lowest 10th percentile of the L₉₀ descriptor
- (3) L_{eq} - Equivalent continuous (energy average) A-weighted sound pressure level
- (4) Daytime (7am-6pm), Evening (6pm-10pm), Night (10pm-7am), 6am – 7am

Source: *Sydney Metro – Western Sydney Airport Noise and Vibration Assessment*

¹ Source: [https://majorprojects.planningportal.nsw.gov.au/prweb/PRRestService/mp/01/getContent?AttachRef=SSI-10051%2120201019T005209.532%20GMT]

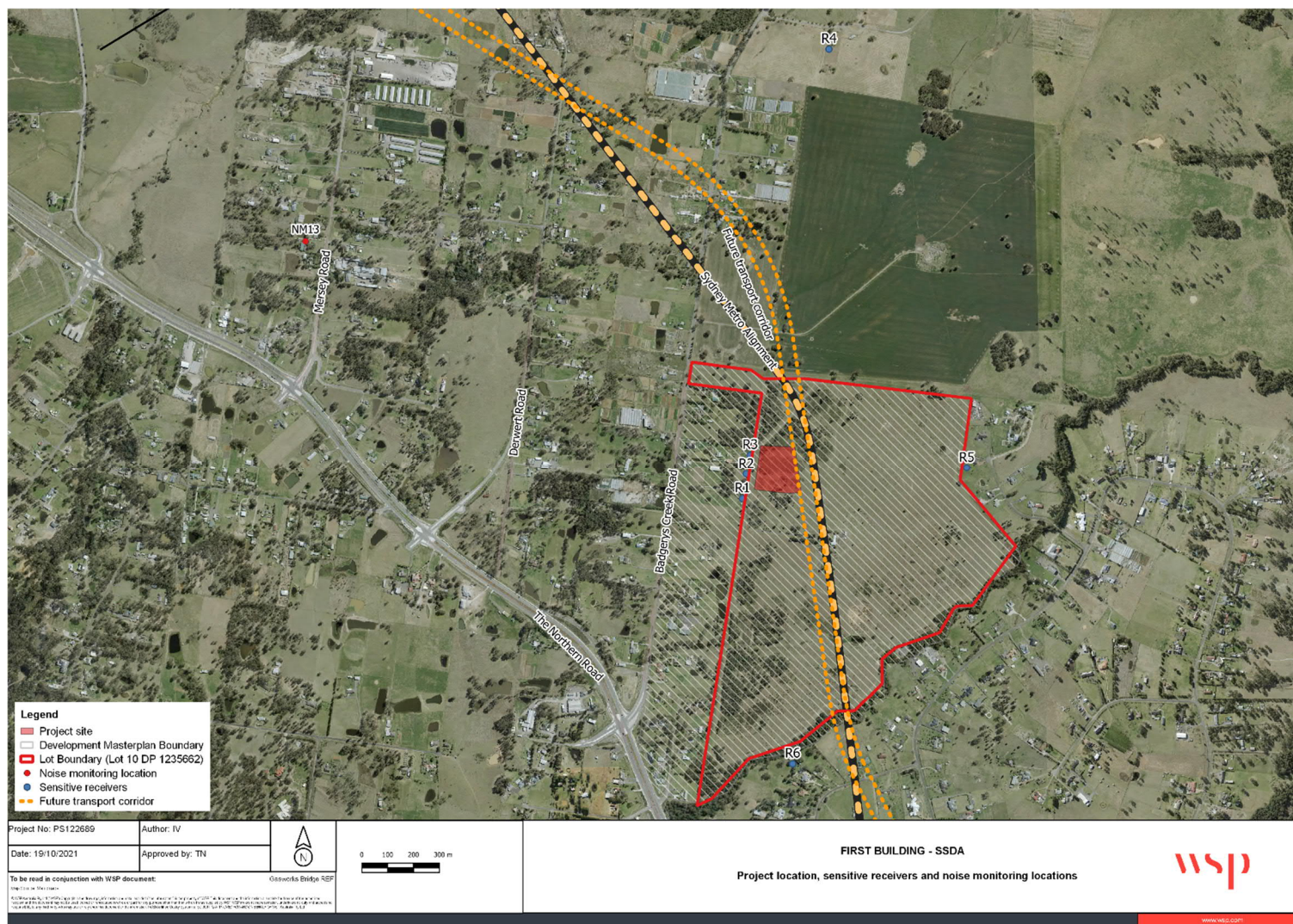


Figure 3.1 Site context, sensitive receivers and historical monitoring location

4 PROJECT CRITERIA

Noise and vibration criteria applicable to the project are derived from various Australian Standards, local and state policies and industry guidelines. The following documents were reviewed to determine the applicable construction noise and vibration criteria.

