Appendix B6

Construction Air Quality Management Plan

The Northern Road Upgrade –
Mersey Road, Bringelly to Glenmore Parkway, Glenmore Park

August 2018

NSW GOVERNMENT

Document control

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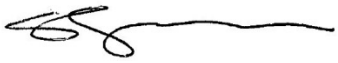		
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2		

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Glossary/ Abbreviations

Term	Expanded text
AFMP	Ancillary Facilities Management Plan
AQI	Air quality index
AWS	Automatic Weather Station
BoM	Bureau of Meteorology
CAQMP	Construction Air Quality Management Plan
CCS	Community Communication Strategy
CEMP	Construction Environmental Management Plan
CFFMP	Construction Flora and Fauna Management Plan
CO	Carbon monoxide
CoA	Condition of approval
Compliance audit	Verification of how implementation is proceeding with respect to an OACEMP (which incorporates the relevant approval conditions)
CSSI	Critical State Significant Infrastructure
CSWMP	Construction Soil and Water Management Plan
CTMP	Construction Traffic Management Plan
DEC	Department of Environment and Conservation (NSW) (former)
DECC	Department of Environment and Climate Change (NSW) (former)
DEOH	Defence Establishment Orchard Hills
DoEE	Commonwealth Department of the Environment and Energy
DP&E	NSW Department of Planning and Environment
DPI	NSW Department of Primary Industries
EIS	Environmental Impact Statement
EMS	Environmental management system
Environmental aspect	Defined by AS/NZS ISO 14001:2015 as an element of an organisation's activities, products or services that can interact with the environment
Environmental impact	Defined by AS/NZS ISO 14001:2015 as any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organisation's environmental aspects
Environmental incident	An unexpected event that has, or has the potential to, cause harm to the environment and requires some action to minimise the impact or restore the environment
Environmental objective	Defined by AS/NZS ISO 14001:2015 as an overall environmental goal, consistent with the environmental policy, that an organisation sets itself to achieve
Environmental Representative (ER)	A suitably qualified and experienced person independent of project design and Construction personnel employed for the duration of Construction. The principal point of advice in relation to all questions and complaints concerning environmental performance

Term	Expanded text
Environmental target	Defined by AS/NZS ISO 14001:2015 as a detailed performance requirement, applicable to the organisation or parts thereof, that arises from the environmental objectives and that needs to be set and met in order to achieve those objectives
EPA	NSW Environment Protection Authority
EP&A Act	*NSW Environmental Planning and Assessment Act 1979*
EPBC Act	*Commonwealth Environmental Protection and Biodiversity Conservation Act 1999*
EPL	NSW Environment Protection Licence under the *Protection of the Environment Operations Act 1997*
ERG	Environmental Review Group
EWMS	Environmental Work Method Statements
Federal-CoA	Condition of the Federal Department of the Environment and Energy Approval Decision
Hold Point	A point beyond which a work process must not proceed without express written authorisation from Roads and Maritime
MP	Monitoring Program
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
Non-compliance	Failure to comply with the requirements of the Project approval or any applicable licence, permit or legal requirements
Non-conformance	Failure to conform to the requirements of Project system documentation including this OACEMP or supporting documentation
NO_2	Nitrogen dioxide
NSW-CoA	Condition of the NSW DP&E Infrastructure Approval
NSW Infrastructure Approval	The infrastructure approval for the Northern Road Upgrade issued by the New South Wales Government on 30 May 2018
OACEMP	Overarching Construction Environmental Management Plan
OEH	NSW Office of Environment and Heritage
PM_{10}	Particulate matter 10 micrometres or less in diameter
$PM_{2.5}$	Particulate matter 2.5 micrometres or less in diameter
POEO Act	*Protection of Environment Operations Act 1997*
Project, the	The Northern Road Upgrade – Mersey Road, Bringelly to Glenmore Parkway, Glenmore Park
REMM	Revised Environmental Management Measure as provided in the Final EIS / SPIR
Roads and Maritime, RMS	NSW Roads and Maritime Services
SEARs	Secretary's Environmental Assessment Requirements
Secretary	Secretary of the NSW Department of Planning and Environment, or delegate
SPIR	Submissions and Preferred Infrastructure Report

Term	Expanded text
TNR	The Northern Road
TSP	Total suspended solids
VOC	Volatile organic compound

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1 Introduction

1.1 Context

This Construction Air Quality Management Plan (CAQMP) forms part of the overarching Construction Environmental Management Plan (OACEMP) for The Northern Road Upgrade – Mersey Road, Bringelly to Glenmore Parkway, Glenmore Park (the Project).

