Vertical First Pty Ltd

Commercial and hotel development above the Former Inwards Parcel Shed at 8-10 Lee Street, Haymarket

Air Quality Assessment

September 2020

Table of contents

Table index

Figure index

Appendices

Glossary and abbreviations

Glossary

Term	Definition
Atlassian Site	8 – 10 Lee Street, Haymarket
The Project	Commercial and hotel development above the Former Inwards Parcel Shed at 8-10 Lee Street, Haymarket
Block B or “Dexus/ Frasers Site”	14-30 Lee Street Haymarket. Adjoining land immediately to the south currently comprising three 8 storey commercial buildings.
Block C or Adina Hotel	2 Lee Street, Haymarket The Former Parcels Post Office The Adina Apartment Hotel Sydney Central
Central Sydney	Land identified as Central Sydney under the Sydney LEP 2012 and includes Sydney’s Central Business District
Sub-precinct	Western Gateway Sub-precinct
Atlassian Central	The Atlassian tower building (building only)
Atlassian Central development	The whole Atlassian development within the Atlassian Site including the tower and public domain works.
Devonshire Street Tunnel	The pedestrian and cycle tunnel running between Chalmers Street and Lee Street
Link Zone	The publicly accessible land within the Site.
Central Walk West	The future western pedestrian entry to the new 19 metre wide underground concourse connecting customers to suburban rail and Sydney Metro platforms.
Habitat Level 1	Flexibly ventilated workspace areas
Dust	Solid particles that are suspended in air, or have settled out onto a surface after having been suspended in air. For the purposes of this qualitative assessment dust is assumed to include particulate matter. In this guidance the term ‘dust’ has been used to include the particles that give rise to soiling, and to human health and ecological effects.

Abbreviations

Abbreviation	Meaning
ACHAR	Aboriginal Cultural Heritage Assessment Report
AHIMS	Aboriginal Heritage Information Management System
APAR	Airports Protection of Airspace Regulations
AS	Australian Standard
ASS	Acid Sulfate Soils
ATP	Australia Technology Park

Abbreviation	Meaning
BC Act	Biodiversity Conservation Act 2016
BCA	Building Code of Australia
BDAR	Biodiversity Assessment Report
Camperdown-Ultimo Strategy	Camperdown-Ultimo Collaboration Area and Place Strategy
CDRP	Central Design Review Panel
Central SSP	Central Station State Significant Precinct
C2E Strategy	Central to Eveleigh Urban Transformation Strategy
CMP	Conservation Management Plan
Council	City of Sydney Council
CPTED	Crime Prevention Through Environmental Design
CPTMP	Construction Parking and Traffic Management Plan
CSPS	Draft Central Sydney Planning Strategy
DES	Design Excellence Strategy
Design Brief	Architectural Design Competition Brief
Design Competition	Architectural Design Competition
Design Guideline	Western Gateway Design Guideline
Devonshire Tunnel	Devonshire Street Pedestrian Tunnel
District Plan	Eastern City District Plan
DPC	NSW Department of Premier and Cabinet
DPIE/Department	NSW Department of Planning, Industry and Environment
DP	Deposited Plan
DSI	Detailed Site Investigation
EIS	Environmental Impact Statement
EPA	NSW Environment Protection Authority
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
ESD	Ecologically Sustainable Development
GANSW	NSW Government Architect's Office
GFA	Gross Floor Area (as defined under the Sydney Local Environmental Plan 2012)
HIS	Heritage Impact Statement

Abbreviation	Meaning
Infrastructure Strategy	State Infrastructure Strategy 2018-2038
LGA	City of Sydney Local Government Area
LSPS	Draft Sydney Local Strategic Planning Statement
m	metre
NIA	Noise Impact Assessment
OEH	NSW Office of Environment and Heritage
OLS	Obstacle Limitation Surface
OWMP	Operational Waste Management Plan
Parcels Shed	Former Inward Parcels Shed
PSI	Preliminary Site Investigation
Region Plan	A Metropolis of Three Cities – Greater Sydney Region Plan
RAP	Remediation Action Plan
RAPs	Registered Aboriginal Parties
RMS	Roads and Maritime Services
RTTC	Radar Terrain Clearance Chart
SEARs	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy
SEPP 55	State Environmental Planning Policy No.55 – Remediation of Land
SEPP Infrastructure	State Environmental Planning Policy (Infrastructure) 2007
SEPP SRD	State Environmental Planning Policy (State and Regional Development) 2011
sqm	Square Metres
SREP SH	Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005
SSD	State Significant Development
SSDA	State Significant Development Application
Sub-precinct	Western Gateway Sub-precinct
Sydney 2030	Sustainable Sydney 2030 Strategy
Sydney LEP 2012	Sydney Local Environmental Plan 2012
Taskforce	Tech Taskforce
TIA	Transport and Accessibility Impact Assessment

Abbreviation	Meaning
TfNSW	Transport for New South Wales
The Minister	The Minister for Planning, Industry and Environment
The Regulation	Environmental Planning and Assessment Regulation 2000
Transport Strategy	Future Transport Strategy 2056
Urbis	Urbis Pty Ltd
VIA	Visual Impact Assessment
WMP	Waste Management Plan
WSUD	Water Sensitive Urban Design

1. Introduction

1.1 Overview

GHD Pty Ltd (GHD) has been commissioned by Atlassian (the Applicant) to prepare this air quality impact assessment report in accordance with the technical requirements of the Secretary's Environmental Assessment Requirements (SEARs), and in support of the SSD-10405 for a commercial and hotel development above the Former Inwards Parcel Shed at 8 – 10 Lee Street, Haymarket.

This air quality impact assessment assesses potential emissions to air from the developer portion of the works. Specifically, this report addresses the SEARs summarised in Table 1.

Table 1 Secretary's Environmental Assessment Requirements

Assessment requirements	Section(s) of this report where addressed
4. Integration with surrounding area	
The EIS shall demonstrate how the proposal: • specifically considers impacts from the ongoing operation, maintenance and potential future expansion requirements of the adjacent transport services (rail, metro, light rail) including noise, vibration, station operations (announcements, lighting) air quality and pedestrian movements on the future amenity and use of the site	Section 5.1
6. Environmental Amenity	
The EIS shall: • address potential air quality and odour impacts during construction and operation of the development and identify appropriate mitigation measures	Sections 4, 5 and 6
14. Construction	
The EIS shall: • address potential impacts of the construction on surrounding areas including the adjoining rail corridor and the public realm with respect to noise and vibration, air quality and odour impacts, dust and particle emissions, water quality, storm water runoff, groundwater seepage, soil pollution and construction waste	Sections 4, 5 and 6

1.2 Description of the Site

The Site is known as 8-10 Lee Street, Haymarket. It is an irregular shaped allotment. The allotment has a small street frontage to Lee Street, however this frontage is limited to the width of the access handle.

The Site comprises multiple parcels of land which exist at various stratums. All the lots are in the freehold ownership of Transport for NSW, with different leasing arrangements:

- **Lot 116 in DP 1078271**: YHA is currently the long-term leaseholder of the Site which covers the areas shown in blue below.

- **Lot 117 in DP 1078271**: This is currently in the ownership of TfNSW and the applicant is seeking the transfer of the leasehold on this land to provide for an optimise basement and servicing outcome for the Site.
- **Lot 118 in DP 1078271**: This is currently in the ownership of TfNSW and the applicant is seeking the transfer of the leasehold for part of the air-rights above part of this allotment to allow for an optimised building envelope for the project. The proposal also uses a part of Lot 118 in DP 1078271 within Ambulance Avenue for Day 1 bike access, secondary pedestrian access and fire service vehicle access.
- **Lot 13 in DP 1062447**: This is currently in the ownership of TfNSW but TOGA (who hold the lease for the Adina Hotel) have a long-term lease of this space in the lower ground area.

The Site (shown in Figure 1-1) has an area of approximately 3,764sqm which includes 277sqm of air rights that apply from RL40.