4.1 Interim Construction Noise Guideline (ICNG)

In the absence of specific noise and vibration requirements within the DCP and SEARs, the *Interim Construction Noise Guideline* (ICNG) has been adopted for this assessment. The ICNG has been developed to aid the identification and understanding the impact of construction noise on sensitive land uses, and the application of reasonable and feasible management measures to minimise construction noise impacts. Given the duration of the construction (approximately 12 months) a quantitative assessment has been undertaken in accordance with the ICNG.

As outlined in the ICNG, a quantitative assessment requires the development of Noise Management Levels (NMLs) based on existing Rating Background Levels (RBLs), and a comparison of predicted construction noise levels with the developed NMLs.

The recommended standard hours defined in the ICNG represent the times of the day when receivers are likely to be less sensitive to noise impacts. Where work is proposed outside of standard hours, justification is required and more stringent NMLs apply. For all other receiver types, the NMLs only apply when the receiver location is occupied / in use.

Table 4.1 sets out the application of the management levels for noise at residences. In this case, no work outside of standard hours is proposed.

Table 4.1 Application of the ICNG noise management levels for residential receivers

TIME OF DAY	NML, dBA L _{EQ} , 15MIN	HOW TO APPLY
Recommended standard hours: Monday to Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays or public holidays	Noise affected RBL + 10 dB	<p>The noise affected level represents the point above which there may be some community reaction to noise.</p> <p>Where the predicted or measured L_{Aeq} (15 min) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level.</p> <p>The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.</p>
	Highly noise affected 75 dB(A)	<p>The highly noise affected level represents the point above which there may be strong community reaction to noise.</p> <p>Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences) if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.</p>
Outside recommended standard hours	Noise affected RBL + 5 dB	<p>A strong justification would typically be required for works outside the recommended standard hours.</p> <p>The proponent should apply all feasible and reasonable work practices to meet the noise affected level.</p> <p>Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should consult with the community.</p>

Table 4.2 presents the NMLs for representative residential receivers, based on RBLs from the noise monitoring described in Section 3.2.2.

Table 4.2 Noise management levels at residential receivers

LOCATION	TIME	RBL, dBA	NOISE MANAGEMENT LEVEL dBA L _{EQ} , 15MIN	HIGHLY NOISE AFFECTED LEVEL dBA L _{EQ} , 15 MIN
All residences	Standard hours ¹	38	48	75

(1) Standard hours are defined as Monday to Friday (7am – 6pm), Saturday (8am – 1pm).

Feasible and reasonable mitigation and management measures, as defined in the ICNG, are to be implemented where NMLs are exceeded either during or outside of recommended standard hours for construction work.

4.2 Construction traffic noise

The ICNG does not provide criteria for assessing the construction traffic on public roads. Instead the ICNG stipulates that construction traffic is assessed under the *Environmental Criteria for Road Traffic Noise* (EPA 1999), which has been superseded by the *Road Noise Policy* (RNP).

The RNP provides guidance on the assessment of noise impacts from road traffic noise on sensitive receivers. Construction traffic would access the site via Badgerys Creek Road.

Based on the road categories provided in Table 2 of the RNP, Badgerys Creek Road is classified as a sub-arterial road since it connects the Northern Road (an arterial road) and Elizabeth Drive (a sub-arterial road). Therefore, the sub-arterial criteria would apply for additional traffic from construction works.

Table 4.3 presents a summary of the applicable criteria for residential receivers.

