Appendix B7

Air Quality and Odour CEMP Sub-plan

M6 Stage 1

October 2021

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Contents

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The document is uncontrolled when printed. One controlled hard copy of the Air Quality and Odour CEMP Sub-plan as part of the CEMP and supporting documentation will be maintained by the Quality Manager at the Project office and on the Project website.

Copy number	Issued to	Version

Glossary/ Abbreviations

Abbreviations	Expanded text
AQOMP	Air Quality and Odour CEMP Sub-plan
AQMP	Air Quality Monitoring Program
BOM	Australian Government Bureau of Meteorology
CEMP	Construction Environmental Management Plan
CGU	CPB Contractors, Ghella, UGL Engineering joint venture
DPIE	NSW Department of Planning, Industry and Environment
EIS	Environmental Impact Statement for M6 Stage 1
EPA	NSW Environment Protection Authority
EP&A Act	*Environmental Planning and Assessment Act 1979*
EES	NSW Department of Environment, Energy and Science
GREP	Government Resource Efficiency Policy
CoA	Minister's Conditions of Approval
PIR	Preferred Infrastructure Report
$PM_{2.5}$	Particulate matter (2.5 micrometres or less in diameter)
PM_{10}	Particulate matter (10 micrometres or less in diameter)
POEO Act	*Protection of the Environment Operations Act 1997*
TfNSW	Transport for New South Wales (formerly Roads and Maritime Services)

1 Introduction

1.1 Context

This Air Quality and Odour CEMP Sub-plan (AQOMP) forms part of the Construction Environmental Management Plan (CEMP) for the M6 Stage 1 (the Project).

This Air Quality and Odour CEMP Sub-plan has been prepared to address the requirements of the Minister's Conditions of Approval (CoA), the environmental management measures listed in the M6 Stage 1 Environmental Impact Statement (EIS) as amended by the Submissions and Preferred Infrastructure Report (PIR), including the environmental management measures listed in the PIR and applicable legislation.

1.2 Background and project description

The Project comprises a new twin motorway tunnel (approximately four kilometres (km) in length) between the M8 Motorway at Arncliffe and President Avenue at Kogarah with a tunnel portal and entry and exit ramps connecting the tunnels to the surface (Figure 1). Works will include a connection to the M8 Motorway, line marking of additional travel lanes between the St Peters interchange to the M6 Stage 1 tunnels, an intersection with President Avenue (including widening and raising of President Avenue), and intersection improvements at the President Avenue/Princes Highway intersection. Mainline tunnel stubs would be constructed to allow for connections to future stages of the M6 Extension.

The Project was declared as Critical State Significant Infrastructure (CSSI) and the M6 Stage 1 Project was approved by the Minister for Planning and Public Spaces on 18 December 2019.

Key features of the Project include:

- Mainline tunnels approximately 3km in length, sized for three lanes of traffic and line marked for two lanes on opening of the motorway;
- Entry and exit ramp tunnels approximately 1.5km in length and a tunnel portal connecting the tunnels to a surface intersection with President Avenue;
- Provision of a new intersection at President Avenue including the widening and raising of President Avenue at this location;
- Upgrade of the President Avenue and Princes Highway intersection to improve capacity and network integration;
- Provision of a new shared cycle and pedestrian pathways;
- Mainline tunnel stubs for a future connection to extend the Project to the south;
- Two motorway operation complexes (MOCs) as follows:
    - Arncliffe: including mechanical and electrical fit-out of the ventilation facility built by the New M5 Motorway project, and provision of a new water treatment plant and substation.
    - Rockdale (south): including a ventilation building, Disaster Recover Site (DRS), substation and power supply, deluge tanks.
- A tunnel ventilation system, including ventilation facilities located at Marsh Street, Arncliffe and West Botany Street, Rockdale, and in-tunnel ventilation systems (jet fans and ventilation ducts);
- New Utility Services, and modifications and connections to existing Utility Services;
- A permanent power supply connection to the Rockdale Ventilation Facility Site MOC from Ausgrid's Canterbury Sub-Transmission Substation;

- Emergency access and evacuation facilities, including pedestrian and vehicular cross, long passages, fire and safety life systems;
- Ancillary infrastructure for motorway operations including operations management and control systems, permanent power supply, communications, lighting, electronic toll collection system, toll gantries and traffic control and signage (both fixed and variable signage);
- Drainage infrastructure to collect surface water and groundwater inflows for treatment;
- Reinstatement of Bicentennial Park and recreation facilities;
- Reinstatement and rehabilitation of construction leased areas within the Arncliffe Site;
- Minor adjustments to local roads in the Project area;
- Development and implementation of systems integration and operating procedures with WestConnex Motorways to ensure safe operation of the interfaces between the Project and the WestConnex Motorways; and
- Any other works as required under the D&C Deed and the SWTC.

The following six surface compounds will facilitate construction of the Project:

- Arncliffe construction ancillary facility (C1), an existing construction site which was used for the construction of the M8 Motorway;
- Rockdale construction ancillary facility (C2), within an existing TfNSW depot;
- President Avenue construction ancillary facility (C3) at Rockdale, within Rockdale Bicentennial Park and an industrial area west of West Botany Street;
- Construction ancillary facilities (C4 and C5) near Muddy Creek to support construction of the Active Transport Corridor; and
- Princes Highway construction ancillary facility (C6) on the corner of Princes Highway and President Avenue, Kogarah to support the intersection surface works.

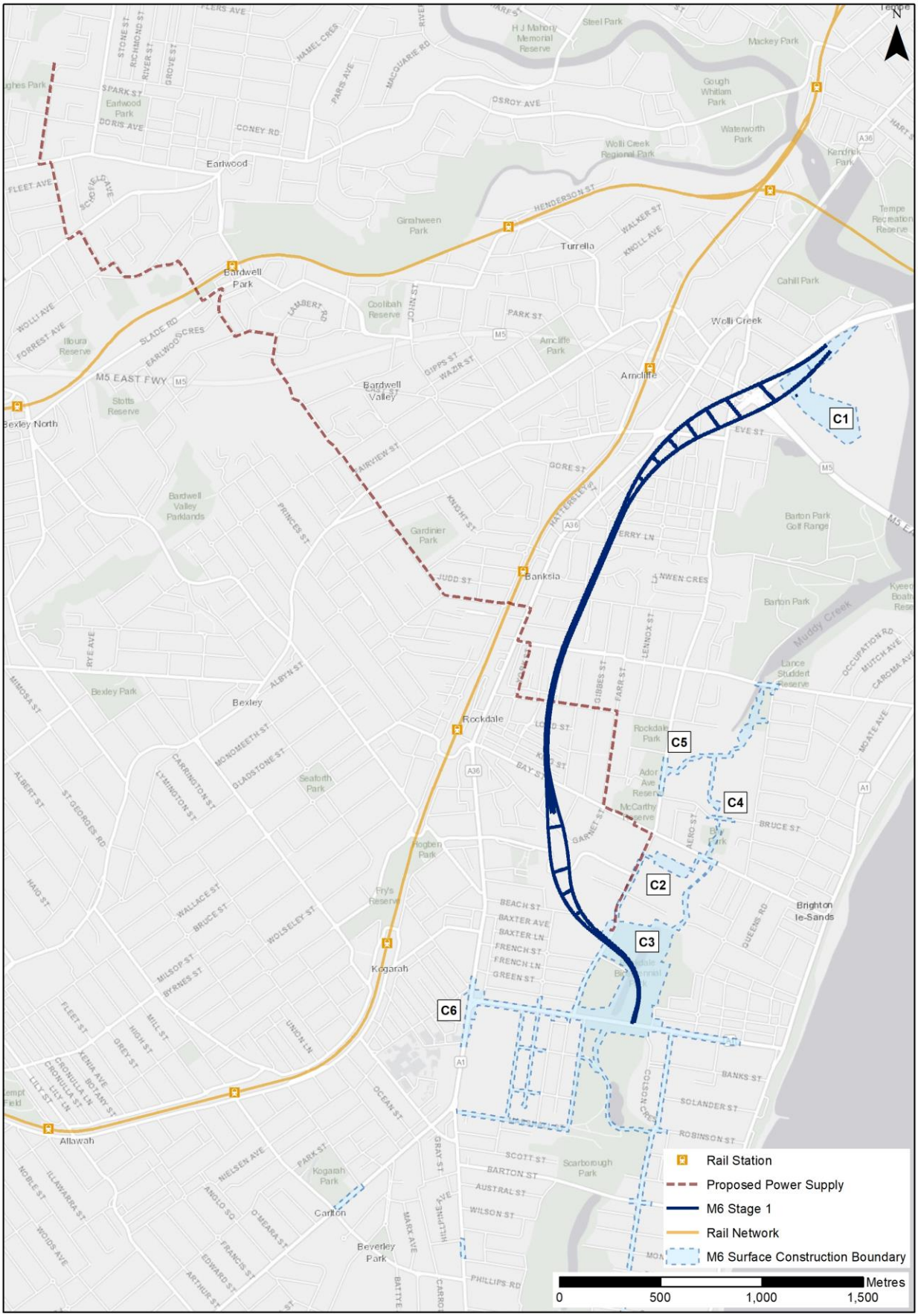

Figure 1: Project footprint

1.3 Scope of Sub-plan

The scope of the Air Quality and Odour CEMP Sub-plan is to describe how the CPB Contractors, Ghella, UGL Engineering (CGU) joint venture proposes to manage potential air quality and odour impacts during construction of the Project. Operational impacts and management measures do not fall within the scope of this Air Quality and Odour CEMP Sub-plan and are not included within the processes contained within this plan.

1.4 Environmental management systems overview

The environmental management system is based on CPB Contractors Environmental Management Systems. An overview of this System is described in Section 1.5 of the CEMP.

1.5 Consultation

The Air Quality and Odour CEMP Sub-plan and associated Monitoring Program has been prepared in consultation with relevant Councils including Bayside Council, Canterbury-Bankstown and Georges River Council. Key matters raised by the stakeholders during this process are featured in Table 1. These matters have subsequently been addressed in this document.

Table 1: Summary of consultation

Relevant Public Authority	Issue	Action
Bayside Council	The criteria that will be used for the assessment of dust impact and monitoring method for the Air Quality Monitoring Program. Is it a visual assessment?"	Appendix A (Construction Air Quality Monitoring Program) was significantly revised to clarify purpose, monitoring methods and locations. A response was provided to the Council confirming monitoring was not reliant on inspections alone and providing further detail.

NSW Health was contacted for consultation; however, all staff had been redeployed for COVID-19 duties and consultation at this time was not possible. The Project will consult with NSW Health as resources become available which may result in subsequent revision of this Plan in accordance with Section 8.2.

The NSW EPA was consulted in the development of Appendix A (Construction Air Quality Monitoring Program), and the outcome of this consultation is addressed within the Monitoring Program (Section 1.3 of Appendix A).

2 Purpose and objectives

2.1 Purpose

The purpose of this Plan is to describe how CGU proposes to manage and protect air quality during construction of the Project.

2.2 Objectives

The key objective of the Air Quality and Odour CEMP Sub-plan is to ensure all CoA, environmental management measures and licence/permit requirements relevant to air quality are described, scheduled and assigned responsibility as outlined in the:

- The Environmental Assessment prepared for M6 Stage 1 Project, including the EIS, the Response to Submissions on the EIS, the PIR and Response to Submissions on the PIR;
- Infrastructure Approval CoA (SSI 8931);
- TfNSW specifications G36, G38 and G40;
- Environment Protection Licence; and
- All other relevant legislation and other requirements included in Appendix A1 of the CEMP.

2.3 Environmental Performance Outcomes and Targets

The environmental performance outcomes related to air quality outlined from Chapter 24 of the EIS, are to design, construct and operate the Project in a manner that minimises air quality impacts (including nuisance dust and offensive odour), as well as risks to human health and the environment to the greatest practicable extent. Construction activities will be managed in accordance with this Sub-plan to meet Project air quality performance outcomes. Construction air quality environmental performance outcomes and targets are summarised in Table 2.

Table 2: Air quality performance outcomes

Performance outcome	Document reference
Effective management of dust, odour and other emissions during construction.	Table 12
To prevent significant air quality impacts (from dust soiling, particulate matter and odours) on receptors through the use of effective mitigation.	Table 12

3 Environmental requirements

3.1 Relevant legislation and guidelines

3.1.1 Legislation

Legislation relevant to the implementation of the Air Quality and Odour CEMP Sub-plan is included in Appendix A1 of the CEMP.

3.1.2 Guidelines and standards

Guidelines, specifications and policy documents relevant to this plan include:

- National Environment Protection Councils (NEPC) – National Environment Protection Measure (NEPM) for Ambient Air Quality Guidelines;
- AS 3580.1.1-2007 Methods of Sampling Analysis of Ambient Air. Part 1.1 Guide to Siting Air Monitoring Equipment;
- AS 3580.10.1-2003 Methods of Sampling Analysis of Ambient Air. Determination of Particulate Matter – Deposited Matter - Gravimetric Method;
- Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (DEC 2005);
- TfNSW QA Specification G36 – Environmental Protection (Management System);
- TfNSW QA Specification G38 – Soil and Water Management (Soil and Water Management Plan);
- Air Quality Monitoring Criteria for Deposited Dust (DEC Guideline); and
- Government Resource Efficiency Policy (OEH 2014).

3.2 Air quality criteria

Air quality monitoring requirements, including air quality criteria, are detailed in the Air Quality Monitoring Program (Appendix A).

3.3 Minister's Conditions of Approval

The CoA relevant to this Plan are listed in Table 3 below. A cross reference is also included to indicate where the condition is addressed in the current Plan, or other Project management documents.