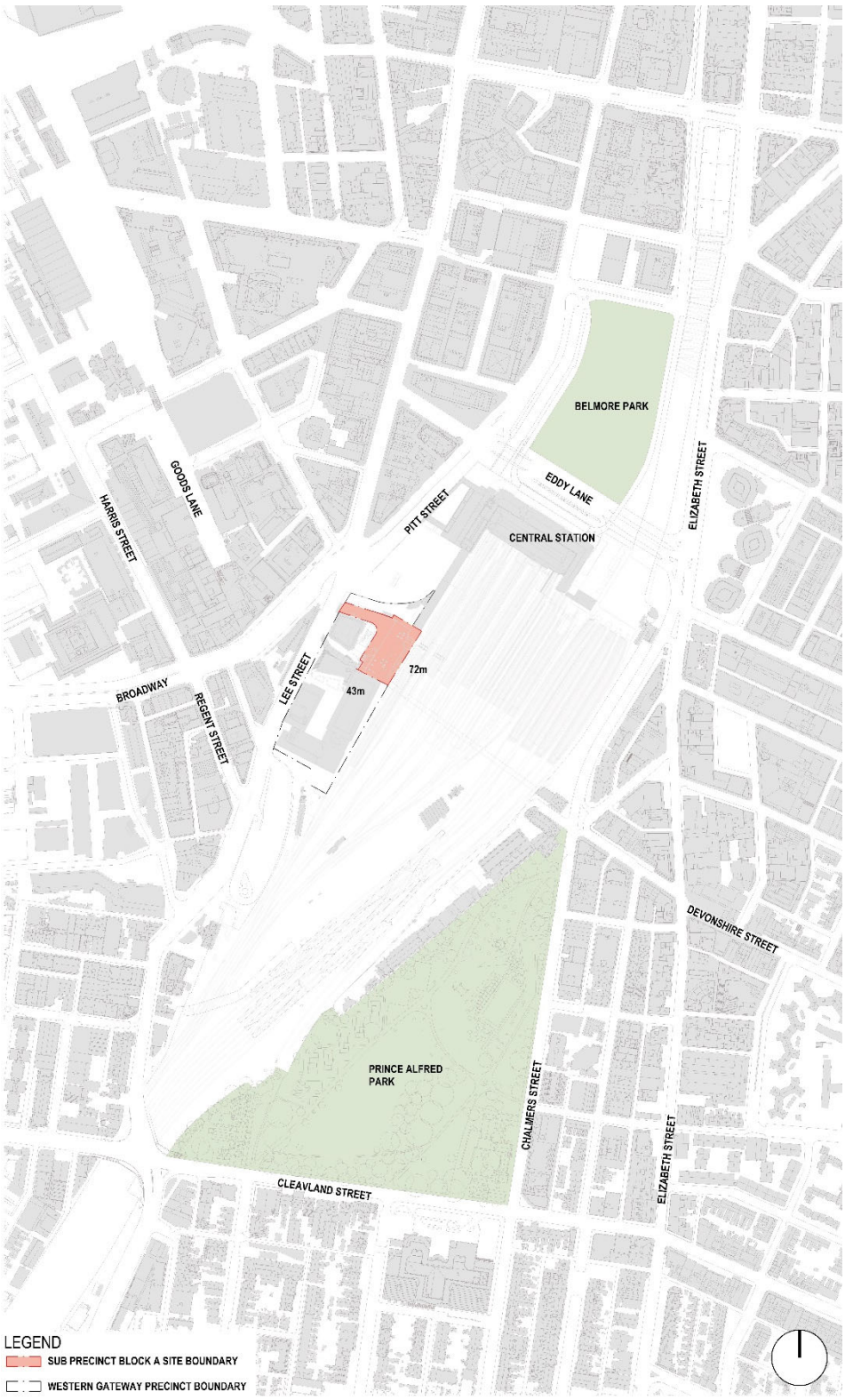


Figure 1-1 Site location and dimensions (Image Source: BVN / SHoP)

1.3 Site and surrounding context

The Site is directly adjacent to the Western Wing Extension of Central Station, and forms part of the 'Western Gateway Sub-precinct' of the Central Railway Station lands. It is situated between the existing CountryLink and Intercity railway platforms to the east and the Adina Hotel (former Parcel Post Office) to the west.

Existing vehicle access to the Site is via Lee Street, however the Lee Street frontage of the Site is only the width of the access handle.

Current improvements on the Site include the Parcels Shed, which operated in association with the former Parcels Post Office (now the Adina Hotel). The Site is currently used as the Railway Square YHA. The Site also includes the western entryway to the Devonshire Street Pedestrian, which runs east-west through Central Station under the existing railway lines.

The Site is situated in one of the most well-connected locations in Sydney. It is directly adjacent to Central Station Railway which provides rail connections across metropolitan Sydney, as well as regional and interstate connections and a direct rail link to Sydney Airport. The Site is also within close proximity to several educational institutes and is a city fringe location which provides access to key support services.

Central Railway Station is currently undergoing rapid transformation to allow for integration of rail, metro and light rail transport infrastructure. This will elevate the role of Central Station not only for transport but also enhance opportunities for urban renewal and revitalisation of the surrounding precinct. This is one of the key drivers for the identification of the Central SSP and the Western Gateway Sub-precinct to accommodate a new innovation and technology precinct.

The proximity of the Western Gateway Sub-precinct to the city, while still being located outside the core Sydney CBD, provides opportunity for it to evolve to attract technology and innovation companies. It has access to all required services while being sufficiently separate to the CBD to establish a distinct technology industry ecosystem. Its CBD fringe location will provide affordable commercial rents which will support Startups and entrepreneurs which are a key component of an innovation precinct.

1.4 Project description

The proposed SSDA will facilitate the development of a new mixed-use development comprising *'tourist and visitor accommodation'* (in the form of a 'backpackers') and commercial office space within the tower form. Retail, lobby and food and drink premises at the Lower Ground level and Upper Ground level.

Atlassian Central at 8-10 Lee Street will be the new gateway development at Central Station which will anchor the new Technology Precinct proposed by the NSW Government. The new building will be purpose-built to accommodate the Atlassian Headquarters, a new TfNSW Pedestrian Link Zone, and the new Railway Square YHA backpacker's accommodation, in addition to commercial floorspace to support Tech Start-ups.

The new development is to be built over the existing heritage former Inwards Parcels Shed (the Parcels Shed) located on the western boundary of Central Station with the Adina hotel to the west. The works includes a 38-storey mixed-use tower with basement loading dock facilities and end of trip (**EOT**) facilities accessed off Lee Street, 2 storey lobby utilising the Parcels Shed building, lower ground and upper ground retail, YHA hostel and commercial tower with staff amenities to the mid-level and roof top areas and a pedestrian Link Zone works for TfNSW.

The building design has been conceived to support the delivery of a site plan designed to connect with future developments to both the south and east and integrate with a cohesive public realm for the broader Sydney community in accordance with NSW government strategic planning.

The tower design is a demonstration project for Atlassian, representing their commitment to environmental sustainability and contemporary workplace settings through tower form and construction systems along with a set of emblematic outdoor workplaces stacked in the tower form.

The existing Parcels Shed will be adaptively re-used in accordance with best practice heritage process and form the upper level of a 2-storey entry volume that connects visually with the 2 level Link Zone. Over the roof of the Parcels Shed, a new privately owned but publicly accessible landscaped area will be created as the first part of a new upper level public realm that may extend to connect to a future Central Station concourse or future Over Station Development.

The proposed mixed use tower directly adjoins a live rail environment to the east and public domain to the north, west and south. These works will consider these rail environments and have been designed to ensure that all TfNSW external development standards are achieved. This ensures there is no impact to the operation or safety of these TfNSW assets.

Interfaces from the overall site and especially the State works Link Zone have been designed in consultation with the adjoining stakeholders. These stakeholders include TfNSW to the north and south, Toga and the Adina Hotel operator to the west and the Dexus Fraser's site to the south. Connections via the Link Zone, through the basements, and off the proposed new Link Zone dive ramp will be designed to enable existing and future developments to function in both the day 1 scenario and end state when all developers have completed their works.

The overall project aspiration is to create a world class tech precinct with effective pedestrian links through the Atlassian site to the Central Station western forecourt to Central Walk west and adjoining stakeholder's sites.

1.5 Assessment methodology

1.5.1 Approach

This air quality impact assessment was undertaken in accordance with guidance from the NSW EPA *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (2016) (the Approved Methods) and the Institute of Air Quality Management *Guidance on the assessment of dust from demolition and construction* (2016) (IAQM guidance).

Based on a review of the air quality emissions from the construction and operation of the Project and the requirements outlined in the SEARs, it was considered appropriate to adopt a qualitative risk based approach to assess potential air quality impacts. This style of approach focuses on identifying the likely air emissions from the Project and recommending appropriate mitigation measures to effectively management potential air quality impacts.

1.5.2 Construction air quality assessment

A risk based approach in accordance with the IAQM guidance was adopted to assess dust from the construction of the Project. A review of other fugitive construction air quality emissions was undertaken and appropriate site specific mitigation measures were recommended.

The IAQM guidance contains a four-step process to qualitatively assess potential dust impacts from construction activities. An overview of the methodology is provided in Table 2.

Table 2 Overview of IAQM guidance risk assessment

Step	IAQM Process
1	A conservative screening based on distance to the nearest sensitive receptor (human and ecological receptor). Further assessment is required if a sensitive receptor is located within the screening criteria.
2	Assess the risk of uncontrolled (no mitigation measures applied) dust impacts (including dust soiling effects, health effects and ecological effects) based on:

Step	IAQM Process
	• Dust emission magnitude of construction activities (demolition, earthworks, construction and trackout) • Sensitivity of the area (based on sensitivity of nearby receptors, number of nearby receptors and distance from source)
3	Determine site specific mitigation measures to appropriately manage all activities with potential to cause dust impacts.
4	Assess the residual risk of dust impacts after site specific mitigation measures have been implemented.

1.5.3 Operational air quality assessment

The operational air quality assessment reviewed potential operational emissions to air and recommended appropriate management measures based on guidance contained within the NSW EPA Local Government Air Quality Toolkits and GHD previous experience.

1.6 Limitations

This report: has been prepared by GHD for Vertical First Pty Ltd and may only be used and relied on by Vertical First Pty Ltd for the purpose agreed between GHD and the Vertical First Pty Ltd as set out in this report.

GHD otherwise disclaims responsibility to any person other than Vertical First Pty Ltd arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Vertical First Pty Ltd and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

1.7 Assumptions

The air quality assessment relied upon the following assumptions:

- Information on construction activities has been sourced from Atlassian Building Central Preliminary Construction Management Plan, Revision 05 – SSDA submissions (June 2020) (CMP).
- Information on sources of operational air quality emissions has been sourced from the Atlassian project team (including correspondence from Avenor, LCI and JMT Consulting)

and concept design documents provided by Atlassian including the Atlassian central concept design narratives and Atlassian central concept design drawings.