Table 4.3 Road traffic noise criteria for residential receivers on existing roads affected by additional traffic from land use developments

ROAD TYPE	ROAD TRAFFIC NOISE CRITERIA	
	DAY (7AM TO 10PM)	NIGHT (10PM TO 7AM)
Sub-arterial road	60 dBA L_{eq} 15hr	55 dBA L_{eq} 9hr

The RNP application states that *'for existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level as a result of the development should be limited to 2 dBA above that of the noise level without the development. This limit applies wherever the noise level without the development is within 2 dBA of, or exceeds, the relevant day or night noise assessment criterion.'*

Therefore, if the road traffic noise levels increase by more than 2 dBA as a result of the proposed construction traffic, and the criteria in Table 4.3 are exceeded, investigation of mitigation options would be required.

4.3 Construction vibration

Vibration associated with construction activities can result in impacts on human comfort or the damage of physical structures such as dwellings. These two impacts have different criteria, with the effects of vibration on human comfort having a lower threshold.

Importantly, cosmetic damage is regarded as minor in nature; it is readily repairable and does not affect a building's structural integrity. If there is no significant risk of cosmetic damage, then structural damage is not considered a risk.

The DCP and SEARs do not provide specific criteria relating to construction vibration, therefore guidance has been taken from the *Assessing Vibration: A Technical Guideline* (AVaTG)(DEC 2006) as outlined in the ICNG.

4.3.1 Cosmetic building damage and structural integrity

There are no vibration limits for cosmetic building damage and structural integrity in AVaTG. Therefore, the limits set out in *British Standard BS 7358-2: Evaluation and measurement for vibration in buildings guide to damage levels from ground-borne vibration* have been adopted.

A summary of the limits is provided in Table 4.4. These peak vibration limits are set so that the risk of cosmetic damage is minimal. They have been set at the lowest level above which damage has been credibly demonstrated. The limits also assume that the equipment causing the vibration is only used intermittently.

Table 4.4 BS 7385-2 Guideline vibration limits for cosmetic damage

GROUP	TYPE OF STRUCTURE	PEAK COMPONENT PARTICLE VELOCITY, mm/s ¹		
		4–15 Hz	15–40 Hz	40 Hz AND ABOVE
1	Reinforced or framed structures Industrial or heavy commercial buildings	50		
2	Un-reinforced or light framed structures Residential or light commercial buildings	15 – 20 ²	20 – 50	50

- (1) Values referred to are at the base of the building, on the side of the building facing the source of vibration (where feasible).
(2) At frequencies below 4 Hz, a maximum displacement of 0.6 mm (zero to peak) should not be exceeded.

4.3.2 Human comfort (amenity)

Table 4.5 presents the limits (vibration dose values) above which there is considered to be a risk that the amenity and comfort of people occupying buildings would be affected by intermittent vibration from construction works. These limits are sourced from *Assessing Vibration: A Technical Guideline* (NSW DEC, 2006).

Table 4.5 Human comfort (amenity) guideline vibration limits (intermittent work and continuous vibrations)

LOCATION	ASSESSMENT PERIOD	VIBRATION DOSE VALUE, m/s ^{1.75}		WEIGHTED RMS VALUES FOR CONTINUOUS VIBRATION ACCELERATION (m/s ²) 1-80 Hz			
		PREFERRED VALUES	MAXIMUM VALUES	PREFERRED Z-AXIS VALUES	PREFERRED X&Y -AXES VALUES	MAXIMUM Z-AXIS VALUES	MAXIMUM X&Y -AXES VALUES
Residences	Daytime	0.20	0.40	0.010	0.0071	0.020	0.014
	Night time	0.13	0.26	0.007	0.005	0.014	0.010

5 ASSESSMENT

The following sections outline the noise and vibration impacts from construction activities associated with the Project. Information available at this stage of the Project is high level and conservative, however impacts will be conservative and allow management and mitigation recommendations to be developed to manage impacts at the nearest receivers.

5.1 Construction noise assessment

To assess the potential noise impacts during construction, scenarios comprising typical plant and equipment have been developed based on indicative staging information.

5.1.1 Construction staging

The Project would be constructed in stages with the stages occurring at different times depending on the activity. A construction methodology was not been finalised at this stage, however an indicative staging was developed as presented in Table 5.1.

Table 5.1 Construction staging (indicative)

CONSTRUCTION STAGE	DURATION
Scenario 1 - Demolition/excavation	3 months
Scenario 2 - Excavation and foundation works	3 months
Scenario 3 - During erection of structure	4 months
Scenario 4 - Fitout and landscaping	2 months

5.1.2 Construction hours

Work would be completed in standard hours, as defined in the ICNG and summarised in Table 5.2.