Table 3: Conditions of Approval relevant to the Air Quality and Odour CEMP Sub-plan

<table>
<tr><th colspan="3">Air Quality and Odour CEMP Sub-plan</th></tr>
<tr><th>CoA No.</th><th>Condition Requirements</th><th>Document Reference</th></tr>
<tr><td>C4</td><td>CEMP Sub-plans must be prepared in consultation with the relevant government agency(s) and council(s) as identified for each CEMP Sub-plan in Table 4.
Table 4: CEMP Sub-plan and relevant public authorities
<table><tr><th></th><th>Required CEMP Sub-plan</th><th>Relevant government agencies and council(s) to be consulted for each CEMP Sub-plan</th></tr><tr><td>(d)</td><td>Air Quality and Odour</td><td>NSW Health and relevant council(s)</td></tr></table></td><td>Section 1.5</td></tr>
<tr><td rowspan="3">C5</td><td>The CEMP Sub-plans must state how:
(a) the environmental performance outcomes identified in the documents listed in Condition A1 as modified by these conditions will be achieved;</td><td>Section 2.3</td></tr>
<tr><td>(b) the mitigation measures identified in the documents listed in Condition A1 as modified by these conditions will be implemented;</td><td>Sections 6 and 7</td></tr>
<tr><td>(c) the relevant terms of this approval will be complied with; and</td><td>Sections 6 and 7</td></tr>
</table>

Air Quality and Odour CEMP Sub-plan		
	(d) issues requiring management during construction (including cumulative impacts), as identified through ongoing environmental risk analysis, will be managed.	Issues requiring management and ongoing risk analysis are discussed in Section 5 of this AQOMP, Section 3.2.1 of the CEMP and Appendix A2 of the CEMP. How the issues will be managed is in Sections 6 and 7 Cumulative impacts and how they are identified and managed are addressed in Section 5.4 of this Plan and Sections 2.5 and 3 of the Staging Report.
C10	The CEMP Sub-plans must be endorsed by the ER and then submitted to the Planning Secretary for approval no later than one (1) month prior to the commencement of the construction activities to which they apply.	Section 2 of the CEMP
C11	Any of the CEMP Sub-plans may be submitted to the Planning Secretary along with, or subsequent to, the submission of the CEMP.	Section 2 of the CEMP
C12	Construction must not commence until the CEMP and all relevant CEMP Sub-plans for such construction activities to which they apply have been approved by the Planning Secretary. The CEMP and CEMP Sub-plans, as approved by the Planning Secretary, including any minor amendments approved by the ER, must be implemented for the duration of construction. Where construction is staged, construction of a stage must not commence until the relevant CEMP and CEMP Sub-plans for that stage have been endorsed by the ER and approved by the Planning Secretary.	Section 2 of the CEMP
E1	Measures must be implemented to minimise and manage the emission of dust, odour and other air pollutants during construction and operation.	Section 6, Table 12 Air Quality and Odour CEMP Sub-plan

<table>
<tr><th colspan="3">Air Quality and Odour CEMP Sub-plan</th></tr>
<tr><td></td><td></td><td>The AQMP (Appendix A of this plan)</td></tr>
<tr><th colspan="3">Air Quality Monitoring Program</th></tr>
<tr><th>CoA No.</th><th>Condition Requirements</th><th>Document Reference</th></tr>
<tr><td>C13</td><td>The Construction Monitoring Programs set out in Table 5 must be prepared and implemented to enable comparison of the actual construction performance against the predicted performance. The Construction Monitoring Programs must be prepared in consultation with the relevant government agencies and councils as identified for each Construction Monitoring Program.

Table 5: Construction Monitoring and relevant public authorities

<table><tr><th></th><th>Required Construction Monitoring Programs</th><th>Relevant government agencies to be consulted for each Construction Monitoring Program</th></tr><tr><td>(e)</td><td>Air Quality Monitoring Program</td><td>EPA</td></tr></table></td><td>Air Quality Monitoring Program (AQMP, Appendix A)

Consultation is addressed in Section 1.3 of the AQMP (Appendix A)</td></tr>
<tr><td rowspan="2">C14</td><td>Construction Monitoring Programs must provide:
(a) details of baseline data available;</td><td>Section 2.1 of AQMP (Appendix A)</td></tr>
<tr><td>(b) details of baseline data to be obtained and when;</td><td>Section 3.4 of AQMP (Appendix A) notes that further baseline data is not required</td></tr>
</table>

Air Quality and Odour CEMP Sub-plan		
	(c) details of all monitoring that will be undertaken;	Section 3 of AQMP (Appendix A)
	(d) the parameters of the project to be monitored;	Section 3 of AQMP (Appendix A)
	(e) the frequency of monitoring;	Section 3.5 of AQMP (Appendix A)
	(f) the location of monitoring;	Section 3 of AQMP (Appendix A)
	(g) the reporting of monitoring and analysis results against relevant criteria, including details of the timing and frequency for reporting the results to the Planning Secretary and relevant government agencies;	Section 4 of AQMP (Appendix A): including Section 4.2.1 Trigger Response Action Plan; and Section 4.4 Reporting.
	(h) details of the methods that will be used to analyse the monitoring data;	Sections 4.2 of AQMP (Appendix A)
	(i) procedures to identify and implement additional mitigation measures where results of monitoring indicate adverse impacts or levels above relevant criteria;	Section 4.2.1 of AQMP (Appendix A)
	(j) any consultation to be undertaken in relation to the monitoring programs; and	Section 1.3 of AQMP (Appendix A)
	(k) (k) any specific requirements as required by Conditions C15 to C18, as relevant.	Not applicable
C19	The Construction Monitoring Programs must be developed in consultation with the relevant government agencies as identified in Condition C13 of this approval, and must identify information, including monitoring parameters,	Section 1.3 of AQMP (Appendix A)

Air Quality and Odour CEMP Sub-plan		
	requested by a relevant agency to be included in a monitoring program.	
C20	The Construction Monitoring Programs must be endorsed by the ER and then submitted to the Planning Secretary for approval at least one (1) month prior to the commencement of construction.	Section 2 of the CEMP
C21	Construction, which is required to be monitored under the Construction Monitoring Programs, must not commence until the Planning Secretary has approved all of the required Construction Monitoring Programs and all relevant baseline data for the specific construction activity has been collected.	Section 2 of CEMP
C22	The Construction Monitoring Programs, as approved by the Planning Secretary and including any minor amendments approved by the ER, must be implemented for the duration of construction and for any longer period set out in the monitoring program or specified by the Planning Secretary, whichever is the greater.	AQMP (Appendix A)
C23	The results of the Construction Monitoring Programs must be made publicly available in the form of a Construction Monitoring Report at the frequency identified in the relevant Construction Monitoring Program. Note: Where a relevant CEMP Sub-plan exists, the relevant Construction Monitoring Program may be incorporated into that CEMP Sub-plan.	Section 4.4 of the AQMP (Appendix A)
Other relevant CoA		
CoA No.	**Condition Requirements**	**Document Reference**
A20	Boundary screening must be erected around all ancillary facilities that are adjacent to sensitive receivers for the duration of construction unless	CEMP, Appendix A4

Air Quality and Odour CEMP Sub-plan		
	otherwise agreed with the relevant council and affected residents, business operators or landowners.	
A21	Boundary screening required under Condition A20 of this approval must minimise visual, noise and air quality impacts on adjacent sensitive receivers.	CEMP, Appendix A4
E1	Measures must be implemented to minimise and manage the emission of dust, odour and other air pollutants during construction and operation.	Section 6, Table 12 of this plan

3.4 Environmental Management Measures

The Air Quality and Odour Environmental Management Measures (EMMs) relevant to the current Plan are listed in Table 4 below. This includes reference to required outcomes, the timing of when the commitment applies, and relevant documents or sections of the environmental assessment which influencethe outcome and implementation.

Table 4: Environmental Management Measures relevant to the Air Quality and Odour CEMP Sub-plan

Outcome	Ref #	Commitment	Timing	AQOMP Reference
Impacts from ambient air quality from dust generation and deposition during construction	AQ1	A Construction Air Quality Management Plan will be developed and implemented to monitor and manage potential air quality impacts associated with the construction of the project and activities at construction ancillary facilities. The management plan will identify project construction activities with the potential to have air quality impacts and the controls required to avoid, minimise and mitigate these impacts. The plan will include measures to:	Prior to construction	Air Quality and Odour CEMP Sub-plan

Outcome	Ref #	Commitment	Timing	AQOMP Reference
		• Minimise project dust generation from stockpiles, haulage routes, work activities, exposed ground surfaces and spoil sheds	Construction	MMAQO4 MMAQO5 MMAQO7 MMAQO15
		• Manage the transport, storage and handling of sand, aggregate and fine materials	Construction	MMAQO9 MMAQO10
		• Minimise generator and vehicle emissions during construction of the tunnel	Construction	MMAQO20 MMAQO21
		• Inspect and address corrective actions	Construction	Section 7.3
		• Modify or cease dust generating works during unfavourable weather conditions. The Plan will be implemented for the duration of construction and will include appropriate dust monitoring procedures.	Construction	MMAQO4
Impacts from ambient air quality from dust generation and deposition during construction	AQ2	Demolition activities, including removal of hazardous building materials will be planned and carried out in a manner that minimises the potential for dust generation. Removal of hazardous building materials will be completed prior to the demolition works.	Construction	MMAQO11

Outcome	Ref #	Commitment	Timing	AQOMP Reference
Odour impacts	AQ3	Odorous material will be treated immediately on-site, and removed from site where necessary. Areas of odorous materials will be excavated in a staged process to allow for treatment and handling. Exposed areas of odorous material will be kept to a minimum to reduce the total emissions from the site. On-site odour measurements will be carried out during excavation works to determine odour emission rates. Results from the monitoring will be used to inform future excavation and treatment activities on site.	Construction	MMAQO22 MMAQO23 MMAQO24
Generation of greenhouse gas emissions	GG6	Construction plant and equipment will be well maintained to allow for optimal fuel efficiency.	Construction	Table 11 Section 5.4 Table 12

4 Existing Environment

The following sections summarise the key factors influencing air quality impacts, within and adjacent to, the Project corridor. The key reference documents are:

- Chapter 9 of the EIS (AECOM 2018);
- Volume 4 Appendix E – Air Quality Technical Report;
- Preferred Infrastructure Report (PIR); and
- Relevant guidelines, specifications and policy documents as referenced in Appendix A1 of the CEMP.

4.1 Air quality records

In October and November 2017, TfNSW installed air quality monitoring stations at:

- The western end of Kings Road, Brighton-Le-Sands; and
- The corner of General Holmes Drive and Tancred Avenue, Kyeemagh.

Air quality monitoring stations measured concentrations of air pollutants such as carbon monoxide and nitrogen dioxide, as well as ozone and particulate matter. They also monitored weather conditions, including temperature, wind direction and wind speed. Further details are provided in Chapter 9 (Air quality and greenhouse gas) and Appendix F (Human health technical report). The Project lies within an urbanised area of Sydney. It is therefore important that the background air quality considered is representative of existing conditions in the local area.

The following is noted in relation to background air quality:

- PM_{10}: Background concentrations of PM_{10} (as an annual average) were below the current air quality guidelines. However, there were exceedances of the 24-hour average criterion, most notably in the warm and dry year 2009.
- $PM_{2.5}$: Long term measurement of annual PM2.5 concentrations has only occurred at three OEH stations - Chullora, Earlwood and Liverpool. Concentrations at these stations showed a broadly similar pattern, with a systematic reduction between 2004 and 2012,followed by a substantial increase in 2013. The main reason for the increase was a change in the measurement method (as the reporting of $PM_{2.5}$ in air varies depending on the type of equipment used). There were a number of exceedances of the 24 hour average criterion of 25 micrograms per cubic metre.
- Carbon monoxide: Background air concentrations (as one-hour and eight-hour averages) were below the current air quality guidelines at all background air monitoring stations. A general downward trend in background air concentrations was observed.
- Nitrogen dioxide: Background air concentrations (as one-hour and annual averages) were below the current air quality guidelines at all background air monitoring stations and roadside monitoring locations..
- Air toxics: A number of measurement campaigns have been undertaken to determine the levels of air toxics around Sydney. All have found that the concentrations remain low, and under the respective Air Toxic NEPM investigation levels.

For background air quality, data were compared with the range of measurements at Environment Energy and Science (EES)/TfNSW stations. These comparisons are provided in Annexure D of Appendix E in the Project EIS (Air quality Technical Report). Long-term average temperatures and rainfall for nearby Sydney Airport are detailed in Table 5.

A more detailed analysis of the historical trends in Sydney's air quality (2004-2016), and the current situation, is provided in Annexure D of Appendix E in the Project EIS (Air Quality Technical Report). The analysis was based upon hourly data from long-term monitoring stations operated by

the Office of Environment and Heritage and TfNSW. Consideration was also given to the shorter-term data from other TfNSW air quality monitoring stations.

4.2 Rainfall and soil dryness

Long-term average temperature and rainfall data for the Bureau of Meteorology (BoM) weather station at Sydney Airport (site number 066037) is presented in Table 5. This is broadly representative of the area.

The annual average daily maximum and minimum temperatures are 22.3°C and 13.5°C respectively. On average, January is the hottest month with an average daily maximum temperature of 26.6°C. July is the coldest month, with average daily minimum temperature of 7.3°C. On average, the wettest month is March, with 117 millimetres falling over five rain days. The average annual rainfall is 1,083 millimetres with an average of 104 rain days per year.

Table 5: Long-term average temperature and rainfall data for Sydney Airport (source EIS)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean daily maximum temperature (°C)												
26.6	26.5	25.3	22.9	20.1	17.6	17.1	18.4	20.7	22.7	24.1	25.9	22.3
Mean daily minimum temperature (°C)												
18.9	19.1	17.6	14.3	11.0	8.7	7.3	8.2	10.5	13.3	15.5	17.6	13.5
Mean monthly rainfall (mm)												
94.6	111.4	117.1	108.8	96.9	124.2	68.6	76.8	59.7	69.7	80.4	73.6	1083.4
Mean rain days per month (number)												
6.8	5.5	7.7	8.8	9.3	9.1	12.0	13.2	11	8.2	6.4	6.5	104.5

Source: BoM (2018) Climate averages for Station: 066037; Commenced: 1929 – last record January 2018; Latitude: 33.99°S; Longitude: 151.17 °E

4.3 Soil Characteristics

Soil moisture content is an important consideration. Drier soils are more prone to release of particulates via wind causing erosion. The Soil Landscapes of the Sydney 1:100,000 Sheet 9130 (NSW Department of Conservation and Land Management 1989) indicates that the Project boundary is underlain by seven soil landscapes. Characteristics of the soil landscapes, as well as their potential for erosion are detailed in Table 6.

Other materials that will be present at the Project and susceptible to erosion include demolition wastes, imported fill, imported road base and hardstand subgrade, historic imported soils and natural soils, and excavated sandstone bedrock. These materials can form nuisance dust when subjected to mechanical forces from construction equipment and removal of existing groundcover, such as pavements and vegetation.

Due to soil characteristics (Table 6), and the high water table, the soil is considered to be less susceptible to movement from wind and associated dust.