2. Existing environment

2.1 Sensitive receptors

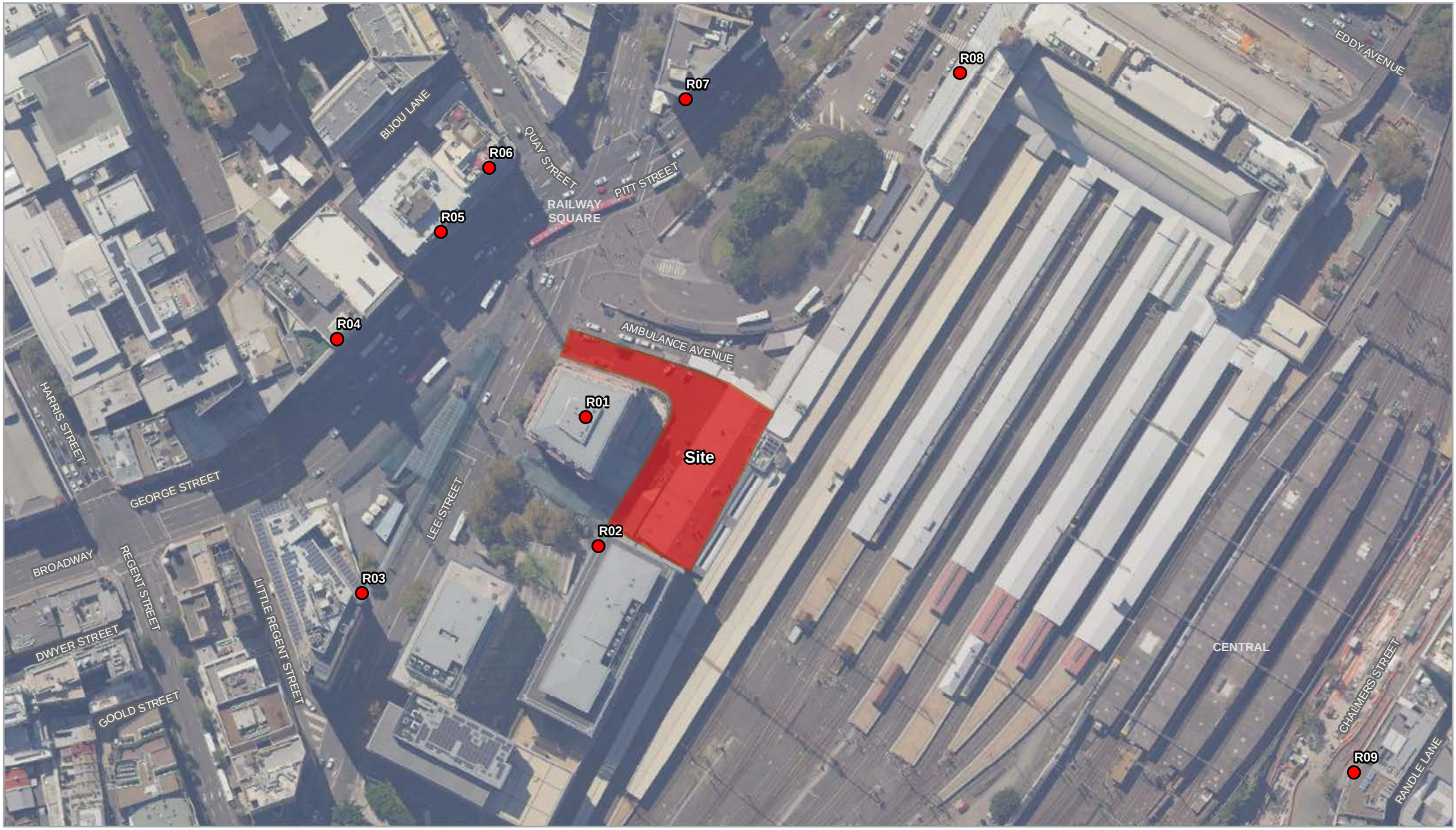
The Approved Methods defines sensitive receptors as locations where people are likely to work or reside and may include a dwelling, school, hospital, office or recreation areas.

Due to the density of nearby commercial premises there are many sensitive receptors. Rather than identifying all sensitive receptors, representative receptors closest to the Site in various directions have been selected. It is expected that the closest receptors would experience the worst-case air quality impacts. If potential air quality impacts from the development comply with the adopted assessment criteria at the nearest receptors, then those situated at a greater distance would also comply.

The locations of the representative sensitive receptors relative to the Site are presented in Table 3 with a description, address and approximate distance from Site. The locations of representative sensitive receptors in the study area are shown in Figure 2-1.

Table 3 Representative sensitive receptor locations

Receptor	Description	Address	Approximate distance from Site
R01	Adina Apartment Hotel Sydney Central	2 Lee St, Haymarket NSW 2000	Adjacent to Site, within 10 m
R02	Henry Deane Plaza	18 Lee St, Haymarket NSW 2000	Adjacent to Site, within 10 m
R03	Mercure Sydney	818-820 George St, Sydney NSW 2000	100 m
R04	TAFE NSW – Ultimo, Building W	827 George St, Ultimo NSW 2007	65 m
R05	Endeavour College of Natural Heath (Sydney Campus)	815-825 George St, Haymarket NSW 2000	60 m
R06	Rendezvous Hotel Sydney Central	Cnr of George and Quay St, Sydney NSW 2000	60 m
R07	Wake Up! Sydney	509 Pitt St, Sydney NSW 2000	100 m
R08	NSW TrainLink	15 Railway Colonnade Dr, Haymarket NSW 2000	100 m
R09	Haven Specialty Coffee	34 Chalmers St, Surry Hills NSW 2010	250 m



Legend

- Site boundary
- Sensitive receptors

Paper Size ISO A4

0 10 20 30 40

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Atlassian Pty Ltd
Schematic Design and DA Advice - Air Quality

Project No. 12527976
Revision No. A
Date 11/05/2020

Site and sensitive receptor location

FIGURE 2-1

Data source: General Topo - NSW LPI DTDB 2012,2015. Cadastre - NSW LPI DCDB 2012. Aerial Imagery - Sixmaps 2018. Created by: sgerman

2.2 Ambient air quality

The NSW Planning, Industry & Environment operate ambient air quality monitoring stations in selected areas around NSW. The nearest station to the Site is the Cook and Phillip monitoring which is located approximately 1.5 km to the northeast of the Site. However the Cook and Philip station began operating on 07/09/2019 so historical monitoring data is limited, therefore additional background data was sourced from the Rozelle monitoring station (located approximately 4.3 km to the northwest).

Ambient pollutant concentrations are presented in Table 4.

Table 4 Ambient air quality concentrations (µg/m^3)

Pollutant	Averaging period	NSW Planning Industry & Environment monitoring station			
		Rozelle			Cook and Phillip[1]
Year		2017	2018	2019	2019
PM_{10}	Maximum 24 hour	54	88	143	117
	Annual average	18	18	23	30
$PM_{2.5}$	Maximum 24 hour	36	19	102	97
	Annual average	7	7	10	17
NO_2	Maximum 1 hour	115	107	169	207
	Annual average	21	19	18	22
SO_2	Maximum 1 hour	63	79	84	47
	Maximum 24 hour	8	13	13	8
	Annual average	1	2	2	2
CO	Maximum 1 hour	1380	1150	5980	5060

Review of the monitoring data identifies abnormally high particulate matter (PM_{10} and $PM_{2.5}$) concentrations in 2019. This is primarily attributed to the bushfires which occurred in the second half of 2019. Historical PM_{10} and $PM_{2.5}$ concentrations measured over the past five years are shown in Figure 2-2 and Figure 2-3 respectively. These figures show a significant spike in particulate matter concentrations occurring at the end of 2019. The bushfire affected data is not considered representative of likely future conditions (natural disasters such as bushfires are infrequent and unpredictable) and so these spike in particulate matter has not been included in this assessment.