Table 5.2 Construction hours

CONSTRUCTION HOURS	MONDAY TO FRIDAY	SATURDAY	SUNDAY OR PUBLIC HOLIDAYS
Standard Hours	7 am to 6 pm	8 am to 1 pm	No work
Construction activities with impulsive or tonal noise emissions	8 am to 5 pm	9 am to 1 pm ¹	No work

- (1) Works may be carried out in continuous blocks not exceeding three hours each with a minimum respite from those activities and works of not less than one hour between each block. 'Continuous' includes any period during which there is less than a one-hour respite between ceasing and recommencing any of the work the subject of this condition.

5.1.3 Construction staging and equipment

Construction of the Project is anticipated to take up to approximately 12 months to complete. An overview of the indicative construction activities and proposed equipment is provided in Table 5.3.

The noise levels and data are taken the *Australian Standard AS2436-2010 Guide to noise and vibration control on construction, demolition and maintenance sites* and the TfNSW Construction Noise and Vibration Guideline (CNVG).

Table 5.3 – Indicative construction staging and equipment

CONSTRUCTION STAGE	EQUIPMENT	EQUIPMENT SWL - dBA	SCENARIO SWL - dBA
Scenario 1 - Demolition/excavation	Excavators	110	120
	Dozers	116	
	Trucks	103	
	Chainsaws	114	
	Bobcat	112	
	Crane	98	
Scenario 2 - Excavation and foundation works	Bore piling	112	122
	Excavators (rock breaker/saw)	118	
	Dozers	116	
	Trucks	103	
	Graders	113	
	Cranes	98	
Scenario 3 - During erection of structure	Hand tools (angle grinders etc for formwork)	116	121
	Concrete pumps	102	
	Excavators	110	
	Dozers	116	
	Trucks	103	
	Vibratory compactor	109	
	Concrete truck/agitator	109	
	Generator	103	
	Jackhammer	113	
Scenario 4 - Fitout and landscaping	Excavators	110	121
	Dozers	116	
	Trucks	103	
	Concrete truck/agitator	109	
	Paving machine	114	
	Cranes	98	
	Hand tools	116	

5.1.4 Noise modelling methodology

Potential noise levels at sensitive receivers have been modelled using the ISO9613 noise prediction algorithm with SoundPLAN v8.2. This method is commonly used and accepted by regulatory agencies in NSW. Noise modelling parameters used in this report are summarised in Table 5.4.

Table 5.4 – Noise modelling parameters

PARAMETER	INPUT DATA
Terrain	Sourced from ELVIS (5m contour intervals)
SoundPLAN module	ISO9613 industrial module
Meteorological condition	Neutral meteorological conditions have been modelled
Source heights	Construction plant and equipment heights are modelled to be 2 metres above ground
Receiver heights	1.5m from the ground
Ground absorption	A ground absorption coefficient of 0.6 has been adopted for this project

5.1.5 Construction noise impact

Precise construction methodology will be confirmed by the construction contractor, however potential noise impacts associated with an indicative construction staging have been conservatively assessed to facilitate community consultation and effective noise management and mitigation prioritisation.

It is understood that construction work will generally be undertaken during standard daytime hours. Predicted worst case construction noise levels at the nearest sensitive receivers are presented in Table 5.5. These levels present the potential maximum noise impact at the nearest residences and assist in identifying the most appropriate management and mitigation options throughout the construction process.

Exceedances are indicated in **bold font**, with highly affected noise levels presented in **bold red font**.

Table 5.5 Predicted maximum construction noise levels per scenario

ID	DISTANCE (m)	NML – STANDARD HOURS dBA L _{EQ} , 15MIN	PREDICTED CONSTRUCTION NOISE LEVEL dBA L _{EQ} , 15MIN			
			CONSTRUCTION SCENARIO			
			1	2	3	4
R1	60	48	73	75	74	74
R2	40	48	80	82	81	81
R3	60	48	79	81	80	80
R4	1500	48	37	39	38	38
R5	660	48	47	49	48	48
R6	1200	48	41	43	42	42

(1) Exceedances of highly noise affected criteria indicated in red font (applicable to residences only).