Table 6: Soil characteristics

Soil landscape	Characteristics	Erosion potential	Sediment type
Tuggerah (tg1 to tg6)	Occurs on gently undulating to rolling coastal dunefields. Soils comprise loamy sand, sand and clayey sands	Low erodibility as soils consist of highly permeable, coarse sand grains, however lack of cohesion makes them susceptible to concentrated flows. Low to moderate erosion hazard for nonconcentrated flows. Very high to extreme erosion hazard for concentrated flows.	Type C

Soil landscape	Characteristics	Erosion potential	Sediment type
Warriewood (wa1 to wa6)	Occur on level to gently undulating swales, depressions and infilled lagoons on quaternary sands. Soils comprise loamy sand, sand and peat (silt loam or silty clay loam) Market gardening at Kyeemagh occurs	Low to very low erodibility. Relatively stable and consist of well drained stable coarse sands or coarse sand grains weakly held together by organic matter or iron compounds The erosion hazard for non-concentrated flows is low. The erosion hazard for concentrated flows is moderate to high and for wind erosion is low to moderate. Ground surface within project boundary is generally stabilised due to urban development.	Type C
Newport (np1 to np6)	Occur on gently undulating plains to rolling rises of Holocene sands mantling other soil material or bedrock. Soils comprise sand, sandy loam, clayey sand and loamy sand	Soils range from having low erodibility (np 4 and np 5) to being moderately erodible (np1, np2, np3 and np6). Erosion hazard for non-concentrated flows is generally high but ranges from high to extreme. Erosion hazard for concentrated flows and wind is high. Ground surface within project boundary is generally stabilised due to urban development.	Type C
Lambert (la1 to la6)	Occur on undulating to rolling low hills on Hawkesbury Sandstone Soils comprise loamy sand, sandy loam, sandy clay loam, clayey sand and weathered sandstone	Soil materials are low (la5, la6) to moderately erodible. The soil erosion hazard for nonconcentrated flows is usually very high but ranges from low to extreme. The soil erosion hazard from concentrated flow is extreme	Type C (Type D for Clays)
Gymea (gy1 to gy4)	Occurs on undulating to rolling rises and low hills on Hawkesbury Sandstone Soils comprise loamy sand, sandy loam, clayey sand, sandy clay loam, sandy clay and light clay	Very low (gy1 and gy2), moderately (gy3) and highly erodible (gy4) soils. Erosion hazard for non-concentrated flows is generally high to very high but can range from moderate to extreme. Soil erosion hazard for concentrated flows is high to extreme.	Type C (Type D for Clays)
Disturbed Terrain (xx1 to xx4)	Terrain extensively disturbed by human activity, including complete disturbance, removal or burial of soil. Variable relief and slopes Variable soils.	Erodibility and erosion hazard is variable.	-
Hawkesbury (ha1)	Occur on rugged, rolling to very steep hills on Hawkesbury Sandstone. Soils include sand, sandy loam, clayey sand, sandy clay loam and medium clay.	Low (ha1) to moderate (ha2, ha3) erodibility. Erosion hazard for non-concentrated flows is generally very high and ranges from moderate to extreme. The soil erosion hazard for concentrated flows is extreme.	Variable Type C, D and F.

4.4 Wind

Data, including wind speed, wind direction, temperature and cloud cover, were obtained from meteorological stations in and near the study area. Figure 2 shows the location of stations. These stations are also listed below:

Meteorological stations from the study area and nearby, were considered and data relevant to the dispersion modelling such as wind speed, wind direction, temperature and cloud cover were obtained. The stations considered include the following locations (refer Figure 2):

- Office of Environment and Heritage (OEH, now EES) air quality stations:
  - Randwick; and
  - Earlwood.
- Bureau of Meteorology (BoM) meteorological stations:
  - Canterbury Racecourse;
  - Sydney Airport;
  - Kurnell; and
  - Little Bay (Coast Golf Club).

A detailed analysis of data from these weather stations is presented in Annexure F of Appendix E of the Project EIS (Air quality Technical Report).

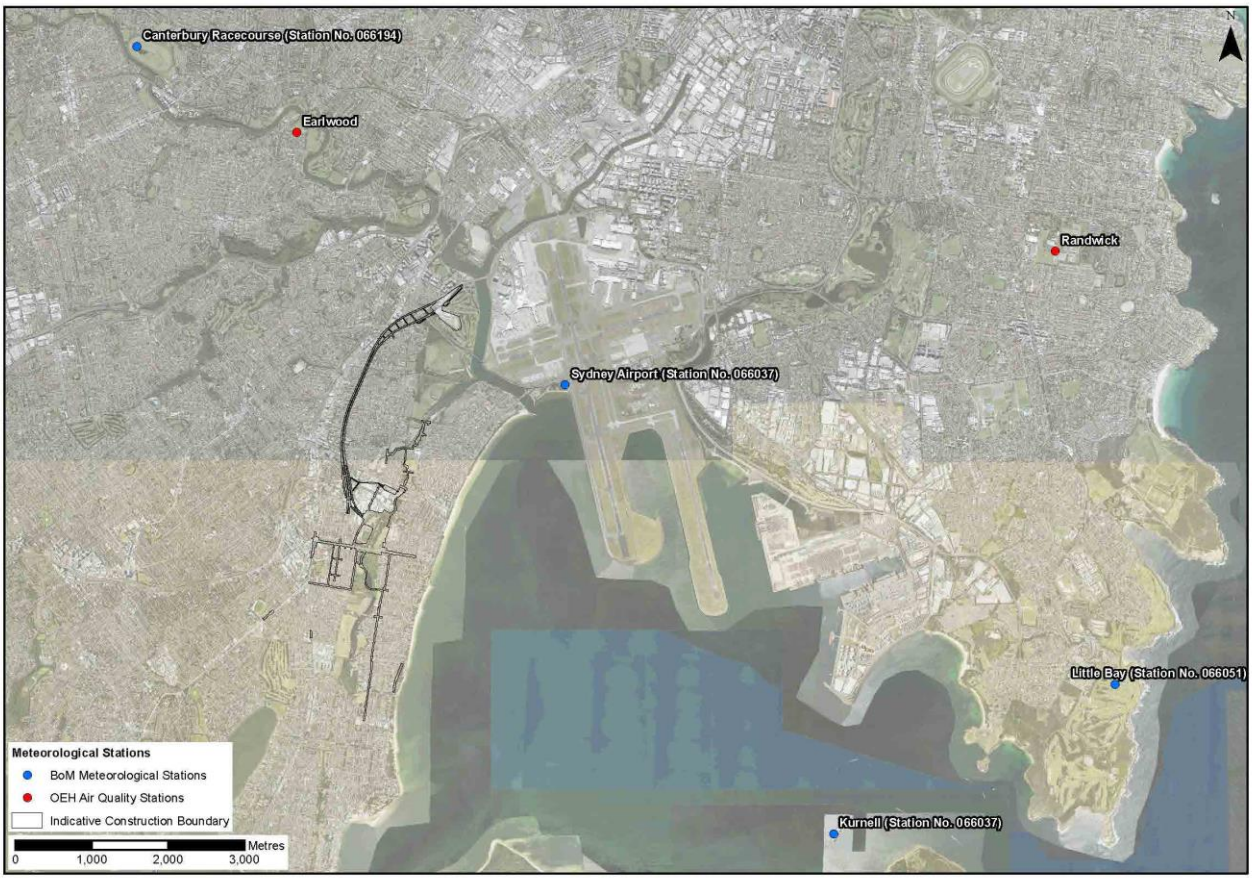

Figure 2: Location of meteorological and air quality Stations

Wind patterns varied across stations due to different instrumentation and siting issues. The most similar patterns were observed at OEH Stations at Earlwood and Randwick, with dominant wind directions from the west, west north-west and north-eastern directions. Average wind speed at the Project ranges from 2.5 to 3m/s.

Wind speed and wind direction influence pollutant concentration. They also influence the impact that construction has on air quality. as well as Grounded sources, such as road traffic, do not travel up or down in the air. These tend to have the highest concentrations under low wind speed conditions. However, wind-blown dust will increase PM concentrations in the air with increasing wind speed.

Wind direction will pose a risk to air quality management throughout the duration of the Project.It has the potential to move material from construction compounds beyond the Project boundary, and into the pathway of residential, sensitive and other receivers. Annual and seasonal wind roses produced as part of the Project EIS for the two closest stations (Earlwood and Sydney Airport), are shown in Figure 3. These are considered representative for the Project.

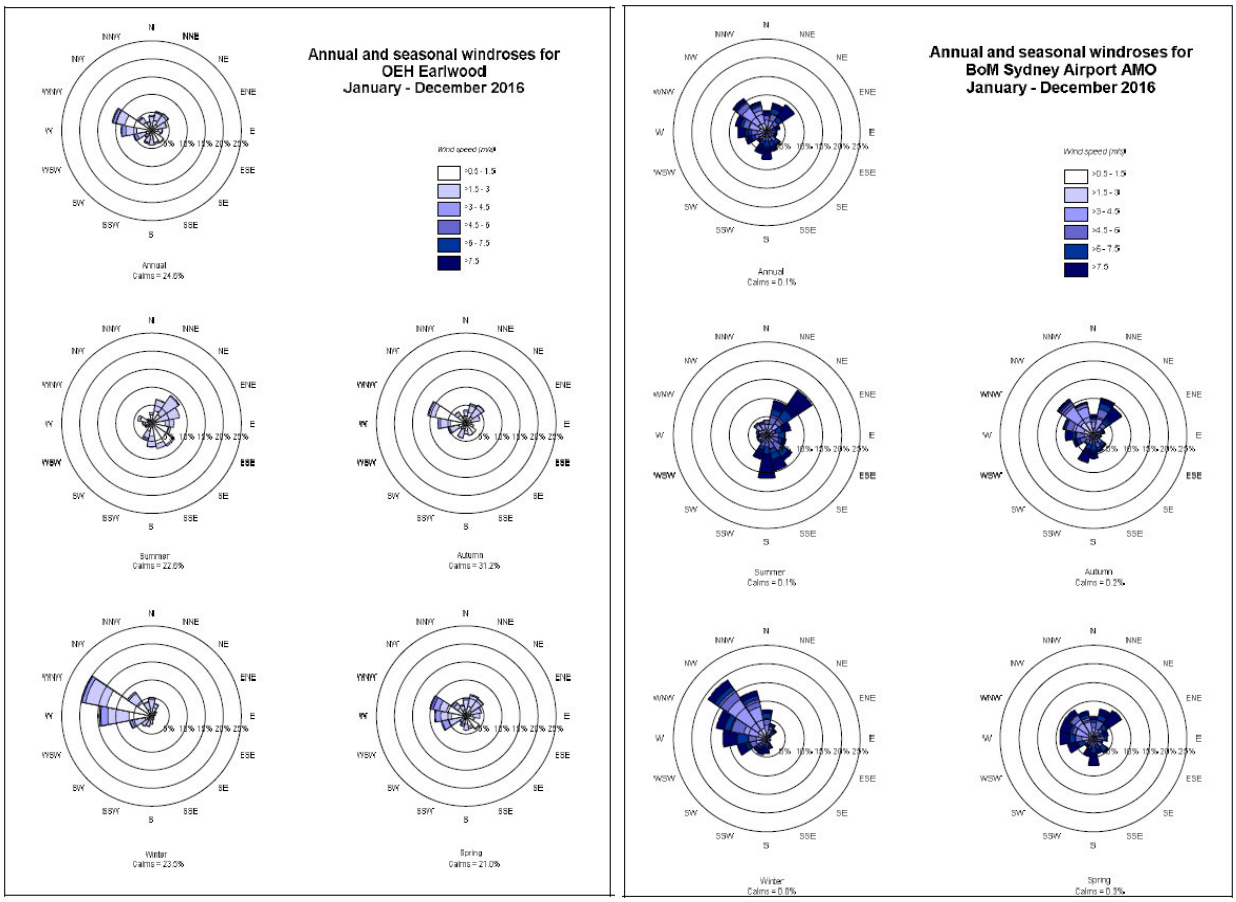

Figure 3: Wind Roses for Earlwood and Sydney Airport

It is anticipated that wind will be a key risk factor for dust impacts from the Project. Dust impact will be managed via the management measures identified in Section 6.

4.5 Odour

A potential source of odour for the project hydrogen sulphide gas. This gas may be released when bulk excavation activities during construction (CEMP Stage 2: construction) disturb acid sulfate soils or the historical landfill materials (Figure 4). These soils, when disturbed, have the potential to release hydrogen sulphide gas which could impact nearby sensitive recievers. The decommissioning of underground storage tanks in the former 7-11 Service Station may also present a risk of odour impacts to residents in the proximity of this site (C6).

Bulk excavation and decommissioning of USTs will only occur during construction (not during CEMP Stage 1: preliminary construction activities) and these impacts will be addressed through

the implementation of the: Acid Sulfate Soils Management Plan (part of the Soils and Surface Water CEMP Sub-plan); Leachate and Landfill Gas CEMP Sub-plan implemented prior to disturbance of landfill materials; and Remediation Action Plans for remediation works including the removal of underground storage tanks.