This CAQMP has been prepared to address the requirements of:

- the NSW Minister's Infrastructure Approval dated 30 May 2018 and Federal Minister for the Environment and Energy's Approval dated 25 June 2018
- the environmental management measures listed in T*he Northern Road Upgrade – Mersey Road, Bringelly to Glenmore Parkway, Glenmore Park NSW Environmental Impact Statement / Commonwealth Draft Environmental Impact Statement* (EIS) (prepared by Jacobs for Roads and Maritime, 2017) as amended by *The Northern Road Upgrade – Mersey Road, Bringelly to Glenmore Parkway, Glenmore Park Submissions and Preferred Infrastructure Report* (SPIR) (prepared by Jacobs for Roads and Maritime, 2017)
- Environment Protection Licence (EPL) conditions
- Roads and Maritime specifications
- all applicable legislation.

Construction of the Project will be undertaken in three stages:

- Stage 4 - Mersey Road, Bringelly, to Eaton Road, Luddenham
- Stage 5 - Littlefields Road, Luddenham, to Glenmore Parkway, Glenmore Park
- Stage 6 - Littlefields Road, Luddenham to Eaton Road, Luddenham.

An overview of the Project, including the extent of the Project stages, is shown on Figure 1-1 and Figure 1-2.

Each stage will be delivered in a separate Construction package that will include all activities needed to complete the stage. Details of the proposed Project staging, including Construction activities and submission of corresponding environmental plans, strategies and protocols, is documented in the Project Staging Report.

The Construction Contractors will develop stage-specific environmental management documentation to address the operational control requirements outlined in the OACEMP that apply to the stages that they are delivering. Stage-specific CAQMPs will be updated, tailored and finalised by the Contractors. Roads and Maritime will review the Contractors' CAQMPs for compliance with the approved OACEMP.

It should be noted that the CAQMP is also referred to in the Project environmental documents as the Air Quality Management Plan. A full list of alternative and interchangeable sub-plan names is included in Appendix A5 of the OACEMP.