[1] Data from 07/09/2019

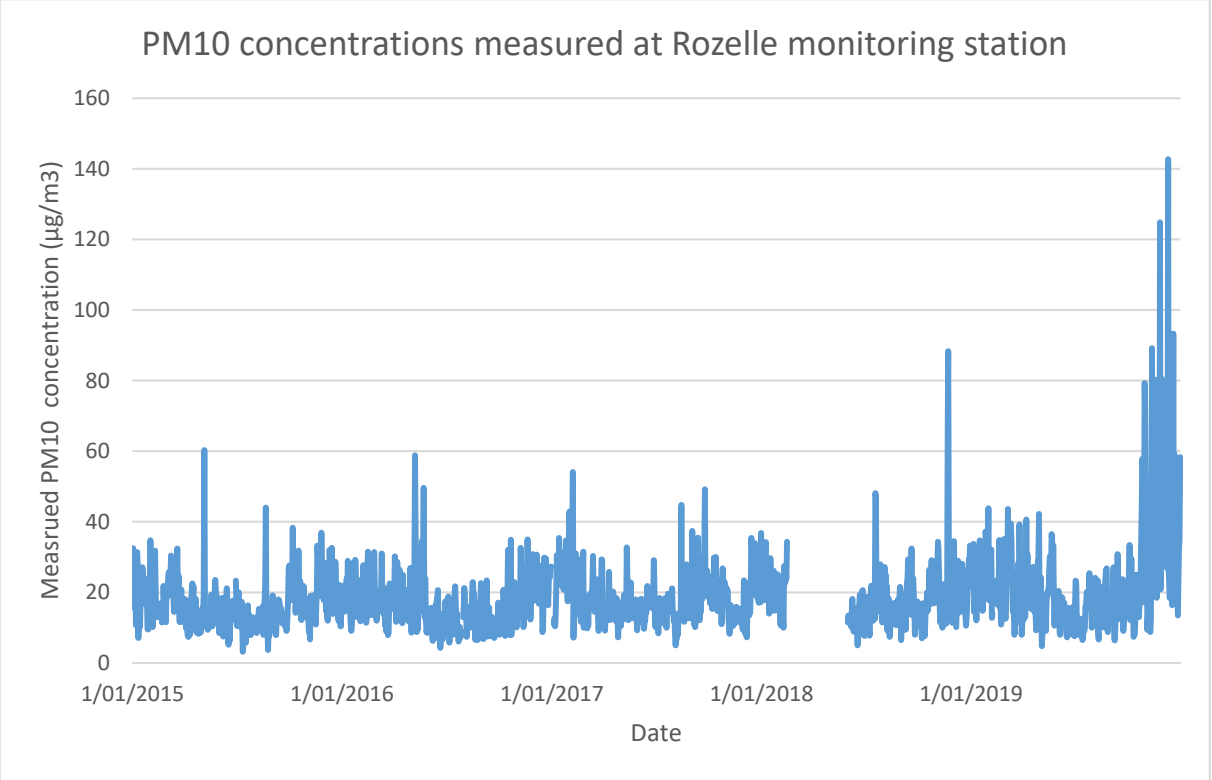


Figure 2-2 PM_{10} concentrations measured at Rozelle monitoring station

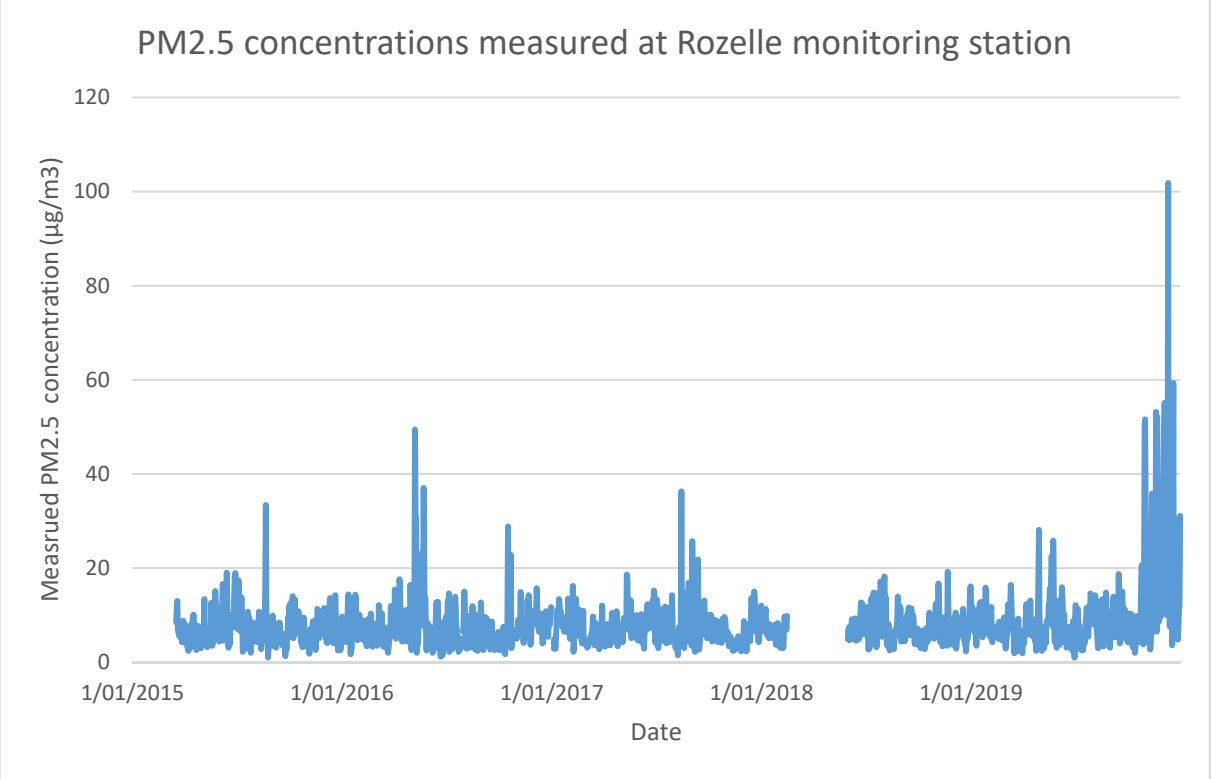


Figure 2-3 $PM_{2.5}$ concentrations measured at Rozelle monitoring station

2.3 Meteorology

Local meteorology taken from the Rozelle NSW Planning, Industry & Environment monitoring station for the most recent calendar year is summarised in Figure 2-4.

Local meteorology shows that:

- Winds predominately occur from the south, northwest and northeast.
- A high percentage of calms were recorded (19.46%)
- Low wind speeds (<2 m/s) predominately occur from the northwest
- High wind speeds (>4 m/s) predominately occur from the south and northeast
- The average wind speed is 1.56 m/s

Site specific meteorology including wind speed and direction is expected to be heavily influenced by the local topography and high rise buildings.

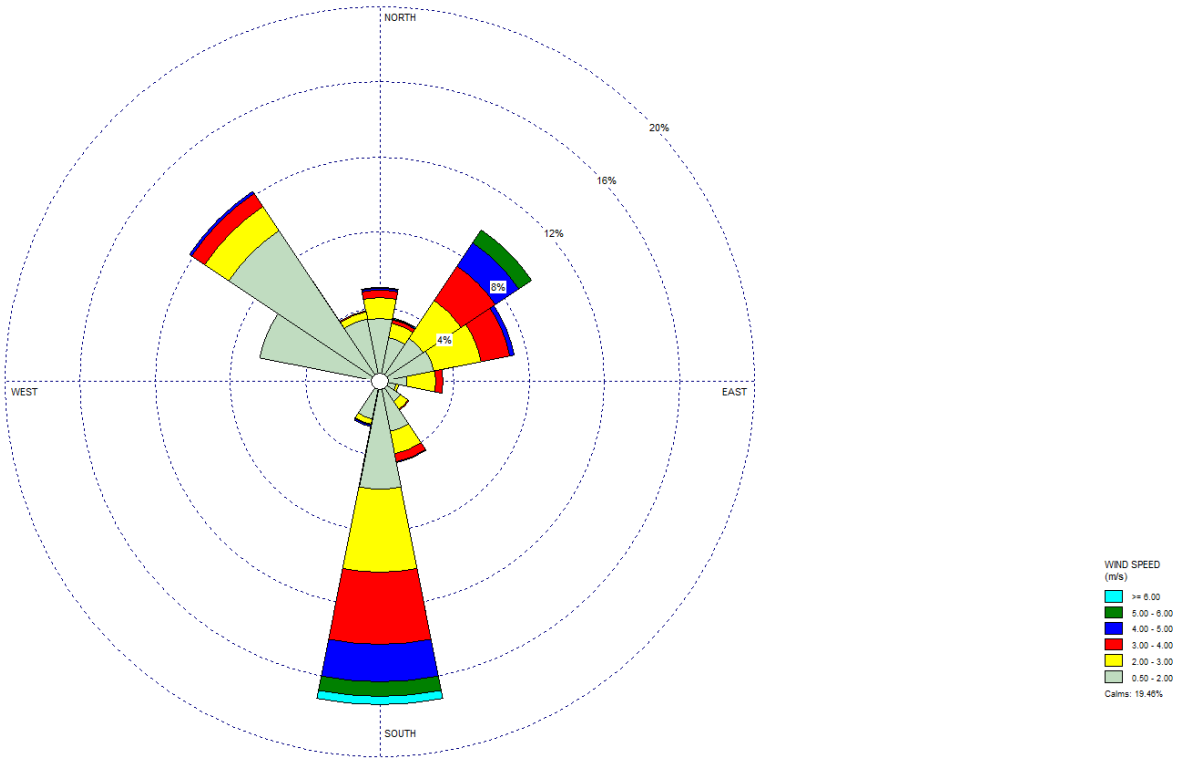


Figure 2-4 Annual wind rose from observations at Rozelle NSW Planning, Industry & Environment monitoring station (01/01/2019 – 01/01/2020)

Based on Figure 2-4, worst case air quality dispersion is expected to occur to receptors located north, southeast and southwest (downwind of the primary wind directions) of the Site.

3. Air quality criteria

3.1 Legislative and policy context to the assessment

The relevant legislation and government guidance for the air quality assessment of the Project are:

- NSW *Protection of the Environment Operations Act 1997* (POEO Act)
- NSW Protection of the Environment Operations (Clean Air) Regulation 2010 (the Clean Air Regulation)
- *Technical framework – Assessment and management of odour from stationary sources in NSW* (the Technical Framework), NSW Department of Environment and Conservation (DECC 2006)
- NSW EPA *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (2016) (the Approved Methods).

The POEO Act provides the statutory framework for managing pollution in NSW, including the procedures for issuing licences for environmental protection on aspects such as waste, air, water and noise pollution control. The POEO Act requires that no occupier of any premises causes air pollution (including odour) through a failure to maintain or operate equipment or deal with materials in a proper and efficient manner. The operator must also take all practicable means to minimise and prevent air pollution (sections 124, 125, 126 and 128 of the POEO Act). The POEO Act includes the concept of 'offensive odour' (section 129) and states it is an offence for scheduled activities to emit 'offensive odour'.

The Clean Air Regulation provides regulatory measures to control emissions from motor vehicles, fuels, and industry.

The Technical Framework provides a legislative context for the control of odour and presents odour assessment criteria guidelines. It provides a framework for different levels of odour assessment, strategies to mitigate odour, and guidance for performance monitoring, regulation and enforcement.

The Approved Methods lists the statutory methods for modelling and assessing emissions of air pollutants from stationary sources in NSW. It considers the above-mentioned legislation and guidance to provide pollutant assessment criteria.

3.2 Project impact assessment criteria

3.2.1 Air quality pollutant assessment criteria

Assessment criteria has been taken from the Approved Methods. These criteria should be met at existing or future off-site sensitive receptors. The assessment criteria is provided as cumulative impacts, where the predicted impact of the Project (incremental) is added to the existing levels (background) in order to assess the pollutants impacts. To determine the level of air quality impacts, emissions from the Project must be assessed against the assessment criteria as shown in Table 5.