The maximum predicted noise levels for the construction works will exceed construction noise levels at the nearest receivers based on the background monitoring information available. These values are based on simultaneous operation

of all equipment at the nearest point to the receiver. It is unlikely that these noise levels would be sustained for greater than a few days per construction stage, as equipment would not be required to operate at that intensity for significant periods, nor would it be likely that all equipment would run simultaneously.

Construction noise levels are predicted to exceed noise levels at all receivers with direct line of site to the construction areas. Noise during construction works is expected to reach a maximum during the excavation and foundation works (3 month duration). During this stage, works including earthworks and piling activities are to occur and plant such as dozers, excavators and piling rigs are proposed to be used.

It is anticipated that shielding of more distant receivers would attenuate noise at receivers further from the Project sites, therefore noise impacts to sensitive privately-owned receivers are likely to be constrained to within 700 m of the construction footprint. The construction noise exceedances for standard hours for the scenarios are outlined in Table 5.6. Exceedances have been presented in terms of exceedances above the NMLs for each scenario. Noise management measures will be required for construction activities as detailed in Section 5.

Table 5.6 Predicted maximum construction noise exceedances (dBA) per scenario

ID	RBL - STANDARD HOURS, dBA	NML – STANDARD HOURS, dBA $L_{EQ, 15MIN}$	EXCEEDANCE ABOVE NML PER SCENARIO, dBA			
			1	2	3	4
R1	38	48	25	27	26	26
R2	38	48	32	34	33	33
R3	38	48	31	33	32	32
R4	38	48	0	0	0	0
R5	38	48	0	1	0	0
R6	38	48	0	0	0	0

For the nearby sensitive receivers located to the west of the Project (R1 to R3), the standard hours NMLs are predicted to be exceeded during all construction scenarios. The exceedance above the NML ranged from 25 to 34 dBA for receivers R1 to R3. Receivers R2 and R3 are predicted to be highly noise affected during all construction scenarios.

Construction noise levels at R5 comply with the daytime NML during Scenarios 1, 3 and 4, with a marginal exceedance of 1 dBA predicted during construction scenario 2. An exceedance of ≤ 2 dBA would not generally be discernible by the average listener, and it is considered this exceedance could be managed utilising measures outlined in Section 5 of this report.

Construction noise levels at R4 and R6 are predicted to comply during the daytime period for all construction scenarios.

Due to the identified potential impacts, further noise mitigation and management measures should be considered. An overview of mitigation and management measures has been outlined in Section 6 to reduce the potential for noise impacts.

Where construction activity noise is likely to exceed the identified management levels, the ICNG requires the following actions:

- The proponent should apply all feasible and reasonable work practices to meet the noise affected level; and
- The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details for the project.

Construction noise mitigation and management measures will be developed as part of a construction noise and vibration management plan developed by the main contractor leading up to and during the construction phase.

5.1.6 Cumulative construction noise impacts

It is noted that the construction of the Aerotropolis Station, that forms part of the Sydney Metro Western Sydney Airport project, may occur at the same time as the construction of the Project. Therefore, there may be cumulative construction noise impacts associated with each construction site at the nearby affected receivers. The Sydney Metro Report predicted construction noise levels due to the construction of the Aerotropolis Station at the nearby affected receivers. The predicted noise levels showed noise levels of approximately 68 dBA at the nearest affected receivers.

In the instance where both construction sites are concurrently undertaking works, it is anticipated that for Receivers R1 to R3 the increase in noise levels would be minimal (up to 1 dBA louder than the predicted noise levels in Table 5.5). For Receivers R4 to R6, the construction noise emanated from the Aerotropolis Station is significantly louder than the construction noise from the Project. Therefore, it is expected that the construction noise levels from the Project would not increase the noise levels predicted for the construction of the Aerotropolis Station.

It is recommended that the cumulative noise impacts should be reviewed when more information is available and included in the construction noise and vibration management plan to be prepared by the contractor.

5.2 Construction traffic noise

The ICNG stipulates that construction traffic is assessed under the Environmental Criteria for Road Traffic Noise (EPA 1999), which has been superseded by the RNP. As discussed in Section 4.2, the RNP states that any increase in road traffic noise as a result of a traffic generating development should be limited to no more than 2 dBA over the existing traffic noise levels.