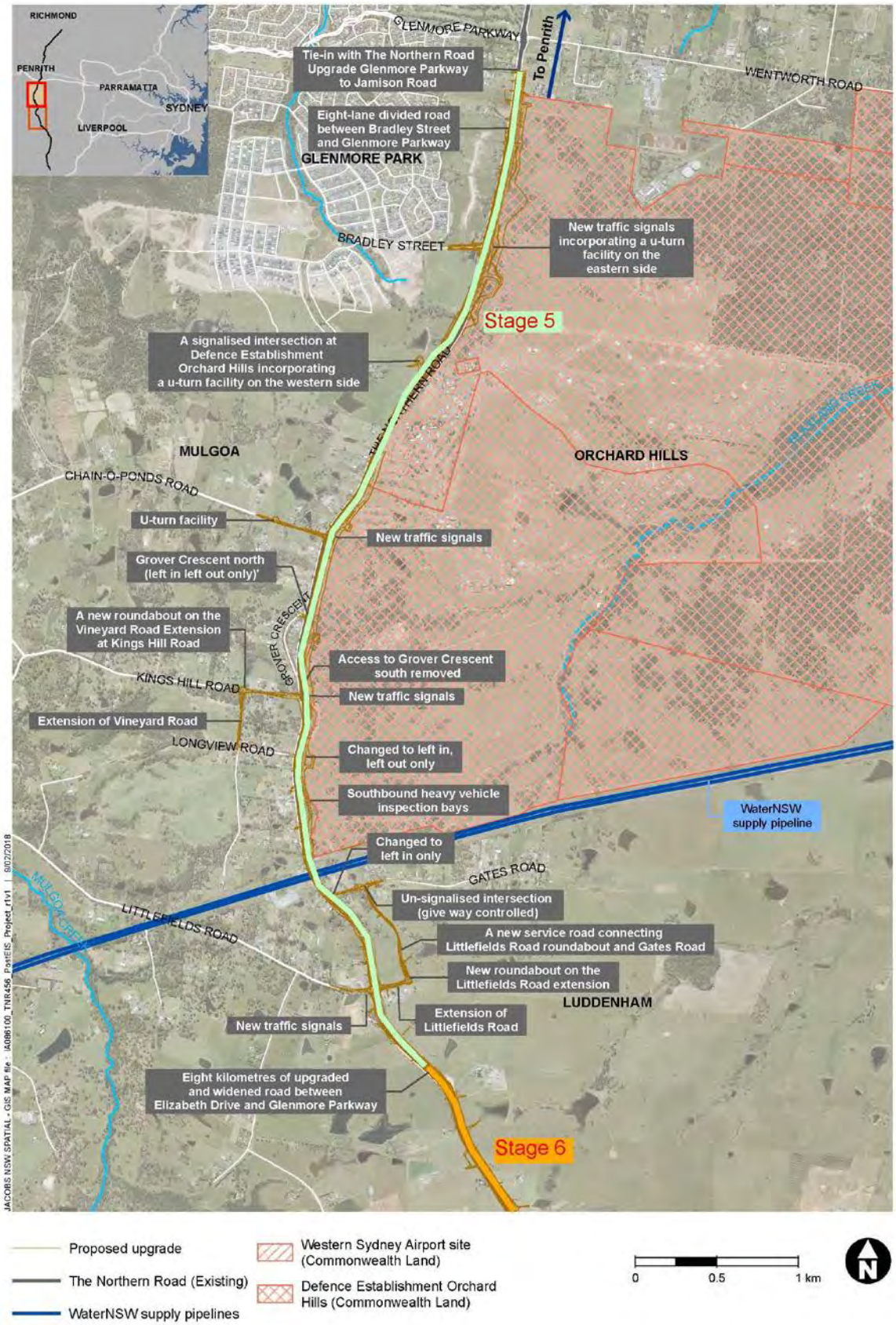

Figure 1-1: Overview of the Project (northern section)