Table 5 Air quality impact assessment criteria

Pollutant	Averaging period	Percentile	Assessment criteria (µg/m^3)
TSP (total suspended particulates)	Annual	100th	90
PM_{10}	24 hour	100th	50
	Annual	100th	25
$PM_{2.5}$	24 hour	100th	25
	Annual	100th	8
CO	1 hour	100th	30000
	8 hour	100th	10000
NO_2	1 hour	100th	246
	Annual	100th	62
SO_2	1 hour	100th	570
	24 hour	100th	228
	Annual	100th	60

3.2.2 Odour assessment criteria

The assessment criteria for odour are applied at the nearest existing or likely future off-site sensitive receptor. The Approved Methods defines odour assessment criteria (measured in odour units (OU))[2] and specifies how they should be applied in dispersion modelling to assess the likelihood of nuisance impact arising from the emission of odour.

Odour impact is a subjective experience and has been found to depend on many factors, the most important of which are:

- Frequency of the exposure
- Intensity of the odour
- Duration of the odour episodes
- Offensiveness of the odour
- Location of the source.

These factors are often referred to as the 'FIDOL' factors.

The odour assessment criteria are defined to take account of two of these factors (F is set at 99th percentile; I is set at between 2 to 7 OU). The choice of assessment criteria is also dependent on the population of the affected area, as shown in Table 6.

Table 6 Odour assessment criteria in the Approved Methods

Population of the affected community	Odour performance criteria (nose response odour certainty units at 99th percentile[3])
Single residence (≤ ~2)	7
~ 10	6
~ 30	5
~ 125	4
~ 500	3
Urban (≥~2,000)	2

[2] The number of odour units is the concentration of a sample divided by the odour threshold or the number of dilutions required for the sample to reach the threshold. This threshold is the numerical value equivalent to when 50 per cent of a testing panel correctly detect an odour

[3] This is a prediction of the odour level that may occur 99 per cent of the time, or that is below these criteria for 99 hours in every 100. Odour performance criteria are designed to be precautionary, so that impacts on sensitive receivers can be minimised.

The criteria assume that 7 OU at the 99th percentile would be acceptable to the average person, but as the number of exposed people increases, there is a chance that more sensitive individuals would be encountered. The criterion of 2 OU at the 99th percentile is considered to be acceptable for large populations (more than 2,000 people).

The criteria have also been specified at an averaging time of nominally one second. The choice of the short averaging time recognises that the human nose has a response time of less than one second, so that modelling of odour impact should allow for the short-term concentration fluctuations in an odour plume due to turbulence.

As the Project is located in an urban environment with the potential to impact more than 2,000 people, an odour criteria of 2 OU was adopted.

4. Project emissions

4.1 Construction

4.1.1 Overview of construction methodology

The proposed construction stages and estimated duration of each stage as outlined in the CMP are provided in Table 7. Further details including the construction timeline is available from the CMP.

Table 7 Proposed construction stages

Stage	Description of works	Estimated duration
Stage 1 – Site establishment	• Site establishment • Placement of hoardings and fencing • Establishment of loading areas • Reconfigure the Adina Hotel Basement to accommodate taxi/ DOA drop/off and the Lot 13 Loading	1 month
Stage 2 – Shed dismantle and demolition	• YHA shed dissembled as per heritage strategy • Demolition of YHA above ground floor	3 months
Stage 3a and stage 3b – Piling, excavation and retention	• Piling and excavation of substructure	12 months
Stage 4 – Core and structure	• Dive structure delivered and connected into Adina Basement • Basement construction • Link Zone structure • Jumpform installation and lift core construction • Core, super structure, CLT floors and façade, commencement of tower fitout link zone services, fitout and commissioning	21 months
Stage 5 – Façade, CLT and fitout	• Completion of tower fitout • Commissioning and handover	18 months

4.1.2 Construction emissions

A review of the construction stages provided in the CMP was undertaken to identify the key emissions to air during the construction of the Project. A summary of potential construction emissions is provided in Table 8. A more detailed discussion is provided below the table.

Table 8 Construction air quality emissions

Construction stage	Key air quality emissions
Stage 1 – Site establishment	• Minor dust emissions from site establishment works • Minor exhaust emissions from diesel power plant, equipment and vehicles
Stage 2 – Shed dismantle and demolition	• Dust emissions from demolition of YHA • Minor dust emissions from shed disassembly and site enabling works • Minor exhaust emissions from diesel power plant, equipment and vehicles
Stage 3a and stage 3b – Piling, excavation and retention (referred herein as Stage 3)	• Dust emissions from bulk earthworks and piling • Exhaust emissions from diesel power plant, equipment and vehicles • Potential odour emissions if contaminants is encountered during bulk earthworks
Stage 4 – Core and structure	• Minor dust emissions from construction of tower structure • Minor exhaust emissions from diesel power plant, equipment and vehicles
Stage 5 – Façade, CLT and fitout	• Minor exhaust emissions from diesel power plant, equipment and vehicles

Dust emissions

The primary emission to air that could impact on health and amenity during the construction of the Project is dust (which includes particulate matter). Stage 2 (Shed dismantle and demolition) and Stage 3 (Piling, excavation and retention) was identified as the only construction stages with potential to release significant dust emissions. Minor dust emission (non-significant quantities) is expected from all other construction stages.

Stage 2 and 3 construction works includes minor demolition works, piling and bulk earthworks. Demolition works are considered minor and would include the removal of the existing dive ramp and demolition of the above ground portion of the YHA. Dust from demolition works is considered highly variable occur for a short period of time while the demolition works are occurring.

The potential air quality impacts associated from the demolition works are highly dependent of the prevailing meteorological conditions at the time of the demolition works which cannot be reliably predicted. Instead it is preferable to manage emissions by adopting appropriate mitigation measures or only undertake demolition works in favourable meteorological conditions.

The primary source of dust is expected to occur from bulk earthworks (Stage 3). Bulk earthworks would involve the use of excavators and haul trucks. Earthworks would occur for a relatively short time frame, approximately 6 months based on advice from Avenor and the preliminary project timeline outlined in the CMP.

A risk based assessment of potential dust impact is provided in Section 5.2.1 and recommended mitigation measures are provided in Section 6.1.

Exhaust emissions

It is likely that all stages of the construction would involve the use of diesel fuelled plant or equipment. Typical examples of diesel fuelled plant and equipment include excavators, piling rigs, haulage trucks, cranes and light vehicles.

The use of diesel fuelled plant and equipment generates various pollutants including oxides of nitrogen, carbon monoxide and particulate matter (mainly $PM_{2.5}$). Exhaust emissions from construction equipment are expected to move around the Site and resulting emissions will be discontinuous, transient, and mobile.

A qualitative assessment of potential exhaust emissions impacts is provided in Section 5.2.1 and recommended mitigation measures are supplied in Section 6.1.

Odour

If contaminants are encountered during excavation works, odour emissions may occur as the contaminants are released to air. At this stage no contaminants are expected to be encountered during earthworks and therefore odour emissions have not been assessed further.

4.2 Operational air quality emissions

Potential sources of operational air quality emissions from the Project would be generated from rooftop plant, building exhaust, chemical/waste storage, café/kitchen emissions and combustion emissions from increased traffic movements. These operational emissions are typical of all high-rise buildings.

A summary of potential operational air quality emissions is provided in Table 9. A more detailed discussion regarding each air quality emissions is provided below.

Table 9 Operational air quality emissions

Operational air quality emission source	Key air quality emissions
Rooftop plant and building exhaust	• Warm/cool air from building ventilation heat pumps • Ducted exhaust from toilets • Smoke exhaust from commercial office fire mode • Ducted exhaust from kitchens • Flue discharges from two standby diesel generators (Ducted from Level 7 Plant room) • Heated humid air for cooling towers
Exhaust outlet above OSD shed	• Warm air exhaust from substations • General air exhaust from general plant rooms, waste rooms and toilets • Carpark exhaust from the loading dock
Below OSD YHA level 1	• Toilet and kitchen exhaust from YHA kitchens and toilets
Commercial kitchens, café and tenant kitchens	• Cooking odour and fumes (ducted to rooftop)

Traffic emissions	• Combustion exhaust emissions including oxides of nitrogen, carbon monoxide and particulate matter (fugitive from nearby roadways and carpark)

Rooftop plant and building exhaust

Rooftop plant and building exhaust are the primary source of operational air quality emissions from the Project. The majority of building exhaust is ducted and released from the rooftop. A detailed breakdown of all mechanical service air quality emissions including expected flow rates is provided in Appendix A.

A qualitative assessment of rooftop plant and building exhaust emissions is provided in Section 5.2.2, recommended mitigation measures are supplied in Section 6.2.

Waste storage

There is potential for odour emissions to be generated from the buildings waste storage facilities, which are located in the basement. It is anticipated that the majority of waste generated odour emissions would be contained within the building and would not result in external impacts.

The proposed waste management infrastructure and practices described in the Operational Waste Management Plan (GHD, 2020) would be adopted to ensure appropriate waste management measures are adopted including suitable types and quantities of waste storage receptacles. Organic wastes would be removed from site at least daily, reducing the possibility of odours.

Potential odour impacts from waste storage are qualitatively assessed in Section 5.2.2 with recommended mitigation measures supplied in Section 6.2.

Café and kitchen emissions

The internal café and tenant kitchens are a source of mixed air quality emissions with the potential to produce various cooking odours and smoke emissions.

The café and kitchens would be equipped with range hoods to capture cooking odour and fumes. The commercial kitchen would be equipped with a commercial kitchen hood to ventilate fumes at a rate of 3,000 L/s.

Once captured by the range hood, the majority of exhaust fumes from cooking areas would be ducted to the rooftop and released via a stack. Cooking fumes from the YHA kitchen would be ducted and released from below OSD YHA level 1. Café and kitchen emissions are highly variable and would depend on the type, frequency and duration of use.

Café and kitchen emissions have been qualitatively assessed in Section 5.2.2, and recommended mitigation measures are provided in Section 6.2.