At the time of writing of this report, construction traffic information was unavailable. As a result, a qualitative assessment of road noise impact has been conducted.

The main access to the Project site would be via Badgerys Creek Road, which is considered to be sub-arterial road with reference to the RNP.

Typically, to result in greater than 2 dB increase in traffic noise level a minimum of 60% increase in the traffic volume will be required. Given that Badgerys Creek Road is classified as a sub-arterial road and currently carries a significant amount of light and heavy vehicles, it is not anticipated that the construction traffic associated with the Project would result in a significant increase in the existing traffic noise levels (i.e. less than a 2 dB increase in traffic noise).

It is recommended that the construction contractor review the construction traffic movements when the methodology is developed to ensure that the provisions of the RNP are satisfied.

5.3 Construction vibration impact assessment

Certain construction activities would require the use of vibration intensive equipment that may affect the nearest sensitive receivers. The most vibration intensive plant nominated as part of the work is the use of vibratory rollers and piling rigs.

Table 5.7 presents the indicative minimum working distances for the nominated construction plant to minimise the risk of structural damage and human comfort for sensitive receivers.

The minimum working distances are based on the typical distance from receivers' work permitted to be carried out to meet the limits set out in Section 6. The distances are indicative only and results may vary depending on the activity, equipment, local ground, and receiver conditions.

Table 5.7 Recommended minimum working distances for vibration intensive plant

PLANT ITEM	RATING / DESCRIPTION	MINIMUM WORKING DISTANCE	
		COSMETIC DAMAGE	HUMAN COMFORT
Large hydraulic hammer	1600 kg - 18 to 34t excavator	22 m	73 m
Handheld pneumatic hammer	10 kg	1 m (nominal)	Avoid contact with structure
Vibratory roller, smooth drum	> 18t	25m	100m
Pile boring	≤ 800mm	2 m (nominal)	4m

All privately owned sensitive residential receivers are located outside the minimum working distances for cosmetic damage and human comfort (refer to Table 4.8) As a result, it is anticipated that the construction vibration levels will satisfy the cosmetic damage and human comfort criteria stipulated in Section 4.3. To minimise the potential for vibration impact on these receivers, mitigation and management measures are discussed in Section 6.

5.3.1 Construction vibration impacts on the planned Sydney Metro tunnel

The Project is located adjacent the planned Sydney Metro alignment, therefore there is potential for vibration impacts on the Sydney metro corridor.

Current design has a carpark located on the eastern side of the development site. The proposed building is located approximately $\geq 55\text{m}$ from the eastern boundary line; and therefore further than 60 metres from the underground Sydney Metro line.

Major vibration intensive construction works are expected to be required for the construction of the building(s). As these are further than 60 metres away, the impact on the Sydney Metro tunnels are expected to be negligible.

Impacts for the construction of the surface carpark within 60 metres of the Sydney Metro tunnel are expected to be minimal.

It is however noted that, at the time of writing this report, the exact timing of the construction of the Sydney Metro tunnel and the construction of this Project is unknown, and it is recommended that the construction vibration impacts on the Sydney Metro tunnel be reviewed when more information is available and included in the construction vibration management plan to be provided by the main contractor.

6 NOISE AND VIBRATION MANAGEMENT

6.1 Construction noise and vibration

As noted in Section 3.1, the construction noise and vibration assessment has been undertaken with the assumption that the nearby sensitive receivers have not been acquired or demolished at the commencement of the works. In the instance where the dwellings are no longer occupied, the recommended mitigation measures may no longer be required.

Additionally, the assessment is limited to the works occurring during Standard Hours. The assessment would need to be revised if works are required to be undertaken outside the Standard Hours described previously.

Prior to commencement of construction works and when details of construction methodology and equipment are available, a Construction Noise and Vibration Management Plan (CNVMP) is to be prepared and implemented in accordance with the requirements of the ICNG. The CNVMP would take into consideration measures for reducing the source noise levels of construction equipment by construction planning and equipment selection where practicable. The CNVMP should include a detailed noise assessment updated to consider potential noise impacts at all affected properties.