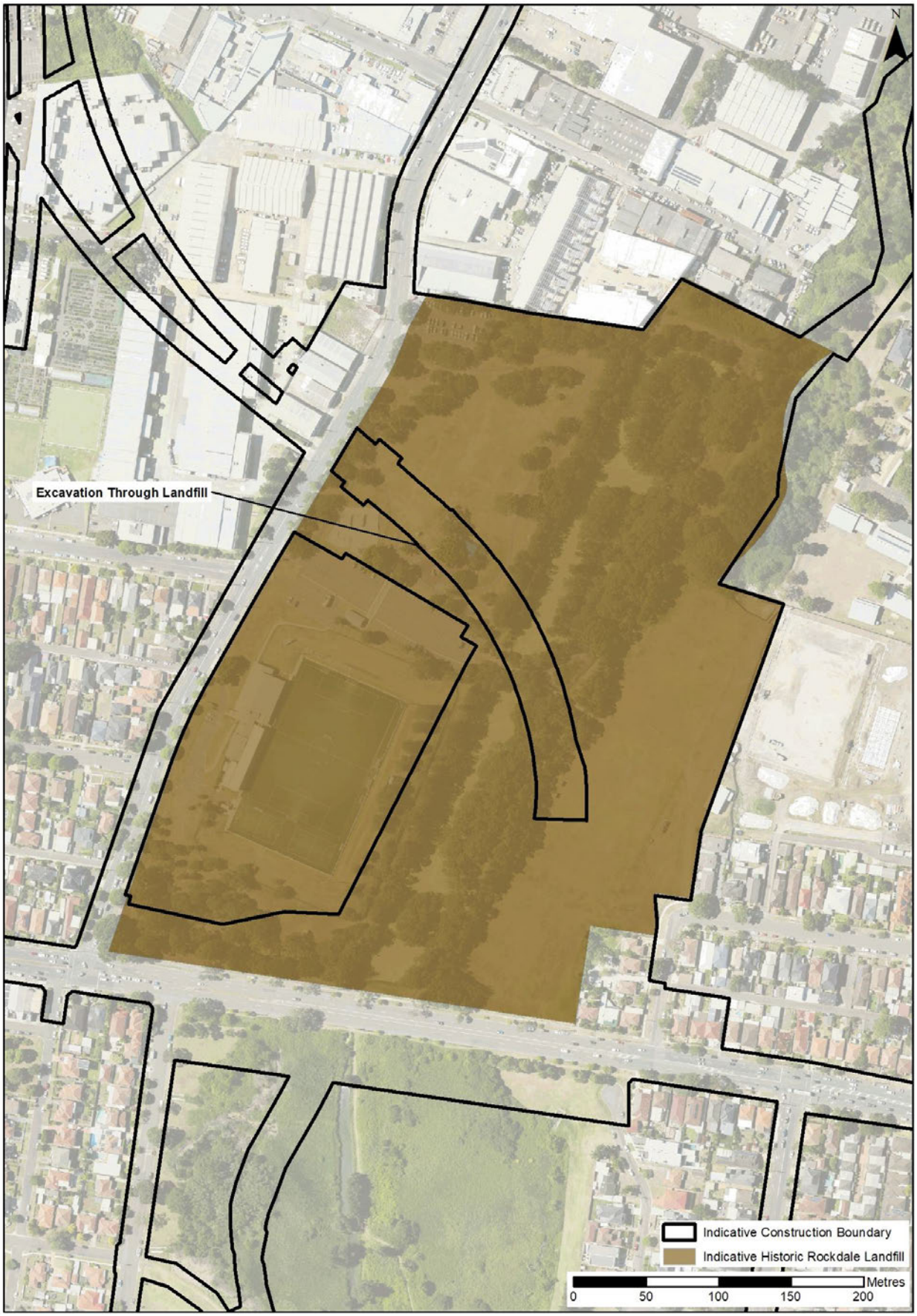

Figure 4: Historic landfill location

5 Environmental aspects and impacts

5.1 Construction activities

The potential for dust emissions during construction of the M6 Stage 1, are primarily related to four types of construction activities:

- **Demolition:** Any activity that involves the removal of existing structures inclusive of underground tanks;
- **Earthworks:** The processes of soil stripping, ground levelling, excavation and landscaping. Earthworks primarily involve excavating material (including contaminated material), haulage, tipping and stockpiling;
- **Building:** Any activity that involves the provision of new structures, or modification or refurbishment of existing structures. 'Structures' include buildings, ventilation outlets and roads;
- **Tracking:** The mobilisation of dust and dirt from construction/demolition sites onto haul roads, or the public road network, by construction vehicles. These materials may then be deposited and resuspended by subsequent vehicle movements.

Other air quality risks from demolition and construction, including release of heavy metals, asbestos fibres, silica dust or other pollutants during the demolition and removal of contaminated soils, will be assessed and addressed through hazmat inspections as per applicable demolition plans.

Air quality considerations at surface sites for the Project include:

- Annoyance due to dust depositing on surfaces (e.g. soiling of surfaces at residences) and visible dust plumes;
- Elevated particulate matter concentrations due to on-site dust generating activities;
- Odour emissions from ASS/PASS disturbed during excavation activities;
- Odour related to remediation activities, including the removal of underground storage tanks at the former 7-11 service station (C6)
- Odour emissions from leachate or landfill gas encountered during bulk earthworks through historical landfill (C3); and
- Increased concentrations of airborne particles and nitrogen dioxide (NO^2) due to exhaust emissions from on-site diesel-powered vehicles and construction equipment.

The EIS notes that exhaust emissions from on-site plant and site traffic are unlikely to have a significant impact on local air quality. The Leachate and Landfill Gas CEMP Sub-plan will be implemented to manage odours related to bulk excavation at Bicentennial Park.

5.2 Factors likely to affect dust generation and impacts

As noted in the EIS, any airborne particulate concentrations related to construction would likely be temporary and relatively short-lived. Key factors in the risk of dust impacts from construction sites includes:

- The nature and duration of the activities being undertaken. The size of the site and the surface area of disturbed ground;
- The meteorological conditions (wind speed, direction and rainfall), since adverse impacts are more likely to occur downwind of the site and during drier periods;
- The proximity of sensitive receivers to the activities;
- The sensitivity of adjacent receivers to dust; and
- The adequacy of the mitigation measures applied to minimise dust.

Construction ground disturbance will occur at locations as per Figure 5.

Figure 5: Indicative location of ground disturbance

5.3 Interface with other management plans

The management of construction related air quality is integrated with construction environmental management, and some management measures that are described in other Management Tools (e.g. CEMP Sub plans or Management Procedures) assist in the management of air quality. To minimise duplication and repetition, Table 7 identifies aspects relating to air quality, which are addressed in other management documents in accordance with the scope outline in CoA C4.

Table 7 Air quality aspects addressed in other management documents

Aspect	Potential Impacts	Management Tool
Odour related to disturbance of Acid Sulfate Soils	During Stage 1 of construction (Preliminary construction), limited disturbance of ASS and PASS is anticipated and potential impacts are minimal (refer to CEMP Appendix A2 – Aspects and Impacts Register).	Appendix B4 Soil and Surface Water Management Procedure: CEMP Appendix A4 Site Establishment Management Plan
	During Stage 2 of construction, ASS and PASS is likely to be encountered in bulk excavations at C2, and C3, and may be encountered during civil works for the ATC, utility or road works.	Appendix B4 Soil and Surface Water CEMP Sub-plan, including Appendix C: Acid Sulfate Soil Management Plan
Odour from leachate and landfill gas	During Stage 1 of construction (Preliminary Construction), disturbance of landfill materials is not proposed. Leachate and landfill gas are not anticipated to be encountered (refer to CEMP Appendix A2 – Aspects and Impacts Register).	
	During Stage 2 of construction, odour impact is likely from bulk excavation of landfill materials at C3. The highest risk of odour is from any exposed leachate and construction techniques will be employed to dewater and minimise leachate.	Appendix B10 Leachate and Landfill CEMP Sub-plan including Leachate and Landfill Gas Monitoring Program
Odour related to remediation of contamination including underground petroleum storage systems	During Stage 2 of construction, remediation activities in accordance with a Remedial Action Plan (RAP) may result in some odour impacts. This may occur during removal of underground structures previously used for fuel storage and material surrounding these structures.	Appendix B8 Contamination CEMP Sub-plan Remediation Action Plan/s
Odour from waste	During both construction stages, some potential odours may be generated from waste that is handled or stored prior to disposal.	Appendix B9 Waste CEMP Sub-plan.

5.4 Construction Air Quality Impacts

The potential air quality impacts of the construction phase of the project were assessed by the EIS using guidance published by the UK Institute of Air Quality Management. The UK guidance was adapted for use in NSW, considering factors such as the assessment criteria for ambient PM_{10} concentrations. Emissions to the atmosphere during construction that could result in adverse impacts to air quality are typically divided into two categories. These are:

1. Dust and particulates; and
2. Gaseous.

The risks associated with construction dust emissions were assessed for four types of activity:

- Demolition;
- Earthworks;
- Building; and
- Tracking (vehicle movements mobilising material).

The EIS assessment method considered three separate dust impacts:

- Annoyance due to dust soiling;
- Risk of health effects due to an increase in exposure to particulate matter ($PM_{2.5}$ and $PM_{10)}$; and
- Harm to ecological receptors.

Key aspects of the Project that may result in dust and particulate emissions include:

- Building demolition at temporary and permanent ancillary facility sites;
- General earthworks;
- Vegetation clearing;
- Operating plant and equipment, crushing and screening;
- Cutting, grinding, sawing and hammering activities;
- Operation of concrete / asphalt agitators;
- Removal of redundant utilities and installation of new utilities (including Permanent Power Supply);
- Topsoil/material handling including stockpiling, material and spoil loading, as well as material and spoil haulage;
- Vehicular movements over unpaved surface (including unsealed access roads);
- Wind erosion of exposed areas and temporary stockpiles;
- Archaeological testing, heritage salvation and conservation works (if required);
- Treatment of contaminated sites or material;
- Tracking of material onto public roads; and
- Improper use of street sweepers.

Air emissions, other than dust, which may be generated by construction activities include:

- Vehicle and plant exhaust emissions.

Aspects of the Project that may result in release of odours and/or gases include:

- Disturbance and exposure of leachate from excavations in organic or contaminated materials (i.e. historical landfill);

- Decommissioning and removal of underground storage tanks at the site of the former 7/11 service station (at C6);
- Removal of redundant utilities and underground storage tanks;
- Removal and treatment of groundwater; and
- Removal and treatment of acid sulfate soils.

Primarily, impacts will be dependent on the nature, extent and magnitude of construction activities, and their interaction with the natural environment. Potential impacts attributable to construction may occur during work establishment, earthworks, spoil handling, storage and transport, and due to plant and vehicle movement and emissions. These potential impacts are described in more detail in the following sections.

Cumulative impacts to air quality are not anticipated to occur from staging of the Project or during construction of the Project. Where unexpected cumulative impacts are identified during works, they will be managed through compliance with relevant CoAs, coordination with external stakeholders including utility providers, and implementation of EMMs related to key environmental impacts. The mechanism for identifying any potential unexpected cumulative impacts will be through monitoring, inspections, reporting and auditing.

Worksite establishment

Potential impacts related to the management of air quality during worksite establishment are outlined in Table 8 below. These impacts would be managed through environmental control measures outlined in Table 12.

Table 8: Potential air quality impacts related to worksite establishment

Activities with potential dust soiling impacts	Activities with potential particulate matter ($PM_{2.5}$/PM_{10}) impacts	Activities with potential odour impacts
• Vegetation clearing and grubbing. • Stockpiling of topsoil and mulched vegetation. • Demolition of buildings and associated infrastructure (asbestos is not addressed in this plan; refer to Asbestos Management Plan). • Wind erosion of exposed surfaces and stockpiles. • Wheel-generated dust from vehicular traffic on unsealed roads and works site access points. • Set up of site facilities including minor piling. • Cutting, grinding, sawing and hammering activities.	• Operation of construction vehicles, plant and equipment; and • All activities with potential dust soiling impacts.	• Decommissioning and removal of underground storage containers at the site of the old 7/11 petrol station (C6). • Relocation of sewer within MOC3 footprint (C3).

Earthworks

Potential impacts related to the management of air quality during earthworks are outlined in Table 9 below. These impacts would be managed through environmental control measures outlined in Table 12.

Table 9: Potential air quality impacts related to bulk earthworks

Activities with potential dust soiling impacts	Activities with potential particulate matter ($PM_{2.5}$/PM_{10}) impacts	Activities with potential odour impacts
• Pads for drilling, piling and diaphragm wall construction. • Operation of excavators, front end loaders, bulldozers, dump trucks and other plant on exposed surfaces. • Tunnelling. • Loading/unloading trucks with spoil and aggregate (including dust generation from within the acoustic sheds). • Wind erosion of exposed surfaces and stockpile. • Wheel-generated dust from vehicular traffic on unsealed roads and work site access points. • Wheel-generated dust from vehicular traffic on unsealed roads and works site access points.	• Operation of construction vehicles, plant and equipment; and • All activities with potential dust soiling impacts.	• Release of hydrogen sulphide gas when bulk excavation activities commence at Rockdale Bicentennial Park. Refer to Figure 4 for the location of the historical landfill. • Release of ammonia from leachate encountered during bulk excavation at the Rockdale Bicentennial Park. Refer to Figure 4 for the location of the historical landfill.

Spoil handling, storage and transport

Potential air quality impacts related to spoil handling, storage and transport are outlined in Table 10 below. These impacts would be managed through environmental control measures outlined in Table 12.

Table 10: Potential air quality impacts related to spoil handling, storage and transport

Activities with potential dust soiling impacts	Activities with potential particulate matter ($PM_{2.5}$/PM_{10}) impacts	Activities with potential odour impacts
• Operation of excavators, front end loaders, bulldozers, dump trucks and other plant on exposed surfaces • Spoil stockpiles • Spoil haulage (uncovered loads), and • Wheel-generated dust from heavy vehicle movements around construction sites and along haulage routes. • Treatment of contaminated material (PASS)	• Operation of construction vehicles, plant and equipment; and • All activities with potential dust soiling impacts.	• Stockpiling of contaminated (including PASS) material.

Plant and vehicle movement and emissions

Potential air quality impacts related to plant and vehicle movement and emissions are outlined in Table 11 below. These impacts would be managed through environmental control measures outlined in Table 12.

Table 11: Potential air quality impacts related to vehicle movement and emissions

Activities with potential dust soiling impacts	Activities with potential particulate matter ($PM_{2.5}$/PM_{10}) impacts	Activities with potential odour impacts
• Wheel generated dust from operation of excavators, front end loaders, bulldozers, dump trucks and other plant on exposed surfaces, • Spoil haulage (uncovered loads), and • Wheel-generated dust from heavy vehicle movements around construction sites and along haulage routes.	• Operation of construction vehicles and plant including poorly maintained equipment and excessive idling of vehicles, and • All activities with potential dust soiling impacts.	• Stockpiling of contaminated material.

Construction plant and equipment will be well maintained to promote optimal fuel efficiency. All vehicles used on site for transporting materials to or from site, or for any other activities associated with the Project, will be maintained to avoid emissions of excessive air impurities in accordance with Part 5.8 of the Protection of the *Environment Operations Act 1997* and the Protection of the Environment Operations (Clean Air) Regulation 2010.

6 Environmental Control Measures

In accordance with CoA C5, E1 and to meet the objectives of this Air Quality and Odour CEMP Sub-plan, specific management and mitigation measures were developed to address impacts on air quality (Table 12))Implementation of these environmental control measures will facilitate the effective management of dust, odour and other emissions during construction, and enable compliance with the environmental performance outcomes described in Chapter 24 of the EIS.