Traffic emissions

Increased patronage to the area due to the Project may increase the number of vehicle movements on nearby roads which in turn would increase vehicle air quality emissions. This is considered unlikely and it is expected that there would be negligible changes in traffic flows due to the Project compared to the current situation, given:

- Staff car parking is not proposed as part of the Project
- Existing parking in Ambulance Avenue and Upper Carriage Lane (outside the YHA) would be removed

- The Project would generate some service vehicles throughout the day, however this increase would be largely offset by the second point above.

It is anticipated that tenants and staff would access the Site via existing public transport routes and not contribute to traffic emissions. Therefore traffic emissions have not been considered further in this assessment.

5. Air quality impact assessment

5.1 Potential impacts on future amenity and use of the Site

It is considered unlikely that ongoing operation, maintenance and potential future expansion requirements of the adjacent transport services (rail, metro, light rail) would have a significant impact on the future amenity and use of the Site.

Rail, metro and light rail services are predominately electric and do not emit any pollutants during their operation.

The primary source of operational emissions from the adjacent transport services are diesel locomotives used for regional travel. These locomotives generally idle at the station for a period of time to warm up before operation. Idling locomotives emit pollutants including oxides of nitrogen, carbon monoxide and particulate matter (mainly $PM_{2.5}$) similar to that of diesel fuelled plant or equipment.

The exact type of locomotives and the number that idle at any one time is not known. The Project is located approximately 10 m from the nearest rail line where idling locomotives may operate. It is possible that idling trains occur simultaneously on platforms 1 and 2 which are both within 25 m of the Project boundary.

GHD has undertaken preliminary modelling using NSW freight locomotive emission rates based on a recent investigation titled *Diesel Locomotive Fuel Efficiency and Emissions Testing: Prepared for NSW EPA* (ABMARC, 2016). Screening level calculations show that maximum ground level NO_2 (worst case pollutant) generally comply with the criteria 25 metres from two idling locomotives. Modelling is based on conservative assumptions and does not include building wake effects, and assumes the locomotives could be idling 24 hours a day.

The majority of the Project is above ground level and therefore NO_2 emissions are expected to mixed with ambient air resulting in reduced NO_2 concentrations at higher levels of the Project

The Project would use a combination of air conditioning and natural ventilation. Air conditioned air would be treated via filtration prior to entering the building removing most pollutants of concern. Natural ventilation is achieved via operable vents that can be opened or closed depending on ambient conditions and the desired internal ventilation. Detailed dispersion modelling including details of the locomotive idling times, locomotive engine type and emissions would be needed to accurately predict potential emission concentrations at the Project ventilation points.

It is understood that the NSW Government has begun a project to replace the aging NSW regional rail fleet with new trains as part of the Regional Rail Fleet Project (NSW Government, 2020)[4]. The new trains would use bi-mode diesel-electric hybrid technology allowing them to operate on overhead electrical power supply while travelling on the electrified section of the NSW rail network.

The Regional Rail Fleet Project plans to have the first new trains running from 2023 with the full fleet coming into service progressively. Therefore is it expected that the rail fleet replacement will have been completed by the time the Project is commissioned (forecast for Q4 2024). Once the Regional Rail Fleet Project is complete, it is anticipated that all trains at Central Station would be capable of electrical operation and therefore diesel exhaust emissions would not be emitted.

However, if there is a delay to the locomotive replacement program, or for other reasons, locomotives with diesel exhaust emissions use the platforms, this could result in adverse

[4] Further information available at https://www.transport.nsw.gov.au/projects/current-projects/regional-rail

outcomes for building users, unless there is a way of ceasing natural ventilation. Therefore it is recommended that the design of the ventilation system might need to be reviewed, and possibly modified, to enable natural ventilation to temporarily shut down at the lower levels, should this situation arise.

Maintenance and future expansion to the transportation networks may result in minor particulate matter emissions for works such as track maintenance and realignment. These works are typically short term activities that are limited to off peak transport hours.

It is assumed that prior to all maintenance and future expansion works during undertaken, an associated environmental assessment would be undertaken to ensure potential environment impacts are minimised.

The environmental assessment would prescribe appropriate air quality mitigation measures to be undertaken during all maintenance and future expansion works. Therefore no adverse impacts on future amenity and use of the Site are expected.

5.2 Potential impacts caused by the Project

A qualitative approach was adopted to assess all potential air quality impacts during the construction and operation of the Project. This was considered appropriate due to the relatively minor nature of the air emissions from the Project.

Instead, this assessment focused on providing suitable mitigation measures to be implemented throughout the construction and operation of the Project to manage and minimise potential air quality impacts.

5.2.1 Construction

A risk based approach in accordance with IAQM guidance was adopted to assess potential particulate matter impacts during the construction of the Project. A qualitative approach as outlined in Section 1.5.2 was adopted to assess all other potential air quality impacts during the construction of the Project. A detailed explanation of methodology undertaken (with accompanying IAQM guidance excerpts) is provided in Appendix B.

Particulate matter

Significant dust emissions were identified to occur during Stage 2 (Demolition of YHA above ground floor) and Stage 3 (Piling and excavation) construction works only, without management measures in place. The below risk based assessment was undertaken for Stage 2 and 3 construction works.

Step 1: Screen the need for a detailed assessment

The closest sensitive receptors are located adjacent to the Site, within approximately 10 metres of the Site boundary and therefore are located within the screening distance (350 from site boundary or 50 m from route used by construction vehicles up to 500 m from site entrance) stipulated by the IAQM. Therefore further assessment is required in accordance with IAQM guidance.

Step 2: Assess the risk of dust impacts

Step 2A: Define the potential dust emission magnitude

Dust emission magnitudes for the proposed construction works have been classified in Table 10 based on the definitions provided in IAQM guidance.

Table 10 Construction dust emissions magnitude classification

Activity	Dust emission magnitude	Justification of magnitude
Demolition	Small	Proposed demolition works consist of demolishing the existing dive ramp only. Ramp is less than 20,000 m^3 and is located below ground level.
Earthworks	Medium	The earthworks area is approximately 3,400 m^2 (falling between IAQM guidance bracket of 2,500 m^2 – 10,000 m^2). Earthworks would occur for a short period of time (approximately 4 months)
Construction	Large	Building volume is greater than 100,000 m^3, however it is understood that onsite concrete batching or sand blasting would not occur
Track out	Small	Unpaved road length would be less than 50 m. Highest potential for trackout would occur during a short period of time (approximately 4 months based on Stage 2 work earths)

Step 2B: Define the sensitivity of the area

Based on IAQM guidance, the sensitivities of dust soiling effects was rated high and the sensitivity of health effects was rated as high.

As the surrounding environment is highly urbanised, no nearby sensitive ecological receptors were identified and therefore potential for ecological impacts was not further assessed.

Step 2C: Define the risk of impacts

Based on the classification established in Step 2A and Step 2B, the resulting uncontrolled risk of dust impacts for each construction activities is provided in Table 11.

Table 11 Preliminary risk rating of construction work (uncontrolled)

Potential impact	Preliminary risk rating			
	Demolition	Earthworks	Construction	Track out
Dust soiling	Medium	Medium	High	Low
Human health	Medium	Medium	High	Low

Step 3: Site specific mitigation

Site specific mitigation measures are provided in Section 6.

Step 4: Determine significant effects

Based on the preliminary risk rating devised in Step 2C and the recommended mitigation measures, the revised risk rating for all construction works is provided in Table 12.

The implementation of appropriated mitigation measure is anticipated to significantly reduce the potential dust emissions and minimise any corresponding impacts.

Table 12 Risk rating of construction work (controlled)

Potential impact	Preliminary risk rating			
	Demolition	Earthworks	Construction	Track out
Dust soiling	Low	Low	Low	Negligible
Human health	Low	Low	Low	Negligible

The findings of the dust risk assessment identified a 'high' risk (worst case risk rating) for uncontrolled Stage 2 and 3 construction works which is considered the worst case for dust emissions during the Project. The implementation of site specific mitigation measures decreased the identified risk rating to 'low'' (worst case risk rating) for controlled Stage 2 and 3 construction works. Significant uncontrolled dust emissions are not expected from any other construction stage.

The mitigated and controlled dust emissions from the construction of the Project are expected to be minor and short term. Therefore significant impacts are not anticipated and any plumes of elevated dust concentrations caused by the Project are expected to remain contained within close proximity and would not cause significant off site impacts.

A review of the background particulate matter concentrations provided in Section 2.2 identified that the daily (24 hour averaged) particulate matter (PM_{10} and $PM_{2.5}$) concentrations are generally below the assessment criteria but isolated spikes are recorded that exceed the assessment criteria (refer Figure 2-2 and Figure 2-3). Annually average particulate matter is below the assessment criteria with the exception of concentrations recorded in 2019 which is attributed to bushfires.

A review of the NSW Department of Planning, Industry and Environment Major Projects website did not identify any other nearby (within 200 metres) construction projects that would occur at the same time as the Project. It is anticipates that significant particulate matter would not be generated from the state portion of the works

Therefore, if the recommended mitigation measures supplied in Section 6.1 are implemented, no incremental (impacts caused by the Project alone) or cumulative (background plus incremental) particulate matter impacts are expected.

Exhaust emissions

The Project is located centrally within Sydney, which experiences significant road traffic on nearby roads. Therefore emissions from construction diesel fuelled plant and equipment are deemed to not have a meaningful contribution to local air quality.

Background nitrogen dioxide, carbon monoxide and particulate matter concentrations are below the assessment criteria (with the exception of recent particulate matter concentrations as mentioned above).

Therefore if the recommended mitigation measures supplied in Section 6.1 are implemented, no incremental or cumulative nitrogen dioxide, carbon monoxide impacts are expected.