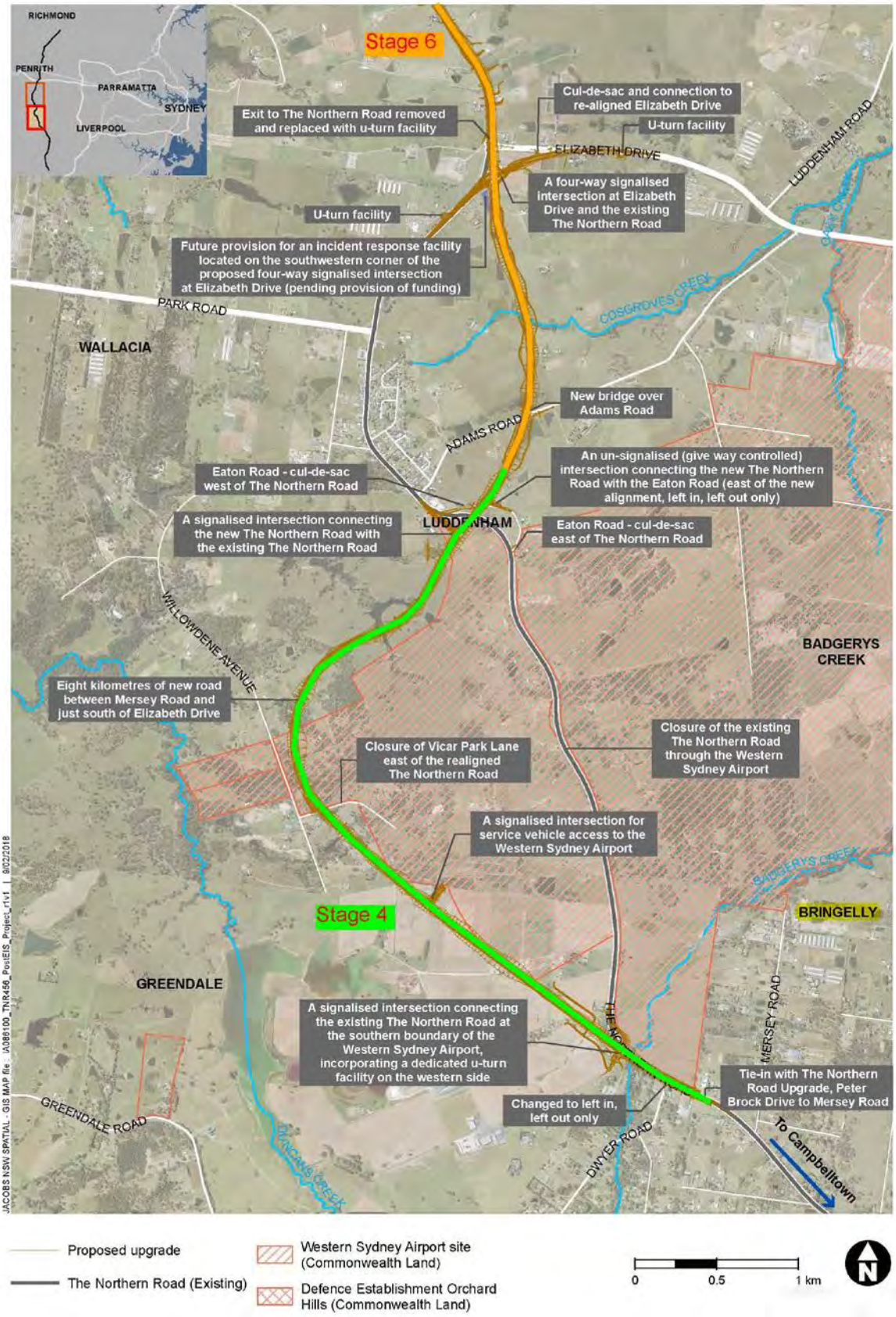

Figure 1-2: Overview of the Project (southern section)

1.2 Background

The EIS assessed the potential air quality impacts from Construction of the Project.

As part of EIS development, a detailed air quality assessment was prepared to address the Secretary's Environmental Assessment Requirements (SEARs) issued by the NSW Department of Planning and Environment (DP&E) and the Commonwealth EIS Guidelines issued by the Federal Department of the Environment and Energy (DoEE). The air quality assessment was included in the EIS as Appendix P.

Revised environmental management measures (REMMs) were provided within the SPIR. Where applicable, the REMMs from the SPIR have been included in this CAQMP.

1.3 Environmental management system overview

The overarching Environmental Management System (EMS) for the Project is described in Section 3 of the OACEMP. The Contractors delivering the Project will have certified EMSs consistent with the overarching EMS described in the OACEMP. The Contractors will develop stage-specific CAQMPs in accordance with the OACEMP and their EMS.

This overarching CAQMP forms part of the environmental management framework for the Project, as described in Section 3.3 of the OACEMP.

The Contractors will be required to develop, as part of their stage-specific CAQMPs, a detailed Construction Air Quality Monitoring Program to address specific requirements of the conditions of approval and REMMs identified in this overarching CAQMP. An overarching Construction Air Quality Monitoring Program is provided in Annexure A of this CAQMP.

The Contractors will, if necessary, tailor and update the overarching Monitoring Program in Annexure A with stage-specific information and include the updated Monitoring Program in their CAQMPs. Where appropriate, the Contractors may provide Roads and Maritime with an alternative equivalent Construction Air Quality Monitoring Program that meets the requirements identified in this CAQMP and relevant Roads and Maritime specifications. Roads and Maritime will review the Contractor's Monitoring Program to confirm compliance with the requirements of this CAQMP and specifications.

Management measures identified in this CAQMP may be incorporated into site or activity specific Environmental Work Method Statements (EWMS). EWMS incorporate appropriate mitigation measures and controls and identify key procedures to be used concurrently with the EWMS. A template EWMS for use by the Contractors is provided in Appendix A9 of the OACEMP.

EWMS will be prepared by the Contractor Environmental Site Representatives and reviewed by the Roads and Maritime Environmental Manager (or delegate) and the independent Environmental Representative (ER) prior to the commencement of the Construction activities to which they apply. Construction personnel undertaking a task governed by an EWMS will undertake the activity in accordance with the mitigation and management measures identified in the EWMS.

Used together, the OACEMP, sub-plans, strategies, procedures and EWMS form management guides that clearly identify required environmental management actions for reference by Roads and Maritime and its Contractors.