Table 12: Construction air quality management and mitigation measures

ID	Measure/Requirement	Resources needed	When to implement	Responsibility	Reference	Evidence
Planning						
MMAQO1	Regular communication between Project sites under construction in close proximity to ensure that measures are in place to manage any potential cumulative dust impacts (i.e. to manage the impact of multiple teams completing separate construction activities). Regular communication between onsite personnel is also to be carried out to ensure mitigation measures are being identified, implemented and monitored.	Construction Area Plan Site Environmental Plans	Construction	Construction Manager Supervisor Environmental and Sustainability Manager or delegate	EMM AQ1	Daily Pre-start records CGU Weekly Environmental Inspection Checklist Observations
MMAQO2	All construction area plans/designs and construction activities will be planned and carried out to avoid where practicable, or minimise, the generation of dust and vehicle emissions.	CEMP Appendix A4 Site Establishment Management Plan (SEMP) Soil and Surface Water Management	Pre-Construction Construction	Supervisor Construction Manager	Best practice EMM AQ1 CoA: A17 C4(a)(d)(e)	Construction area plans/designs

ID	Measure/Requirement	Resources needed	When to implement	Responsibility	Reference	Evidence
		Procedure (during preliminary construction) Soil and Surface Water CEMP Sub-plan (following preliminary construction)			E1	
Incident management						
MMAQO3	Environmental incidents related to Air Quality that are (or have the potential to be) classified as C1-C3 under TfNSW Environmental Incident Classification and Reporting Procedure, will be immediately verbally notified to the TfNSW Environment and Sustainability Manager. All incidents which cause or are likely to cause material harm to the environment are to be immediately reported to the EPA and other authorities as per the Pollution Incident Response Management Plan (PIRMP) and in accordance with CoA A39 and A40	CEMP Section 3.10 CEMP Appendix A7 (TfNSW Environmental Incident Classification and Reporting Procedure) PIRMP	Construction	Supervisor Construction Manager Environmental, and Sustainability Manager	POEO Act G36	Environmental Incident Report
Dust management						

ID	Measure/Requirement	Resources needed	When to implement	Responsibility	Reference	Evidence
MMAQO4	Construction activities with the potential to generate dust will be modified or ceased during windy conditions to reduce the potential for dust generation. Expected windy weather conditions will be communicated via daily pre-start and will be monitored, and communicated where necessary, throughout the day.	Prestarts Access to BOM Construction Area Plan	Construction	Supervisor Environmental and Sustainability Manager;	EMM AQ1 CoA E1	Daily Pre-Start Records Inclement weather inspections records Monitoring records
MMAQO5	Appropriate measures to reduce potential dust generation, such as the use of water carts, sprinklers, dust screens and surface treatments, will be implemented within Project sites as required. These controls will also be implemented to reduce the emission of dust out of the door openings of acoustic sheds. These measures will be implemented to minimise dust leaving the premises and before any soil disturbance or vegetation clearing commences.	Access to water, water carts, sprinklers, dust screens, sheds and surface treatments. Construction Area Plan	Pre-construction Construction	Supervisor Construction Manager Environmental and Sustainability Manager Engineers	EMM AQ1 EMM AQ2 CoA E1	Site Environment Plans CGU Weekly Environmental Inspection Checklist
MMAQO6	Site access and egress points and all sealed surfaces within Project sites will be maintained and	Construction Area Plan	Pre-construction	Construction Manager Environmental and	EMM AQ1 EMM AQ2	Daily Pre-Start Construction

ID	Measure/Requirement	Resources needed	When to implement	Responsibility	Reference	Evidence
	managed to reduce dust generation. At the establishment of construction ancillary facilities, controls such as wheel wash systems and rumble grids will be installed to minimise the deposition of loose material on sealed surfaces outside Project sites.	Street sweeper Chip seal, concrete, asphalt and soil binders Wheel washes, rumble grids, wetting systems, segregation (clean/dirty areas)	Construction	Sustainability Manager Supervisor	G36 and G38 CoA E1	area plans/designs CGU Weekly Environmental Inspection Checklist Site Environment Plans Erosion and Sediment Control Plans Vehicle Management Plan
MMAQO7	Materials that have potential to result in dust generation will be managed using standard ESCP and stockpile protocols (e.g. limiting height). Materials, being stored/stockpiled on site for more than 10 days undisturbed, that have the potential to result in dust generation, will have dust mitigation measures applied to reduce the risk of dust generation. Measures include storing material	Construction Area Plan and Work Packs. Soil and Surface Water Management Procedure (during preliminary construction) including: Stockpile Management Procedure.	Construction	Construction Manager Supervisor Environmental and Sustainability Manager Engineers	EMM AQ1 G36 &G38 CoA E1	CGU Weekly Environmental Inspection Checklist Erosion and Sediment Control Plans

ID	Measure/Requirement	Resources needed	When to implement	Responsibility	Reference	Evidence
	within site enclosures, stabilising material using soil binders / tackifiers, covering with anchored fabrics, surface compacting / crusting stockpiles, installing dust suppression systems such as misters / sprinklers. This will be undertaken in accordance with the "Blue Book" (DECC, 2008).	Soil and Surface Water CEMP Sub-plan (following preliminary construction) Site enclosures Soil binders Covers Excavators Misters / sprinklers				
MMAQO8	Dust suppression and/or collection techniques will be used during cutting, grinding or sawing activities likely to generate dust in close proximity to sensitive receivers (e.g. vacuum extraction or water suppression or other engineered controls).	Engineered dust controls Construction Area Plan and Work Packs	Construction	Construction Manager Supervisor	EMM AQ1 EMM AQ2 CoA E1	Pre-start records CGU Weekly Environmental Inspection Checklist
MMAQO9	The potential for dust generation will be considered during the storage and handling of loose and fine materials. Equipment will be selected, and processes developed to minimise the potential for dust generation (e.g. location selection, avoiding double handling, use of misting or	Construction Area Plan and Work Packs Vacuum trucks Sprinklers Soil binders Geofabrics/plastics	Construction	Construction Manager Supervisor	EMM AQ1 EMM AQ2 CoA E1	CGU Weekly Environmental Inspection Checklist Procurement records Work Packs

ID	Measure/Requirement	Resources needed	When to implement	Responsibility	Reference	Evidence
	sprinklers, receiving material in bulk bags etc.).					
MMAQO10	All loaded spoil haulage trucks and other Project-related heavy vehicles transporting material will ensure loads are covered to prevent dust emissions during transport in accordance with relevant road regulations. Covers will be removed during unloading and loading.	Functional trailer covers	Construction	Spoil Team Mechanical Supervisor Supervisor	EMM AQ1 EMM AQ2 CoA E1	Project Plant Inspection records Subcontractor Agreements CGU Weekly Environmental Inspection Checklist
MMAQO11	Demolition activities, including any removal of hazardous dust-generating materials, will be planned and carried out with adequate dust suppression to minimise the potential for dust generation (e.g. considering weather conditions before works, removing unconsolidated material with dust generating capacity before mechanical demolition or misting sprays). Removal of hazardous dust-generating building materials will be completed prior to the commencement of general	Demolition Plan Sprinklers Soil binders Gurneys Hoses Fogging Sprinklers HAZMAT survey	Construction	Construction Manager Project Manager Engineer Environmental and Sustainability Manager Supervisor	EMM AQ1 EMM AQ2 G36 &G38 CoA E1	Daily Pre-Start CGU Weekly Environmental Inspection Checklist Subcontractor Agreements HAZMAT Surveys Work Packs

ID	Measure/Requirement	Resources needed	When to implement	Responsibility	Reference	Evidence
	demolition works wherever possible, to minimise impacts. All demolition works and the removal of hazardous dust generating building materials must follow a work method developed for the specific task. The work method must include consideration of the results of HAZMAT surveys and all other relevant information. The work method must be documented in a Work Pack and approved by the Project Manager					
MMAQO12	Construction works will minimise areas of exposed soil where practicable, to reduce the potential for dust generation. Exposed soils will be temporarily stabilised (e.g. soil binder, covering piles with Geofab, water suppression) during adverse weather conditions (forecast to cause dust generation) and prior to extended periods of inactivity (e.g. Shutdowns) to minimise dust generation. Exposed soils will be revegetated and/or permanently stabilised as soon as reasonable and feasible	Soil binders and cover crop Staging work Geofabric Landscaping Hardstand	Construction	Environmental and Sustainability Manager Supervisor	EMM AQ1 EMM AQ2 Best practice G36 and G38	Work Packs CGU Weekly Environmental Inspection Checklist

ID	Measure/Requirement	Resources needed	When to implement	Responsibility	Reference	Evidence
	following disturbance.					
MMAQO13	Ensure that stockpiles of materials with the potential to result in dust emissions are managed (i.e. enclosed or adequately protected) to reduce potential dust generation and odour.	Soil and Surface Water Management Procedure (during preliminary construction): including Stockpile Management Procedure Soil and Surface Water CEMP Sub-plan (following preliminary construction)Soil binders Water carts Stockpile compaction Geofabrics/plastics Deodorises	Construction	Supervisor	EMM AQ1 EMM AQ2 Soil and Surface Water Management Procedure (during preliminary construction) Soil and Surface Water CEMP Sub-plan (following preliminary construction)G36 &G38	Daily Pre-Start Records CGU Weekly Environmental Inspection Checklist Erosion and Sediment Control Plans
MMAQO14	Water carts will service haul roads and will be monitored during earthworks operations, ceasing works if necessary during high winds where dust controls are not effective.	Construction Area Plans Water carts	Construction	Supervisor	EMM AQ1 Best Practice	Daily Pre-Start Records Inclement weather inspections CGU Weekly

ID	Measure/Requirement	Resources needed	When to implement	Responsibility	Reference	Evidence
						Environmental Inspection Checklist
MMAQO15	Long term stockpiles (e.g. stockpiles left exposed and undisturbed for longer than 10 days) of topsoil will have cover crop established. Long term stockpiles of all other material will be appropriately covered to prevent air quality impacts as per MMAQO7.	Seed cover Geofabrics/ plastics Soil and Surface Water Management Procedure (during preliminary construction) including: Stockpile Management Procedure Soil and Surface Water CEMP Sub-plan following preliminary construction)	Construction	Engineer Supervisor	Best practice EMM AQ1 G36 &G38 Soil and Surface Water Management Procedure (during preliminary construction) including: Stockpile Management Procedure Soil and Surface Water CEMP Sub-plan (following preliminary construction)	Construction area plans/designs Erosion and Sediment Control Plans Work Packs CGU Weekly Environmental Inspection Checklist
MMAQO16	Areas surrounding tunnel door sheds and portals will be managed using measures such as water carts, wetting systems, segregation of clean and dirty	Water carts Wetting systems Segregation (clean/dirty areas)	Construction	Supervisor	EMM AQ1	Vehicle Management Plan Erosion and Sediment

ID	Measure/Requirement	Resources needed	When to implement	Responsibility	Reference	Evidence
	areas, etc., to minimise dust generation.					Control Plan CGU Weekly Environmental Inspection Checklist
MMAQO17	Underground/tunnelling works will have a dedicated dust collection and ventilation system (e.g. scrubbers). This system is implemented and monitored in accordance with the Work Health Safety Management Plan and is not a measure/requirement of this Sub-plan. However, it is noted that these measures support compliance prior to air reaching the surface.	Dust extraction and filtration system	Construction	Construction Manager Safety Director Supervisor Mechanical Supervisor	Best practice EMM AQ1	Construction area plans/designs Work Packs
MMAQO18	All site personnel must report observations of release of dust from the premises to supervisory staff so that appropriate management measures can be implemented.	Induction	Pre-construction Construction	All staff	Best practice	Informal site observations CGU Weekly Environmental Inspection Checklist
MMAQO19	The effectiveness of measures in this plan will be monitored through the implementation of the Air Quality Monitoring Program (refer to Appendix A).	Air Quality Monitoring Program	Construction	Environmental and Sustainability Manager	Best practice	Air Quality Monitoring Reports

ID	Measure/Requirement	Resources needed	When to implement	Responsibility	Reference	Evidence
Operating vehicles/machinery						
MMAQO20	Construction plant and equipment will be operated, inspected and maintained to maximise efficiency and comply with relevant emission standards. Construction plant and equipment will be well maintained to promote optimal fuel efficiency. Engine idling will be minimised when plant is stationary, and plant will be switched off when not in use to reduce emissions.	Plant on-boarding team	Construction	Supervisor Plant Operators Mechanical Supervisor	EMM AQ1 G36	CGU Weekly Environmental Inspection Checklist Plant and equipment records
MMAQO21	The use of mains electricity will be favoured over diesel or petrol-powered generators where practicable to reduce site emissions.	Sustainability Management Plan	Construction	Procurement team Mechanical and Electrical Team	EMM AQ1 G36	Procurement assessment records CGU Weekly Environmental Inspection Checklist
Odour						
MMAQO22	In the event of uncovering waste with a noxious odour, or detection of nuisance odours (nuisance to workers or confirmed beyond site	Construction Area Plan Application of	Construction	Supervisor Construction Manager	Best practice EMM AQ3	CGU Weekly Environmental Inspection

ID	Measure/Requirement	Resources needed	When to implement	Responsibility	Reference	Evidence
	boundaries), construction personnel will report the source of the odour to the Environmental and Sustainability Manager. Odorous material would be treated immediately onsite, and removed from site where necessary. Areas of odorous material would be kept to a minimum to reduce the total emissions from the site. Mitigation measures that may be implemented include: • Odour suppressants will be applied; • Materials will be removed from site as quickly as possible; • Where stockpiling of material occurs, the material will be covered (where feasible); and • Water or leachate from PASS/ASS stockpiles will be collected in sump for treatment and/or removal to a licenced facility.	odour suppressants		Engineers Environmental and Sustainability Manager		Checklist Work Packs Air Quality Monitoring Program Reports
MMAQO23	Where there is a risk of noxious or nuisance odour being emitted due	Communication s Strategy	Construction	Stakeholder and Community	Best practice	Community notifications

ID	Measure/Requirement	Resources needed	When to implement	Responsibility	Reference	Evidence
	to construction activities (e.g. decommissioning and removal of UST, excavation and handling of PASS/ASS and landfill material), receivers located within the vicinity of the work area will be notified of potential risk of odour. The Leachate and Landfill Gas CEMP Sub-plan must be developed and implemented prior to excavation at Bicentennial Park. On-site odour measurements will be carried out during these excavation works to determine odour emission risk. Results from the monitoring will be used to inform ongoing and future activities. Program works with potential for odour to be completed as quickly as possible. Sensitive receivers will be informed of mitigation and management measures. Notification will be undertaken in accordance with the Communication Strategy. Complaints will be managed in accordance with the Complaints Management System.	Construction Area Plan and Work Packs Community and Stakeholder team		Relations Manager Construction Manager Environmental and Sustainability Manager	EMM AQ3 CEMP Leachate and Landfill Gas CEMP Sub-plan (required before bulk excavation at Bicentennial Park) Leachate and Landfill Gas Monitoring Program (required before bulk excavation at Bicentennial Park)	Work Packs