5.2.2 Operation

As this is a new project, exact pollutant emissions cannot be measured. The Project is committed to achieving best practice sustainability and environmental performance measures and initiatives to manage and control air quality emissions. A qualitative approach was adopted to assess all potential air quality impacts during the operation of the Project.

Rooftop plant and building exhaust

Rooftop mechanical plant and all exhaust air from the building would be ducted and discharged in accordance to the Building Code of Australia (National Construction Code Building Code of Australia, The Australian Building Codes Board) requirements.

Emissions from the rooftop plant and exhaust are released from the 38th and 39th level (approximately 87 metres above ground level) and would consequently be well mixed and dispersed with ambient air by the time they reach the ground level.

The standby generators would be for emergency use only and would not be operated under normal circumstances. Therefore the primary operational air quality emission is warm/cool air from building ventilation systems which is not expected to have a significant impact human health or environmental amenity.

Due to the land use and high-rise nature of surrounding environment, rooftop plant and building exhaust emissions are considered minor and would not significantly contribute to ambient pollutant concentration

Therefore assuming all building exhaust discharge points are installed and operated in accordance with the Building Code of Australia requirements and the recommended mitigation measures provided in Section 6.2 are implemented, no operational air quality impacts from rooftop plant and building exhaust are expected.

Waste storage

The proposed waste management infrastructure and practices described in the Operational Waste Management Plan (GHD, 2020) would be adopted to ensure appropriate waste management measures are adopted. These include suitable types and quantities of waste storage receptacles.

Potential air quality and odour emissions from waste storage would be negligible as long as proper storage methods and adequate management measures are implemented.

Therefore if the recommended mitigation measures provided in Section 6.2 are implemented, no significant operational air quality impacts from waste storage are expected.

Café and kitchen emissions

Potential air quality and odour emissions from café and kitchen sources would be negligible as long as adequate management measures are implemented.

Therefore if the recommended mitigation measures provided in Section 6.2 are implemented, no significant operational air quality impacts from cafes and kitchens are expected.

6. Recommended mitigation measures

6.1 Construction

A list of recommended mitigation measures to minimise potential air quality impacts during the construction of the Project is provided below. This list incorporates management measures supplied in the Local Government Air Quality Toolkit, Module 3, Part 3: Air quality guidance notes for Construction sites (NSW EPA, 2017) and IAQM guidance.

The following mitigation measures are recommended for the construction of the Project:

- Work zones should be encapsulated during construction using dust proof scaffolds and hoarding
- The proposed selection of construction plant should be reviewed and equipment and dust reduction measures utilised where possible
- Cover all spoil stockpiles where possible
- Particulate matter generated from construction activities is typically more prominent during dry and windy conditions. Water suppression should be used during these worst case conditions and when visible plumes of dust are observed to be dispersed from the Site
- The frequency of water dust suppression should be increased during worst case dust dispersion meteorological conditions (dry and windy)
- The construction site should be maintained and kept clean
- Controlled site access should be maintained with vehicle wash down/clean down facilities (wheel wash if necessary) to be established to maintain access roads
- All vehicles transporting spoil or other dispersible material should be appropriately covered to prevent the escape of dust or other material while in transit
- A log of all dust complaints received should be compiled and any potential causes of the complaint noted. If a trend in complaints is identified, work methods should be adjusted accordingly to minimise the likelihood of any future complaints
- Construction plant and equipment should be properly operated and maintained to minimise excessive exhaust emissions
- Visual monitoring should be undertaken by site management to ensure that construction works do not generate unacceptably high quantities of dust
- Footpaths and roadways should be kept clean and cleaned if required
- Appropriate air quality mitigation measures (as provided above) should be included in the Construction Environment Management Plan
- Works should be limited to standard construction hours where possible (see discussion below).

Hours of construction work

Construction hours would be limited to day time hours of 7 am to 5 pm Monday to Friday and 7 am to 3 pm on Saturdays where possible.

In certain circumstances, construction works may be required to be undertaken outside of construction hours. Approval from the relevant regulatory will be sought prior to commencing any construction works outside of normal construction hours. It is anticipated that the following construction works may need to be undertaken outside of standard construction hours:

- Delivery and haulage of heavy civil engineering machinery and plant (e.g. piling rig)
- Maintenance of civil engineering excavation works (e.g. dewatering the Site if required)
- Installation and removal of the large plant and equipment, cranes, mast climbers, hoists
- Hoisting of rooftop plant and machinery
- Delivery, haulage and installation of larger structural steel members
- Emergency repairs to public areas
- Works on Council, Transport for NSW (RMS), Energex, and Ausgrid land.

6.2 Operation

A list of recommended mitigation measures to minimise potential air quality impacts during the operation of the Project is provided below. This list incorporates management measures supplied in the Local Government Air Quality Toolkit, Module 3, Part 3: Air quality guidance notes for Food outlets (NSW EPA, 2017).

The following mitigation measures are recommended for the operation of the Project:

- Install rooftop mechanical plant and building exhaust air extraction system in accordance to the Building Code of Australia requirements
- Install appropriately sized range hoods and filtration devices over all commercial kitchens to collect cooking fumes
- Remove oil and grease by filtration or scrubbing
- Modify cooking methods, where feasible
- Practice good housekeeping, to avoid odours typically associated with a build-up of rancid fats and putrefaction of foods and food wastes (undertaken as per general practice)
- Make sufficient waste collection receptacles available for collection and proper storage of all waste
- Empty waste collection receptacles regularly, don't allow them to overflow and keep their lids closed when not in use, to minimise the spread of odour.

There is potential that emissions from idling diesel locomotives impact on the Project when natural ventilation is used rather than air conditioning. The NSW Government has begun a project to replace the aging NSW regional rail fleet with new diesel-electric hybrid technology trains as part of the Regional Rail Fleet Project.

However, if there is a delay to the locomotive replacement program, or for other reasons, locomotives with diesel exhaust emissions use the platforms, this could result in adverse outcomes for building users, unless there is a way of ceasing natural ventilation. Therefore it is recommended that the design of the ventilation system might need to be reviewed, and possibly modified, to enable natural ventilation to temporarily shut down at the lower levels, should this situation arise.

7. Conclusions

GHD has undertaken an air quality assessment for the construction and operation of the Project.

A risk based approach in accordance with the IAQM guidance was adopted to assess dust emissions from the construction of the Project. The assessment concluded that there would be a low risk of dust impacts if the recommended mitigation measures are implemented.

A qualitative approach was adopted to assess all other pollutants (diesel fuelled plant and equipment exhaust emissions) during the construction of the Project.

No significant air quality impacts were identified to occur during the construction of the Project. Mitigation measures to minimise potential air quality impacts during the construction were recommended. Assuming the recommended mitigation measures are implemented, no significant air quality impacts are expected to occur during the construction of the Project.

A qualitative approach was adopted to assess air quality impacts on nearby receptors during the operation of the Project. No significant air quality impacts were identified to occur during the operation of the Project.

Mitigation measures to minimise potential air quality impacts during the operation were recommended. Assuming the recommended mitigation measures are implemented, no significant air quality impacts are expected to occur during the operation of the Project.

Screening level modelling identified that emissions from idling diesel locomotives on platform 1 and 2 may impact on the Project when natural ventilation is used rather than air conditioning. The NSW Government has begun a project to replace the aging NSW regional rail fleet with new diesel-electric hybrid technology trains as part of the Regional Rail Fleet Project that should be completed by Project opening.

However, if there is a delay to the locomotive replacement program, or for other reasons, locomotives with diesel exhaust emissions use the platforms, this could result in adverse outcomes for building users, unless there is a way of ceasing natural ventilation. Therefore it is recommended that the design of the ventilation system might need to be reviewed, and possibly modified, to enable natural ventilation to temporarily shut down at the lower levels, should this situation arise.

8. References

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Appendices

Appendix A – Mechanical service air quality emissions sources

Table 13 Atlassian Mechanical Service Emission Sources

Level	Source	Type	Air Qty (L/s)
3m above OSD Shed Roof	Substations	Warm air	6,600
3m above OSD Shed Roof	End of Trip	Toilet Exhaust	1,500
3m above OSD Shed Roof	Loading Dock	Carpark Exhaust	28,000
3m above OSD Shed Roof	General Plant rooms	General Exhaust	8,000
3m above OSD Shed Roof	Waste rooms	General Exhaust	800
Below OSD YHA Level 1	YHA Toilets	Toilet Exhaust	6,600
Below OSD YHA Level 1	YHA Kitchens	Kitchen Exhaust	4,000
Level 7 Plantroom West	Diesel Generators	Warm air	65,000
Level 7 Plantroom West	YHA Space Heat Pumps	Warm/Cool air	3,000
Level 7 Plantroom West	YHA DHW Heat Pumps	Warm air	27,000
Level 36 Plantroom West	Commercial Office Toilets	Toilet Exhaust	30,000
Level 37 Plantroom Roof	Commercial Office Heat Pumps	Cool air	240,000
Level 38 Plantroom Roof	Commercial Office Fire Mode	Smoke Exhaust	11,000
Level 38 Plantroom Roof	Commercial Office Fire Mode	Smoke Exhaust	25,000
Level 38 Plantroom Roof	Tenant Kitchen Exhaust	Kitchen Exhaust	6,000
Level 38 Plantroom Roof	Commercial Office	General Exhaust	12,000
Level 38/39 Plantroom Roof	Tenant Cooling Towers	Heated Humid Air	32,000
Level 38 Plantroom Roof	L7 Diesel Generators	Flue Discharges	8,440
Level 38/39 Plantroom Roof	Radiant Panel Cooling Towers	Heated Humid Air	60,000
Level 38/39 Plantroom Roof	Commercial Office Cooling Towers	Heated Humid Air	95,000

Table 14 Diesel Gen Set Flue Discharge

Pollutant	Per Unit	Units	Total	Units
Nox	3243.7	mg/nm3	6487.4	mg/nm3
CO	698.4	mg/nm3	1396.8	mg/nm3
HC	69.9	mg/nm3	139.8	mg/nm3
PM	32	mg/nm3	64	mg/nm3

Appendix B - Construction dust risk assessment methodology

The construction dust risk assessment was undertaken in accordance with the IAQM guidance. The four step process is detailed below.