The CNVMP would outline measures to reduce the noise impact from construction activities. Reasonable and feasible noise mitigation measures which would be considered include:

- avoiding any unnecessary noise when carrying out manual operations and when operating plant
- ensuring spoil is placed and not dropped into awaiting trucks
- avoiding/limiting simultaneous operation of noisy plant in discernible range of a sensitive receiver where practicable
- switching off any equipment not in use for extended periods e.g. heavy vehicles engines would be switched off whilst being unloaded
- no idling of delivery trucks
- keeping truck drivers informed of designated routes, parking locations and acceptable delivery hours for the site
- compounds, refuelling areas and work areas designed to promote one-way traffic so that vehicle reversing movements are minimised.
- minimising talking loudly; no swearing or unnecessary shouting, or loud stereos/radios onsite; no dropping of materials from height where practicable, no throwing of metal items and slamming of doors.
- maximising offset distances between noisy plant and adjacent sensitive receivers and determining safe working distances
- using the most suitable equipment necessary for the construction works at any one time
- directing noise-emitting plant away from sensitive receivers
- regularly inspecting and maintaining plant to avoid increased noise levels from rattling hatches, loose fittings etc
- using non-tonal reversing/movement alarms such as broadband (non-tonal) alarms or ambient noise-sensing alarms for all plant used regularly onsite (greater than one day), and for any out of hours works
- use of quieter and less vibration emitting construction methods where feasible and reasonable.

The most applicable standard management measures are outlined as follows:

- construction hours and scheduling:

- works should generally be carried out during standard construction hours (i.e. 7 am to 6 pm Monday to Friday; 8 am to 1 pm Saturdays).
- vibration monitoring:
 - to avoid structural impacts as a result of vibration or direct contact with structures, the proposed works would be undertaken in accordance with the safe work distances and attended vibration monitoring or vibration trials would be undertaken where these distances are required to be challenged
 - vibration resulting from construction and received at any structure outside of the Project would be managed in accordance with:
 - for structural damage vibration - British Standard *BS 7385 Part 2-1993 Evaluation and measurement for vibration in buildings*.
 - for human exposure to vibration the acceptable vibration - values set out in the *Environmental Noise Management Assessing Vibration: A Technical Guideline* (Department of Environment and Conservation, 2006) which includes British Standard *BS 6472:1992 Guide to Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz)*.

Table 6.1 provides indicative benefits of typical engineering control mitigation measures for construction activities, based on guidance in AS 2436 and experience on similar construction proposals.

Table 6.1 - Indicative noise reduction from construction controls

ENGINEERING CONTROLS	POSSIBLE NOISE REDUCTION, dBA
Portable temporary screens	5-10
Screen or enclosure for stationary equipment	10-15
Maximising the offset distance between noisy plant items and sensitive receivers.	3-6
Avoiding using noisy plant simultaneously and/or close together, adjacent to sensitive receivers.	2-5
Orienting equipment away from sensitive receivers.	3-5
Carrying out loading and unloading away from sensitive receivers.	3-5
Using noise source controls, such as the use of residential class mufflers, to reduce noise from all plant and equipment including bulldozers, cranes, graders, excavators and trucks	5-10
Selecting site access points and roads as far as possible away from sensitive receivers	3-6

7 CONCLUSION

WSP has conducted a noise and vibration impact assessment for the proposed research and development facility located at 215 Badgerys Creek Road, Bringelly.

Limited project information was available at the time of writing of this report; preliminary noise and vibration impact on surrounding receivers were modelled based on industry guidelines using conservative factors and assumptions. During all construction stages, maximum predicted noise levels will exceed NMLs at the sensitive receivers to the west of the Project site, and will require noise management and mitigation. Two sensitive receivers were identified as being highly noise affected. Modelling has been completed based on conservative assumptions about usage and is unlikely that predicted noise levels would be sustained for greater than a few days per construction stage. Shielding of more distant receivers would attenuate noise at receivers further from work areas.

From the predicted noise levels, noise mitigation measures have been recommended in Section 6 to minimise the impact from construction noise.

Based on available information, it is anticipated that any increase in road traffic noise levels due to construction traffic would be minimal and will comply with relevant noise goals.

An assessment of construction vibration impacts has been conducted, and the potential for vibration impact at sensitive receivers or structures is considered minimal.

Based on the findings of this assessment, the construction noise and vibration impacts associated with the Project can be managed to achieve acceptable levels, when the recommendations provided in this report are implemented.

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