ID	Measure/Requirement	Resources needed	When to implement	Responsibility	Reference	Evidence
MMAQO24	Where there is a risk of odour being emitted due to construction activities, works are to be programmed and managed to reduce the duration of exposure where possible.	Construction Area Plan	Construction	Construction Manager Supervisor Environmental and Sustainability Manager	Best practice EMM AQ3	CGU Weekly Environmental Inspection Checklist Work Packs Air Quality Monitoring Program Reports
MMAQO25	Findings of odour monitoring will be used for continuous improvement of construction methodologies.	Leachate and Landfill Gas Monitoring Program (prior to bulk excavation works in Bicentennial Park)	Works intercepting leachate and landfill material	Construction Manager Supervisor Environmental and Sustainability Manager	Best practice EMM AQ3	Air Quality Monitoring Program Reports Work Packs
Refer to the Leachate and Landfill Gas CEMP Sub-plan for mitigation measures (including odour mitigation) for construction activities (CEMP Stage 2 activities) at Bicentennial Park (C3).						
Other						
MMAQO26	Ensure that Project specific control measures are communicated and documented into Work Packs.	Construction Area Plans Work Packs Inductions	Construction	Construction Manager Environmental and Sustainability Manager	Best practice	Work Risk Assessment Construction Area Plan Work Pack Site Environment

ID	Measure/Requirement	Resources needed	When to implement	Responsibility	Reference	Evidence
						Plans
MMAQO27	The application of pesticides will be modified, reduced or controlled during high or unfavourable wind conditions where wind can carry pesticides outside of the defined treatment area.	Environmental Work Method Statements (EWMS)	Construction	Supervisor	Best practice	EWMS Weekly environment inspections
MMAQO28	All potentially hazardous material will be identified and removed from buildings in an appropriate manner, prior to the commencement of and/or progressively during demolition and in accordance with all relevant codes of practice.	Demolition Plan Work Packs	Construction	Construction Manager Environmental and Sustainability Manager	EMM AQ2 G36 Best Practice	Work Packs HAZMAT Reports Environmental Incident Report
MMAQO29	Undertake weekly documented site inspections while construction works are occurring to identify and action any air quality issues (including odour) resulting from Project activities.		Construction	Environmental and Sustainability Manager	EMM AQ1 G36 and G38	CGU Weekly Environmental Inspection Checklist
MMAQO230	Inclement weather inspections will be undertaken throughout the construction of the Project.		Construction	Environmental and Sustainability Manager or delegate	EMM AQ1 G36 and G38	Inclement weather inspection

7 Compliance management

7.1 Roles and responsibilities

The CGU Project organisational structure, and overall roles and responsibilities, are outlined in Section 3.3 of the CEMP. Specific responsibilities for the implementation of environmental controls are detailed in Section 6 of this Plan.

7.2 Training

All employees, contractors and utility staff working on site will undergo site induction training relating to air quality issues. The induction training will address elements related to air quality management including:

- Requirements of this Plan;
- Applicable and relevant legislative requirements;
- Roles and responsibilities for air quality management;
- Typical construction activities that may impact air quality and associated environmental mitigation and management measures; and
- Incident response procedure.

Targeted training in the form of toolbox talks or specific training will also be provided to personnel with a key role in air quality management. Examples of training topics include:

- Potential sources of dust, emissions and other air pollutants;
- Impacts to the environment and surrounding community;
- Planning and preparedness for high wind events and dust risk periods; and
- Erosion and sediment controls installation methods.

Targeted training in the form of toolbox talks or specific training will also be provided to personnel with a key role in air quality management.

Further details regarding staff induction and training are outlined in Section 3.5 of the CEMP.

7.3 Monitoring and inspections

Construction air quality monitoring will be conducted in accordance with the Construction Air Quality Monitoring Program included in Appendix A. Where monitoring detects a non-compliance, an incident report and corrective actions will be raised.

Inspections will include daily site inspections by Site Supervisors, and weekly site inspection by environmental personnel during construction as a minimum. The frequency of these inspections may be increased to reflect the risk associated with potential impacts during adverse weather conditions or during specific construction activities. Inspections items that are specific to identifying potential air quality issues include:

- Visible sources of dust;
- Visible dust emissions;
- Implementation and effectiveness of all dust controls;
- No continuous visible vehicle/plant/equipment emissions for longer than 10 seconds as per the POEO Clean Air Regulation;
- Haul road integrity (clean, no potholes etc)
- No mud tracking off-site; check main exit/entry points and material on public roads;

- No detectable offensive odours or gases (e.g. inspection of potential odour sources including freshly disturbed areas, open stockpiles, water treatment plants, waste skips, etc); and
- Weather forecast (e.g. rainfall and wind) will be checked daily to allow for proactive dust management actions to be implemented.
- The fixed monitoring devices have not been damaged and appear operational

An adaptive approach to dust and odour management will be implemented. Mitigation measures can be amended and improved if they are found to not meet the required outcomes. Weather forecasts and observations will be assessed, and communicated through pre-starts and other tools. Plant pre-starts and inspections will be conducted and recorded to ensure that the plant is in good working order, and to ensure that there are no continuous visible emissions for longer than 10 seconds.

Site inspections will be recorded (along with actions and issues observed) and actioned appropriately within agreed timeframes. These inspections would be recorded as part of Environmental Inspection Checklist. Additional requirements and responsibilities in relation to inspections are documented in Section 3.9.1 and Section 3.9.2 of the CEMP.

7.4 Auditing

Audits (both internal and external) will be undertaken to assess the effectiveness of environmental controls, as well as compliance with this sub plan, CoA and other relevant approvals, and licenses and guidelines.

Audit requirements are detailed in Section 3.9.3 of the CEMP.

7.5 Reporting

Project reporting requirements relevant to the management of air quality are identified in Table 13. Reporting of air quality monitoring results is presented in Section 4.4 of the AQMP (Appendix A of this Sub-plan).

Table 13: Reporting requirements

Item	Frequency	Standards	External reporting	Responsibility
Incidents	At each occurrence	As required by the CoA, EPL, PIRMP, TfNSW Environmental Incident Classification and Reporting procedure, and TfNSW Environment incident report.	Appropriate authority dependant on the nature of the incident (e.g. EPA, the Secretary) (refer to Section 3.8 of CEMP & CEMP Appendix A7)	Project Manager Supervisor Environmental and Sustainability Manager
Complaints	Daily (ER, EPA) Weekly (DPIE)	As required by the CoA and EPL. Communication, notification and complaints handling requirements regarding air quality matters will be managed through the Complaints Management System and the Communication Strategy.	ER (CoA A27(a)) EPA (in accordance with the EPL conditions) DPIE (as requested by the Secretary; CoA B10)	Supervisor Project Manager Environmental and Sustainability Manager
NSW Government Resource Efficiency Policy (GREP)	Annually (before 31 July) and on completion of construction	A required by TfNSW G36 Specification. Reporting on the conformity, or otherwise, of mobile non-road diesel and plant equipment used for the Work Under deed with the relevant United States Environment Protection Authority (US EPA), European Union (EU) standards or approved equivalent emission standards. The report will be prepared in accordance with the GREP “Clean Air data management tool”, which details the types of diesel plant and equipment that are to be included and excluded.	TfNSW	Environmental and Sustainability Manager
Construction Air Quality Monitoring Results	Monthly (EPL data) 6-monthly reporting	Refer to Appendix A (Air Quality Monitoring Program), specifically Section 3.4	EPA (in accordance with the EPL conditions) DPIE (as required by CoA C23)	Environmental and Sustainability Manager

8 Review and improvement

8.1 Continual improvement

Section 3.2.2 of the CEMP describes the process for the continual improvement of project documents.

Continual improvement of this Plan will be achieved by ongoing evaluation of environmental management performance against environmental policies, objectives and targets, for the purpose of identifying opportunities for improvement.

The continual improvement process is designed to:

- Identify areas of opportunity for improvement of environmental management and performance;
- Determine the cause or causes of non-conformances and deficiencies, and develop and implement a plan of corrective and preventative actions (refer to Section 3.12 of the CEMP);
- Verify the effectiveness of the corrective and preventative actions;
- Document any changes in procedures resulting from process improvement; and
- Make comparisons with objectives and targets.

8.2 Air Quality and Odour CEMP Sub-plan update and amendment

Section 3.13 of the CEMP describes the process for revising and updating the CEMP and its Sub-plans. This will occur as needed. Only the Environmental and Sustainability Manager, or delegate, has the authority to change any of the environmental management documentation.

A copy of the updated plan and changes will be distributed to all relevant stakeholders in accordance with the approved document control procedure - refer to Section 2 of the CEMP.

Appendix A Air Quality Monitoring Program

Construction Air Quality Monitoring Program

Project Name: M6 Stage 1

Project number:	M6S1
Document number:	M6S1-CGU-NWW-ENPE-PLN-000408
Revision date:	17/10/2021
Revision:	01

Document approval

Rev	Date	Prepared by	Reviewed by	Approved	Remarks
A.01	08/07/2021	[redacted]	[redacted]	[redacted]	Issued to TfNSW
A.02	18/08/2021	[redacted]	[redacted]	[redacted]	Updated with TfNSW comments and issued for consultation
00	27/09/2021	[redacted]	[redacted]	[redacted]	Issued for approval
01	17/10/2021	[redacted]	[redacted]	[redacted]	Updated in response to DPIE comments

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1. Introduction

1.1. Context

This Construction Air Quality Monitoring Program (the Program) has been prepared for implementation during construction of the M6 Stage 1 (the Project). This Monitoring Program is Appendix A of the Air Quality and Odour CEMP Sub-plan and has been prepared to address the requirements of the Minister's Conditions of Approval (CoA), the Environmental Management Measures (EMM) listed in the M6 Stage 1 Environmental Impact Statement (EIS) and other applicable legislation. This Monitoring Program is part of the Construction Environmental Management Plan (CEMP) and further context and detail is provided in the Air Quality and Odour CEMP Sub-plan and CEMP.

1.2. Scope

This Construction Air Quality Monitoring Program describes how the CPB Contractors, Ghella, UGL Engineering (CGU) joint venture will monitor air quality impacts during construction of the Project in accordance with CoAs C13(e) and E1. The Project's EIS identified that the key risks to air quality during the construction phase of the Project were: annoyance due to dust soiling; the risk of health effects due to an increase in exposure to particulate matter for the nearest sensitive receivers; and harm to ecological receptors.

The Construction Air Quality Monitoring Program is focused on detecting dust and soiling impacts (the risks identified in Section 9.5 of the EIS) and considers the sensitivity of nearby receivers to dust impacts, noting that dust risk is also closely related to the distance from the source (as per Table 9-18 of the EIS). Monitoring has been tailored to these risks and is optimised to provide real-time data that can allow pro-active and reactive management to any issues identified through monitoring.

A Trigger Action Response Plan (TARP) was developed in consultation with the EPA and in addition to providing management responses for monitoring results detected through this Monitoring Program, it also includes management responses for the detection of odours related to general construction activities. During the consultative process, it was agreed that odour arising from general construction activities will be monitored through inspections and managed through the TARP in this Monitoring Program, while odour arising from:

- Remediation would be managed in accordance with the applicable Remediation Action Plan/s
- Bulk excavation of acid sulfate soils would be managed in accordance with the Acid Sulfate Soil Management Plan
- Excavation of material at Bicentennial Park would be managed in accordance with the Leachate and Landfill Gas CEMP Sub-plan and Monitoring Program

The purpose of monitoring is to measure potential impacts to local air quality and to facilitate the implementation of appropriate management measures to address impacts during construction. Information and data collected during the implementation of this Monitoring Program will be used in the assessment of mitigation measures applied during construction of the Project (refer to Table 12 of Air Quality and Odour CEMP Sub-plan).

Tunnel ventilation monitoring requirements are not within the scope of this construction phase Monitoring Program and this program does not attempt to address ambient air quality monitoring, which is required to commence at least 12 months prior to operation in accordance with CoAs E19 to E25.

1.3. Consultation

This Program was prepared in consultation with New South Wales (NSW) Environmental Protection Authority (EPA) in accordance with CoA C13(e). Comment was sought on a draft AQMP and the EPA provided feedback was used to update and correct the document. A subsequent meeting was held with the EPA to discuss the feedback and the proposed updates to the plan. The Monitoring Program was also provided to relevant councils (Bayside Council, Canterbury Bankstown Council and Georges River Council) and NSW Health during consultation on the Air Quality and Odour CEMP Sub-plan.

Key matters raised by the stakeholders during this process are listed in Table 1.

Table 1: Summary of consultation

Relevant Public Authority	Query	Action
Bayside Council	"Confirm the criteria that will be used for the assessment of dust impact….. Is it a visual assessment?	The Monitoring Program focusses on the detecting particulate matter in air near site boundaries, using fixed location and mobile sampling devices. A response was provided to the council and the plan was updated with additional details.
EPA	The EPA raised a number of issues regarding the level of detail provided in the stand-alone Monitoring Program. The EPA requested more justification regarding selection of monitoring methods and locations, the relevance of standards, and compliance with CoAs.	This Monitoring Program was updated in response to the EPA's comments to provide further clarity on the purpose of the program and to provide additional detail on monitoring methods and procedures. A meeting was held with the EPA on 24/09/2021 to close out the comments.
NSW Health	Due to current pandemic conditions, NSW Health was unable to provide resources for consultation at this time.	CGU commits to consulting with NSW Health (and updating the monitoring program if required) when resources become available.

This Monitoring Program has been updated to address the matters raised during consultation.

Community feedback and complaints relating to air quality will be managed in accordance with the Air Quality and Odour CEMP Sub-Plan and Communications Strategy.

2. Air quality

2.1. Existing environment

An assessment of the air quality environment was undertaken as part of the Environmental Impact Statement (EIS) which characterised the existing environment based on the following key criteria:

- **Particulate matter:**
  - **PM_{10}:** background concentrations of PM_{10} (as an annual average) were below the current air quality guidelines. However, there were exceedances of the 24-hour average criterion, most notably in warm and dry periods;
  - **$PM_{2.5}$:** Long term measurement of $PM_{2.5}$ concentrations has only occurred at three OEH stations (Chullora, Earlwood and Liverpool). There were a number of exceedances noted of the 24-hour average criterion of 25 micrograms per cubic metre;
- **Carbon monoxide:** background concentrations of carbon monoxide in air (as one-hour and eight-hour averages) were below the current air quality guidelines;
- **Nitrogen dioxide:** background concentrations of nitrogen dioxide in air (as one-hour and annual averages) were below the current air quality guidelines at background and roadside monitoring stations; and
- **Air toxics:** Several measurement campaigns have been undertaken to determine the levels of air toxics around Sydney. All campaigns have found the concentrations of air toxics remain low and under the respective Air Toxic NEPM investigation levels.