B.1 Step 1: Screen the need for a detailed assessment

The first step of the IAQM assessment is a screening component used to determine if further assessment is required. If a receptor is located within the screening criteria then further assessment is required.

The IAQM guidance stipulate the following screening distances:

A human receptor within:

- *350 m of the boundary of the site; or*
- *50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the site entrances(s)*

An ecological receptor within

- *50 m of the boundary of the site; or*
- *50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the site entrances(s)*

B.2 Step 2: Assess the risk of dust impacts

Step 2 assess the risk of uncontrolled (no mitigation measures applied) dust impacts (including dust soiling effects, health effects and ecological effects) based on:

- Dust emission magnitude of dust generating construction activities (demolition, earthworks, construction and trackout)
- Sensitivity of the area (based on sensitivity of nearby receptors, number of nearby receptors and distance from source)

B.2.1 Step 2A: Define the potential dust emission magnitude

Step 2A defines the potential dust emission magnitude (large, medium or small) from the project based on four common dust generating activities:

- Demolition
- Earthworks
- Construction
- Trackout

The IAQM provides the following guidance to help define the potential dust emission magnitude:

Demolition: Example definitions for demolition are:

- *Large: Total building volume >50,000 m^3, potentially dusty construction material (e.g. concrete), on-site crushing and screening, demolition activities >20 m above ground level;*
- *Medium: Total building volume 20,000 m^3 – 50,000 m^3, potentially dusty construction material, demolition activities 10-20 m above ground level; and*

- *Small: Total building volume <20,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber), demolition activities <10 m above ground, demolition during wetter months.*

Earthworks: Earthworks will primarily involve excavating material, haulage, tipping and stockpiling. This may also involve levelling the site and landscaping. Example definitions for earthworks are:

- *Large: Total site area >10,000 m^2, potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds >8 m in height, total material moved >100,000 tonnes;*
- *Medium: Total site area 2,500 m^2 – 10,000 m^2, moderately dusty soil type (e.g. silt), 5-10 heavy earth moving vehicles active at any one time, formation of bunds 4 m - 8 m in height, total material moved 20,000 tonnes – 100,000 tonnes; and*
- *Small: Total site area <2 ,500 m^2, soil type with large grain size (e.g. sand), <5 heavy earth moving vehicles active at anyone time, formation of bunds <4 m in height, total material moved <20,000 tonnes, earthworks during wetter months.*

Construction: The key issues when determining the potential dust emission magnitude during the construction phase include the size of the building(s)/infrastructure, method of construction, construction materials, and duration of build. Example definitions for construction are:

- *Large: Total building volume >100, 000 m^3, on site concrete batching, sandblasting;*
- *Medium: Total building volume 25,000 m^3 – 100,000 m^3, potentially dusty construction material (e.g. concrete), on site concrete batching; and*
- *Small: Total building volume <25,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber).*

Trackout: Factors which determine the dust emission magnitude are vehicle size, vehicle speed, vehicle numbers, geology and duration. As with all other potential sources, professional judgement must be applied when classifying trackout into one of the dust emission magnitude categories. Example definitions for trackout are:

- *Large: >50 HDV (>3.5t) outward movements in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length >100 m;*
- *Medium: 10-50 HDV (>3.5t) outward movements in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50 m – 100 m; and*
- *Small: <10 HDV (>3.5t) outward movements in any one day, surface material with low potential for dust release, unpaved road length <50 m.*

B.2.2 Step 2B: Define the sensitivity of the area

Step 2B defines the sensitivity of the area (for dust soiling effect, human health impacts and ecological impacts) based on sensitivity of nearby receptors, number of nearby receptors and distance from source

IAQM guidance for selection of receptor sensitivity is provided in Table 15.

Table 15 Receptor sensitivity classification guidance

Effect	Receptor sensitivity classification		
	High	Medium	Low
Dust soiling effects	• Users can reasonably expect enjoyment of a high level of amenity; or • The appearance, aesthetics or value of their property would be diminished by soiling; and • The people or property would reasonably be expected to be present continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land. *Indicative examples include dwellings, museums and other culturally important collections, medium and long term car parks and car showrooms.*	• Users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home; or • The appearance, aesthetics or value of their property could be diminished by soiling; or • The people or property wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land. *Indicative examples include parks and places of work.*	• The enjoyment of amenity would not reasonably be expected; or • Property would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling; or • There is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land. *Indicative examples include playing fields, farmland (unless commercially-sensitive horticultural), footpaths, short term car parks and roads.*
Health effects of PM_{10}	• Locations where members of the public are exposed over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day). *Indicative examples include residential properties. Hospitals, schools and residential care homes should also be considered as having equal sensitivity to residential areas for the purposes of this assessment.*	• Locations where the people exposed are workers, and exposure is over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day). *Indicative examples include office and shop workers, but will generally not include workers occupationally exposed to PM_{10}, as protection is covered by Health and Safety at Work legislation.*	• Locations where human exposure is transient. *Indicative examples include public footpaths, playing fields, parks and shopping streets.*

Effect	Receptor sensitivity classification		
	High	Medium	Low
Ecological effects	• Locations with an international or national designation and the designated features may be affected by dust soiling; or • Locations where there is a community of a particularly dust sensitive species such as vascular species included in the Red Data List For Great Britain. *Indicative examples include a Special Area of Conservation (SAC) designated for acid heathlands or a local site designated for lichens adjacent to the demolition of a large site containing concrete (alkali) buildings.*	• Locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown; or • Locations with a national designation where the features may be affected by dust deposition. *Indicative example is a Site of Special Scientific Interest (SSSI) with dust sensitive features.*	• Locations with a local designation where the features may be affected by dust deposition. *Indicative example is a local Nature Reserve with dust sensitive features.*

Using the identified receptor sensitivity, the sensitivity of the area to dust soiling effects, human health impacts and ecological impacts is determined using Table 16, Table 17 and Table 18 respectively.

Note that the annual mean PM_{10} concentrations presented by the IAQM guidance for selecting the sensitivity of the area to human health impacts is based on background PM_{10} from the UK. Therefore the annual mean PM_{10} concentrations in Table 17 has been modified to consider local Site conditions and recorded background measurements. This modification is consistent with IAQM guidance as it notes that professional judgement may be used to determine alternative sensitivity categories, taking into account the following factors:

- any history of dust generating activities in the area
- the likelihood of concurrent dust generating activity on nearby sites
- any pre-existing screening between the source and the receptors
- any conclusions drawn from analysing local meteorological data which accurately represent the area; and if relevant the season during which the works will take place;
- any conclusions drawn from local topography;
- duration of the potential impact, as a receptor may become more sensitive over time; and
- any known specific receptor sensitivities which go beyond the classifications given in this document.

Table 16 Sensitivity of the area to dust soiling effects

Receptor sensitivity	Number of receptors	Distance from the source (m)			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

Table 17 Sensitivity of the area to human health impacts

Receptor sensitivity	Annual mean PM_{10} concentration	Number of receptors	Distance from the source (m)				
			<20	<50	<100	<200	<350
High	15 – 25 µg/m^3	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	< 15 µg/m^3	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium		>10	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
Low		1	Low	Low	Low	Low	Low

Table 18 Sensitivity of the area to ecological impacts

Receptor sensitivity	Distance from the source (m)	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

B.2.3 Step 2C: Define the risk of impacts

Step 2C defines the risk of dust impacts (assuming no mitigation measures are implemented) based on the potential dust magnitude (Step 2A) and sensitivity of the area (Step 2B). the risk of dust impacts for demolition, earthworks, construction and trackout is determined using Table 19, Table 20, Table 21 and Table 22 respectively.

Table 19 Risk of dust impacts - Demolition

Sensitivity of the area	Dust emission magnitude		
	Large	Medium	Small
High	High risk	Medium risk	Medium risk
Medium	High risk	Medium risk	Low risk
Low	Medium risk	Low risk	Negligible

Table 20 Risk of dust impacts - Earthworks

Sensitivity of the area	Dust emission magnitude		
	Large	Medium	Small
High	High risk	Medium risk	Low risk
Medium	Medium risk	Medium risk	Low risk
Low	Low risk	Low risk	Negligible

Table 21 Risk of dust impacts - Construction

Sensitivity of the area	Dust emission magnitude		
	Large	Medium	Small
High	High risk	Medium risk	Low risk
Medium	Medium risk	Medium risk	Low risk
Low	Low risk	Low risk	Negligible

Table 22 Risk of dust impacts - Trackout

Sensitivity of the area	Dust emission magnitude		
	Large	Medium	Small
High	High risk	Medium risk	Low risk
Medium	Medium risk	Low risk	Negligible
Low	Low risk	Low risk	Negligible

B.3 Step 3: Site specific mitigation

Step 3 defines the appropriate site specific mitigation measures that should be adopted to minimise the potential dust impacts identified in Step 2C.

The IAQM recommends that local authority guidance should be taken into account with developing appropriate dust mitigation measures.

In addition, the IAQM contains suggested mitigation measures for all sites and includes measures specific to demolition, earthworks, construction and trackout.

The completion of Step 3 would result in a comprehensive list of recommended site specific mitigation measures

B.4 Step 4: Determine significant effects

Step 4 defines the residual risk of dust impacts after the site specific mitigation measures identified in Step 3 have been implemented. The IAQM notes it is normally possible to effectively mitigate potential dust impacts and that professional judgement must be used throughout the assessment process (especially to determine the residual risk of dust impacts).

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