The EIS identified that the main air quality risks during construction would be annoyance due to dust soiling, an increase in exposure to particulate matter for the nearest sensitive receivers, and harm to ecological receptors from particulate matter. The EIS stated that construction dust (i.e. particulate matter) is unlikely to present a serious ongoing problem and identified that any predicted effects would be temporary and relatively short-lived. Nearby sensitive receivers that have potential to be impacted by construction of the Project are shown in Figure 1. This Monitoring Program has been developed to collect real time measurements related to the identified risk (particulate matter impacting nearby and adjacent sensitive receivers), to enable proactive and reactive management responses to the identified risks.

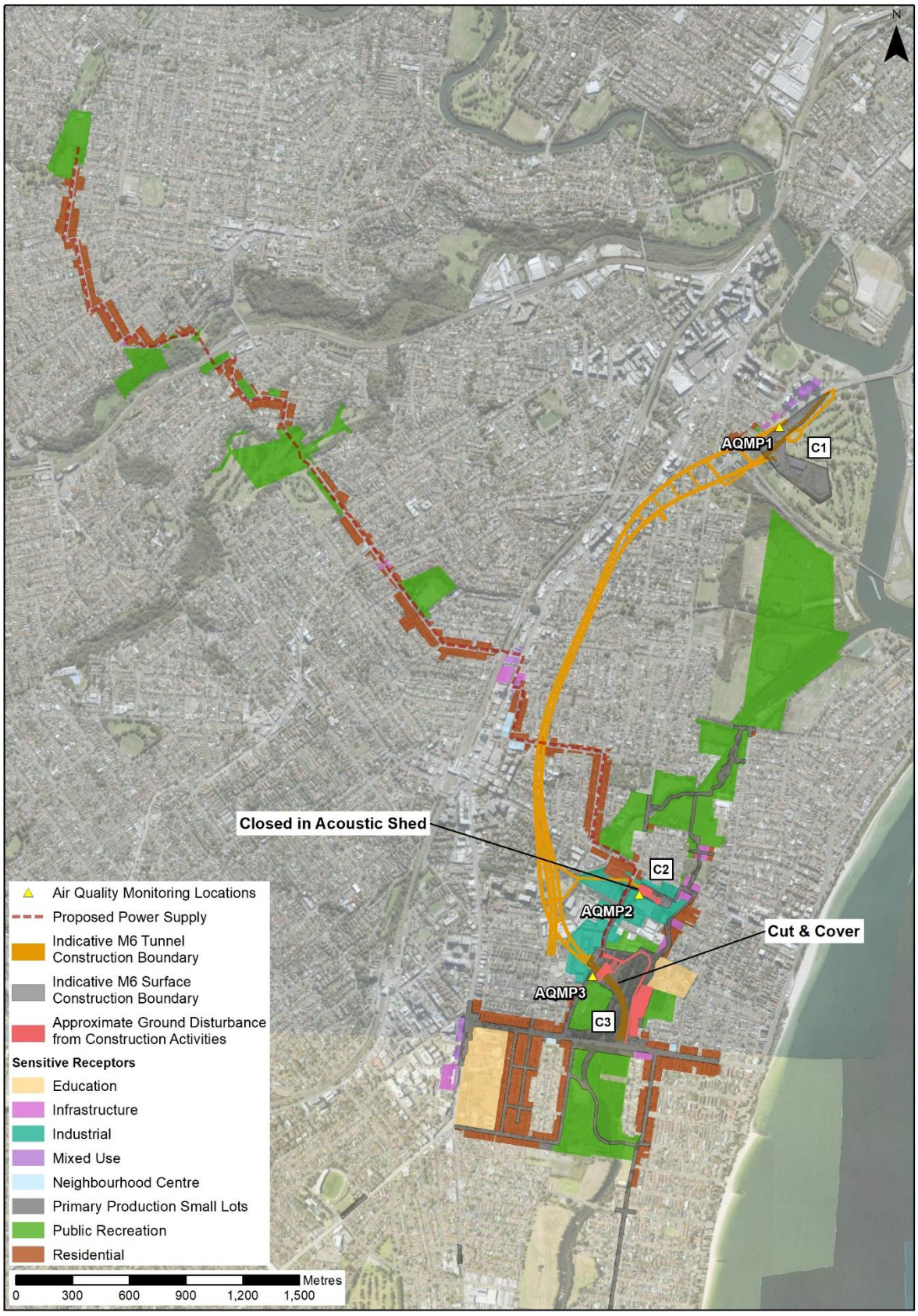


Figure 1: Nearby sensitive receivers

2.2. Monitoring and Inspections

Table 9-2 of the Air Quality Technical Report (Appendix E to the EIS) identifies that to monitor air quality impacts from construction, regular site inspections would be required to assess construction activities and asses potential air quality issues (e.g. dust and odour) as they arise. In addition, dust monitoring should be implemented to detect potential impacts to nearby sensitive receivers.

An environmental inspection regime has been developed and is described in the Air Quality and Odour CEMP Sub-plan (Section 7.3). Inspections will include daily site inspections by Site Supervisors, and weekly site inspection by environmental personnel during construction as a minimum. The frequency of these inspections may be increased to reflect the risk associated with potential impacts during adverse weather conditions or during specific construction activities. Inspections items that are specific to identifying potential air quality issues include:

- Visible sources of dust;
- Visible dust emissions;
- Implementation and effectiveness of all dust controls;
- No continuous visible vehicle/plant/equipment emissions for longer than 10 seconds as per the POEO Clean Air Regulation;
- Haul road integrity (clean, no potholes etc)
- No mud tracking off-site; check main exit/entry points and material on public roads;
- No detectable offensive odours or gases (e.g. inspection of potential odour sources including freshly disturbed areas, open stockpiles, water treatment plants, waste skips, etc); and
- That installed air quality monitoring devices are un-damaged and appear operational.

Environmental inspections will be managed in accordance with the CEMP, noting that the detection of any general construction related odours will be managed by implementing the TARP in this Monitoring Program (Section 3.2.1).

This Monitoring Program has been developed primarily to describe the monitoring of particulate matter in the immediate vicinity of construction sites. This program describes the monitoring required to assess the potential impacts to air quality during construction of the Project. The Monitoring Program is targeted to detect the emission of dust and particulate matter (PM_{10} and $PM_{2.5}$) that can impact the adjacent sensitive receivers including ecological receptors.

3. Monitoring Methods

3.1. Fixed location monitoring

Particulate matter (PM_{10} and/or $PM_{2.5}$) will be monitored continuously at fixed locations at the boundary of the main construction ancillary facilities C1, C2 and C3. Data will be collected using a single-channel, light-scattering laser photometer used in real-time for aerosol mass readings (e.g. SiteHive or similar). The monitoring device will use a sheath air system that isolates the aerosol in the optics chamber to keep the optics clean for reliability.

A fourth semi-mobile monitoring station will be allocated for minor construction ancillary facilities including C4, C5 and C6. This station will also be used along the roads and active transport corridor as works progress. Indicative locations of all monitoring points are mapped in Appendix A and coordinates are included in Table 2.

Table 2: Indicative coordinates of fixed monitoring stations

Fixed monitoring location ID	Easting	Northing
Fixed Monitor C1	329552	6243384
Fixed Monitor C2	328912	6240907
Fixed Monitor C3	328786	6240196
Semi-mobile Monitor C4 – C6	To be deployed along road and ATC alignment	

The indicative locations of these fixed monitoring devices were selected based on the risk of construction dust impacts as assessed during the EIS. Locations for the measurement of particulate matter were selected at the boundary of the construction ancillary facilities and focused at specific points that would be more likely to be associated with air quality risks (e.g. near haul roads where vehicle movements can raise particulate matter) and/or adjacent to where sensitive receivers listed with a medium or high sensitivity are located close to the construction boundary.

Where possible, monitoring devices would be sited in consideration of the factors described in AS/NZS 3580.1.1 (Methods for sampling and analysis of ambient air – guide to siting air monitoring equipment. Other constraints (security, access to power/communications and proximity to structure including trees) may also impact actual location. As such, the actual location for the monitoring devices may vary from the indicative locations (+/- 50metres) due to these additional considerations for installation.

3.2. Activities-based monitoring

In addition to the fixed location monitoring at construction boundaries, activities-based monitoring of air quality will also be undertaken at sensitive receivers and/or designated locations. Particulate matter (PM_{10} and/or $PM_{2.5}$) will be monitored using a hand-held device. Data will be collected using a light-scattering laser photometer used in real-time for aerosol mass readings (e.g. using a TSI DustTrak 8532 or similar). The mobile device will be used for regular, attended monitoring of PM_{10} (or $PM_{2.5}$) over a fixed period (e.g.15-minutes). Activity-based monitoring will generally be conducted at the nearest downwind sensitive receiver on a monthly basis, during applicable works (construction works with potential air quality impacts).

This type of monitoring enables flexible and responsive monitoring options to assess risks and impacts on both a regular basis (e.g. monthly at nearest downwind sensitive receiver) and in response to events (e.g. adverse weather, a complaint or detection of exceedances at fixed locations). By assessing the same parameter as the fixed location monitoring devices using a comparable technique, direct data comparison will be possible and may aide in data analysis and risk assessment. Monitoring will also be undertaken at least once per month in close proximity to fixed monitoring devices to confirm consistency of data. Maps of monitoring locations are included in Appendix B and coordinates of each location are included in Table 3.

Table 3: Activities Based Monitoring Locations

Activities based monitoring location ID	Activity	Location Description and Receiver Type	Easting	Northing
ARC01_A	C1 Entry and exit to compound	Marsh Street Residential Receiver	329473	6243396
ARC04_A	C4&C5 ATC works	McIntyre Avenue Residential Receiver	329371	6241596
ARC05_A	C4&C5, ATC works	Bruce Street Residential Receiver	329050	6241169
ARC07_A	C2 Entry and exit	West Botany Road Residential Receiver	328767	6240969
ARC07_B	C4&C5 ATC works	Bay Street Residential Receiver	329082	6240938
ARC08_A	C3 Haul road, C4&C5 ATC works	End of Kings Road Residential Receiver	328964	6240603
ARC09_A	C3 Haul road stockpile area C4&C5 ATC works	Brighton-le-Sands Public School Other Sensitive Receiver	328897	6240415
ARC11_A	C3 Bulk excavation from surface and spoil haulage	French Street Residential Receiver	328486	6240417
ARC12_A	C6 Princes Highway intersection works	Gladstone Street Residential Receiver	327861	6240305
ARC14_A	C3 President Avenue roadworks	President Avenue Residential Receiver	328180	6240174
ARC15_A	C4&C5 ATC works	Annette Avenue Residential Receiver	328409	6239950
ARC16_A	C3 Cut and cover haul road & stockpile area, C4&C5 ATC works	O'Neill Street Residential Receiver	328777	6240078
ARC17_A	C3 President Avenue road works C4&C5 ATC works	Colson Crescent Residential Receiver	328757	6239902

3.3. Odour monitoring

Odour surveys are an effective tool for evaluating odour risk and the effectiveness of mitigation and management. Inspections and assessment of odour sources are described in the Air Quality and Odour CEMP Sub-plan (Section 7.3). If odours are detected from general construction activities at the site boundary during inspections, management actions will be implemented in accordance with the Trigger Action Response Plan (Section 3.2.1). It is noted that several plans and monitoring programs interface with odour management and while odour related to general construction activities will be addressed in accordance with this Monitoring Program, it is noted that:

- Odour arising from remediation would be managed in accordance with the applicable Remediation Action Plan/s
- Odour arising from bulk excavation of acid sulfate soils would be managed in accordance with the Acid Sulfate Soil Management Plan
- Odour arising from excavation at Bicentennial Park would be managed in accordance with the Leachate and Landfill Gas CEMP Sub-plan and Monitoring Program

3.4. Air Quality Goals

Project air quality goals for fixed monitoring locations and activities-based monitoring were adopted from the 24-hour National Environment Protection Council (NEPC) standards. This provides a conservative approach and adherence to these goals over shorter periods of measurement will accomplish compliance with these standards. The recommended air quality standards for PM_{10} and $PM_{2.5}$ are 50 µg/m3 and 25 µg/m3 respectively over a 24-hour exposure period and these have been adopted for use over shorter averaging periods (Table 4).

Table 4: Air quality goals for monitoring program

Monitoring type	PM_{10} µm diameter	$PM_{2.5}$ µm diameter	Averaging Period
Fixed location monitoring	50 µg/m3	25 µg/m3	1 hour
Activities based monitoring	50 µg/m3	25 µg/m3	15 minute
Monitoring conducted in response to complaints or as directed by EPA	50 µg/m3	25 µg/m3	15 minute

If an exceedance is identified, a management response will be triggered. Details of management responses are detailed in Section 4.2. It is noted that criteria for PM_{10} and $PM_{2.5}$ will likely be exceeded when there is no impact from construction (based on the existing environment described in the EIS). The $PM_{2.5}$ criteria is particularly sensitive to temporal fluctuations and will likely be exceeded frequently. An emphasis will be placed on the management of PM_{10} exceedances and criteria will be reviewed at 6-monthly intervals with details of reviews provided in each monitoring report (Section 4.4). As the proposed monitoring method uses established air quality goals, a seperate baseline data collection period is not required to establish triggers.

3.5. Monitoring frequency and data collection

Monitoring data from fixed location and semi-mobile monitoring devices will be collected and logged in real-time and supplemented with rolling and cumulative averages. Graphical reporting along with visual representation of trigger/response values, with automated alarm process will enable efficient and effective data interrogation (including trend analysis) and enable timely proactive and reactive management to occur.

Monitoring data from activities-based monitoring devices will be recorded for the monitoring period and analysed immediately in the field, prior to upload to the monitoring register (also noting meteorological parameters such as up-wind/down-wind). Activities-based monitoring will be undertaken at the commencement of new activities, then monthly in air receiver catchments at the closest accessible down-wind sensitive receiver. Monitoring will only take place during activities which are identified as having the potential to impact air quality (e.g. earthworks). These activities are outlined in Section 5.1 of the Air Quality and Odour CEMP Sub-plan. Activities-based monitoring for the Permanent Power Supply and Active Transport Corridor will occur at the nearest accessible down-wind sensitive receiver along the alignment once per month during earthworks.

Table 5: Monitoring frequency and method

Type of monitoring	Frequency	Equipment[3]
Fixed location monitoring	Continuous	Fixed location device (e.g. SiteHive Hexanode)
Activities based monitoring	Monthly	Handheld / mobile device (e.g. TSI DustTrak 8532)
Other monitoring	As required in response to adverse weather events, other detections, complaints or as directed by EPA	Handheld / mobile device (e.g. TSI DustTrak 8532)

[1]Fixed location monitoring will be located at C1, C2 and C3. A semi-mobile "fixed location" monitoring device will be deployed along the C4, C5 and C6 work areas as required.
[2]All monitoring will be completed in accordance with the instructions provided for a particular device as per the Original Equipment Manufacturer (OEM).

3.6. Quality assurance and documentation

The use of fixed location, real time monitoring systems supplemented with activities-based monitoring provides accurate data appropriate for construction air quality monitoring purposes. The systems will be operated in compliance with the manufacturer's manual, including siting, use, maintenance and calibration. The Environmental and Sustainability Manager will be responsible for procuring appropriate equipment, maintenance and calibration services. All personnel participating in measurement, data analysis or field maintenance activities will be trained in the use of equipment and appropriate data handling techniques.

QA/QC maintenance and calibration will be undertaken in accordance with manufacturers guidelines. As a minimum, equipment will be maintained at calibrated by approved facilities at least annually. Field maintenance will be performed by trained project personnel and at minimum will include zero calibration of handheld devices before each use. Trained personnel will also schedule and complete monthly comparative checks with each fixed unit (i.e. using a handheld monitor in proximity to fixed devices) to assess data. All monitoring devices will be subject to quality assurance protocols as per OEM and calibration records will be maintained in accordance with the appropriate standards.

4. Compliance management

4.1. Roles, responsibility and training

The CGU Project team's organisational structure and overall roles and responsibilities are outlined in Section 3.4 of the CEMP. Specific responsibilities for the implementation of environmental controls for Air Quality are detailed in the Air Quality and Odour CEMP Sub-plan.

All personnel working on site will undergo site induction and targeted training relating to air quality management issues, detailed in the AQOMP. All personnel involved in the implementation of this Monitoring Program will receive training in the correct use of the equipment, including field maintenance, use, storage and data analysis. The Environmental and Sustainability Manager is responsible for training and keeping records of trained staff.

4.2. Data analysis and management response

Results obtained during the Monitoring Program will be compared against the values listed in Table 4. If an exceedance is identified, a management review and response will be triggered.

The review will assess:

- Data related to the exceedance, monitoring location and other project data (trending, rolling averages, nearby monitoring locations);
- Regional air quality data (from BoM and EPA air quality stations nearby)
- Additional air quality data where available (e.g. M8 Ambient Air Monitoring Stations)
- Recent meteorological data;
- Project activities including works and Environmental Management Controls (Table 10 of Air Quality and Odour CEMP Sub-plan) in place at the time.
- Other (non-project) activities that may influence monitoring results (unrelated works or events such as fires)

If the exceedance is determined to be attributable to Project works, the event will be treated as an environmental incident and managed in accordance with the requirements of the CEMP (section 3.8 and Appendix A7), and corrective and preventative actions will be identified and implemented.

4.2.1. Trigger Action Response Plan

A Trigger Action Response Plan (TARP) has been developed for implementation with this Monitoring Program and is detailed in Table 6. If any monitoring criteria are exceeded, the Environmental and Sustainability Manager will be informed and supervise the implementation of the TARP.

Table 6 Trigger Action Response Plan

	Category	Level	Actions
Triggers	**$PM_{2.5}$**	Within goal of 25 µg/m3	Inspections and monitoring to continue as scheduled
		Exceeds 25 µg/m3	Immediately conduct PM10 monitoring at the location and confirm exceedance. If PM10 monitoring is compliant, note exceedance of PM2.5 and schedule additional monitoring within 1 week. If PM10 monitoring exceeds goals, complete data analysis and review and identify possible contributing factors by: ▪ Targeted inspection of construction activities that are potentially responsible ▪ Increased monitoring (e.g. supplement data with additional activities-based or mobile monitoring). ▪ Review implementation of management control measures If the exceedance is likely to be attributable to Project Activities, report and manage the exceedance as an incident or non-conformance as per CEMP Section 3.8, including notifications and appropriate response management.
	PM_{10}	Within goal of 50 µg/m3	Inspections and monitoring to continue as scheduled
		Exceeds 50 µg/m3	Complete data analysis and review and identify possible contributing factors by: ▪ Targeted inspection of construction activities that are potentially responsible ▪ Increase monitoring (e.g. supplement data with additional activities based or mobile monitoring). ▪ Review implementation of management measures If the exceedance is likely to be attributable to Project Activities, report and manage the exceedance as an incident or non-conformance as per CEMP Section 3.8, including notifications and appropriate response management.
	Odour	Odour detection at site boundary during inspection	Identify possible source. Establish if odour is related to construction activities: ▪ Refer to Leachate and Landfill Gas Monitoring Program where applicable. ▪ Refer to Remediation Action Plans where applicable. ▪ Refer to the Acid Sulfate Soil Management Plan (Appendix C of Soil and Surface Water CEMP Sub-plan) where applicable. Review mitigation measures in place and assess implementation. Assess further controls that can be implemented, this may include: ▪ Use of deodorisers ▪ Remove and/or cover odorous materials If an offensive odour is present and is likely to be attributable to Project Activities, report and manage the exceedance as an incident or non-conformance as per CEMP Section 3.8, including notifications and appropriate response management.

4.3. Compliance and Auditing

Auditing of this Monitoring Program (both internal and external) will be undertaken to assess the effectiveness of the Monitoring Program including implementation, management responses to exceedances and reporting. Compliance and auditing requirements are detailed in the CEMP (Section 3.9). If a non-compliance and/or a non-conformance is identified, the process outlined in Section 3.10 of the CEMP will be followed.

4.4. Reporting

During construction, air quality monitoring data will be collected and assessed against the criterion identified in Table 4. An Air Quality Monitoring Report will be submitted to DPIE within 60 days of the end of the reporting period unless otherwise agreed with DPIE and will be made publicly available. Reporting of construction air quality data will also be completed in accordance with the requirements of the EPL.

Reporting requirements associated with the Program for the construction phase of the Project are presented in Table 7.

Table 7: Construction Air Quality Reporting Requirements

Report	Frequency	Content	When	Reporting Authority
Air Quality Monitoring Report	Six monthly	▪ Data summary tables from monitoring undertaken in reporting period ▪ Exceedances ▪ Management responses to any exceedances which may have occurred during reporting period	Within 60 days of end of reporting period	DPIE
Pollution monitoring data	Monthly	▪ Monitoring data that is required to be collected by an EPL condition	Published monthly	EPA

5. Review and improvement

5.1. Continual improvement

The implementation of this Monitoring Program will be audited and reviewed throughout the construction period for the purposes of continual improvement. Section 3.2.2 of the CEMP describes the process for the continual improvement of Project documents.

Continual improvement of this Program will be achieved by the ongoing evaluation of environmental management performance against environmental policies, objectives and targets and Project performance outcomes of the EIS.

The continual improvement process is intended to:

- Identify areas of opportunity for improvement of environmental management and performance;
- Determine the cause or causes of non-conformances and deficiencies;
- Develop and implement a Program of corrective and preventative action to address any non-conformances and deficiencies (refer to Section 3.10 of the CEMP);
- Verify the effectiveness of the corrective and preventative actions;
- Document any changes in procedures resulting from process improvement; and
- Make comparisons with objectives and targets.

6. References

- National Environment Protection Councils (NEPC) – National Environment Protection Measure (NEPM) for Ambient Air Quality Guidelines
- AS 3580.1.1-2007 Methods of Sampling Analysis of Ambient Air. Part 1.1 Guide to Siting Air Monitoring Equipment
- AS 3580.10.1-2003 Methods of Sampling Analysis of Ambient Air. Determination of Particulate Matter – Deposited Matter - Gravimetric Method

Appendix A Map of Fixed Monitoring Stations

▲ Air Quality Monitoring Station

N
W E
S

0 50 100 150 200 Metres

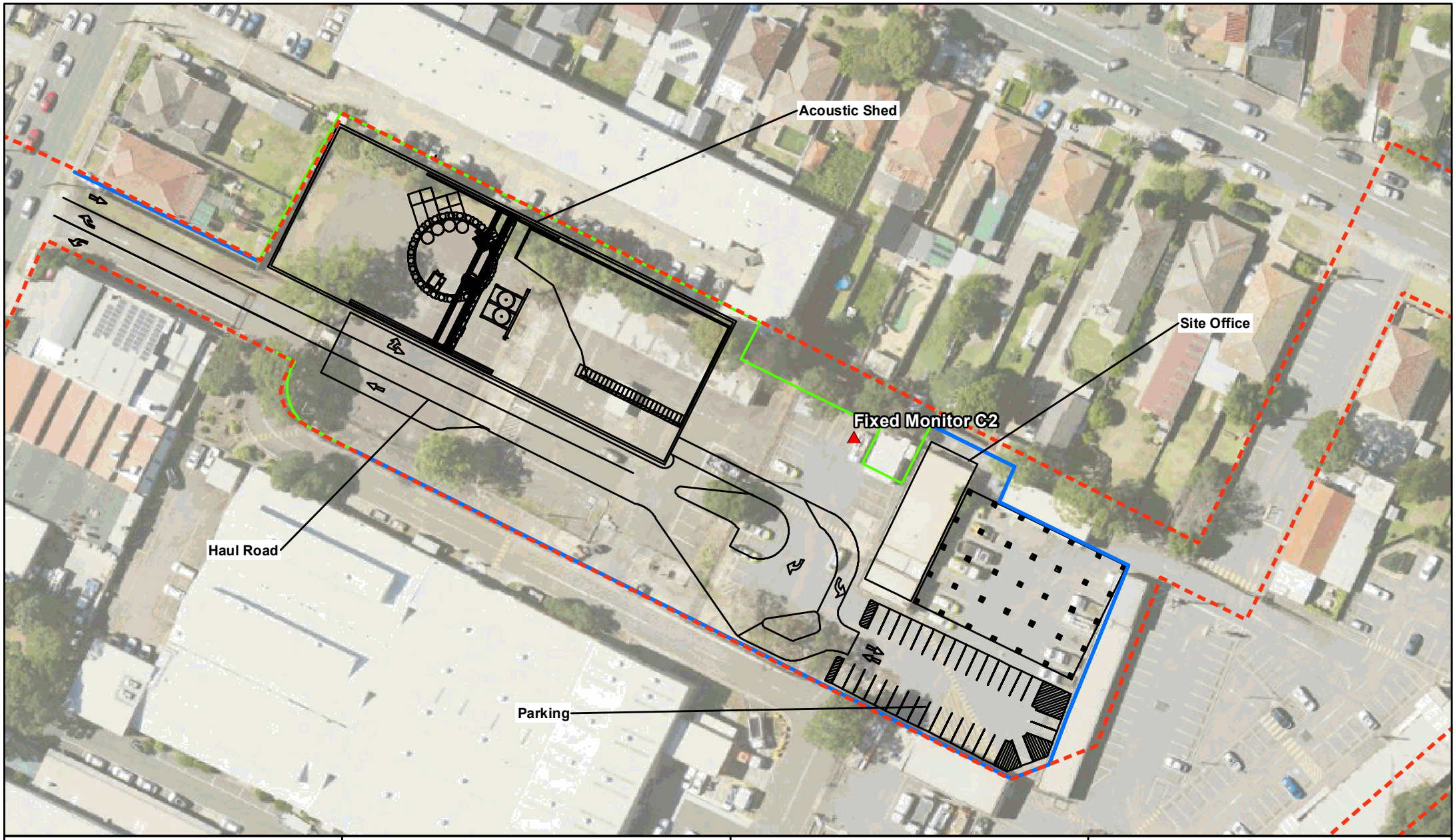
CPB CONTRACTORS | Ghella 3 Generations of Tunnellers | UGL

Original Size	A4	Drawn	GIS
Coordinate System	MGA Zone 56	Designed	MM
Height Datum	AHD	Date Printed	7/07/2021
Filename	Air Quality Monitoring - Arncliffe.mxd		

Fixed Air Quality Monitoring Station

Arncliffe

Project Number



Air Quality Monitoring Station
Construction Boundary
Hoarding - 3m
Noise Wall - 5m

N
W
E
S
0 10 20 30 40 50 Metres

CPB CONTRACTORS | Ghella | UGL

Original Size	A4	Drawn	GIS
Coordinate System	MGA Zone 56	Designed	MM
Height Datum	AHD	Date Printed	6/07/2021
Filename	Air Quality Monitoring - Rockdale Depot.mxd		

Air Quality Monitoring

Rockdale Depot

Project Number

Air Quality Monitoring Station
Construction Boundary
C&C
Open

N
W
E
S
0 20 40 60 80 100 Metres

CPB CONTRACTORS | Ghella 3 Generations of Tunnellers | UGL

Original Size	A4	Drawn	GIS
Coordinate System	MGA Zone 56	Designed	MM
Height Datum	AHD	Date Printed	4/08/2021
Filename	Air Quality Monitoring - Bicentennial Park.mxd		

Air Quality Monitoring

Bicentennial Park

Project Number

ATC Boundary

N
W E
S

0 200 400 600 800 Metres

CPB CONTRACTORS | Ghella 3 Generations of Tunnellers | UGL

Original Size	A4	Drawn	GIS
Coordinate System	MGA Zone 56	Designed	MM
Height Datum	AHD	Date Printed	7/07/2021
Filename	Air Quality Monitoring - ATC.mxd		

Semi Mobile Air Quality Monitoring Station

Active Transport Corridor

Project Number

Princes Hwy / Presidents Ave / Local Roads Boundary

N
W E
S

0 100 200 300 Metres

CPB CONTRACTORS | Ghella 3 Generations of Tunnellers | UGL

Original Size	A4	Drawn	GIS
Coordinate System	MGA Zone 56	Designed	MM
Height Datum	AHD	Date Printed	7/07/2021
Filename	Air Quality Monitoring - Presidents Ave.mxd		

Semi Mobile Air Quality Monitoring Station

Princes Hwy / Presidents Ave / Local Roads

Project Number

Appendix B Map of Activities Based Monitoring Locations