The review and document control processes for this CAQMP are described in Section 6.7 and 6.8 of the OACEMP.

1.3.1 CAQMP preparation, endorsement and approval

This overarching CAQMP has been prepared to satisfy the NSW and Federal conditions of approval (CoA) in relation to air quality management during Construction of the Project. This CAQMP includes a Construction Air Quality Monitoring Program (Annexure A) to satisfy the requirements of NSW-CoA C9(a).

This CAQMP and Construction Air Quality Monitoring Program will be reviewed by the Roads and Maritime Senior Project Manager and the Senior Environment Officer and endorsed by the ER. The Monitoring Program will be submitted to the Secretary of the Department of Planning and Environment (DP&E) for approval in accordance with NSW-CoA C12 no later than one month prior to commencement of Construction of the Project, or as otherwise agreed by the Secretary.

In accordance with NSW-CoA C13, Construction of the Project will not commence prior to approval of the Monitoring Program by the Secretary, and all relevant air quality baseline data for the Project has been collected.

1.4 Consultation

1.4.1 Consultation for preparation of the CAQMP

No consultation under the NSW Minister's Infrastructure Approval was required for the preparation of this CAQMP or the Construction Air Quality Monitoring Program.

1.4.2 Ongoing consultation during Construction

Ongoing consultation between Roads and Maritime and its Contractors, stakeholders, the community and relevant agencies regarding the management of air quality impacts will be undertaken during the Construction of the Project as required. The process for the consultation will be documented in the Community Communication Strategy (CCS).

Consultation requirements under the EIS and SPIR for air quality issues identified in the REMMs are listed in Table 1-1.

Table 1-1: Consultation requirements identified in the EIS and SPIR

REMM	Consultation requirements identified in the EIS and SPIR
AQ-2	Consultation would be carried out consistent with the Community Consultation Framework in relation to air quality near ancillary sites and relevant incident management processes during Construction.
AQ-6	Develop Construction program in consultation with the contractor(s) developing the Western Sydney Airport site. Maintain consultation through the course of both projects to plan activities in a manner which limits potential air quality-related impacts. Wherever possible and practical, co-ordinate activities with a high potential to generate dust so that they do not occur at the same time. Stop activities if dust is observed to be emanating from the airport.

REMM	Consultation requirements identified in the EIS and SPIR
CI-2	Where relevant, consultation would be undertaken with proponents of other nearby developments to increase the overall awareness of project timeframes and impacts.

2 Purpose and objectives

2.1 Purpose

The purpose of this CAQMP is to describe how air quality will be managed and protected during Construction of the Project.

2.2 Objectives

The key objective of this CAQMP is to ensure that air quality impacts are minimised. To achieve this objective, the Contractors will:

- identify sensitive receivers and ensure appropriate environmental controls and procedures are implemented during Construction activities
- ensure appropriate measures are implemented to address the requirements of the conditions of approval outlined in Table 3-1 and the revised environmental management measures detailed in Section 7
- ensure appropriate measures are implemented to comply with all relevant legislation and other requirements as described in Section 3 of this CAQMP.

Refer to Appendix B7 Construction Waste and Energy Management Plan for measures to reduce greenhouse gas emissions during Construction.

2.3 Targets

Targets for the management of air quality impacts during the Project include:

- achieve full compliance with relevant legislative requirements and the conditions of approval
- achieve full compliance with EPL air quality conditions
- minimise and manage potential air quality / dust impacts from the Construction of the Project
- control dust and exhaust emissions of plant and equipment from Construction activities
- minimise adverse impacts on existing air quality
- minimise impacts on, and complaints from, the community or stakeholders
- ensure training on best practice air quality management is provided to all Construction personnel through site inductions
- aim to achieve compliance of mobile non-road diesel plant and equipment with the relevant United States Environmental Protection Agency, European Union standards or approved equivalent emission standards.

3 Environmental requirements

3.1 Relevant legislation and guidelines

3.1.1 Legislation and regulatory requirements

Legislation and regulations relevant to air quality management includes:

- *Environmental Planning and Assessment Act 1979* (EP&A Act)
- *Protection of the Environment Operations Act 1997* (POEO Act)
- *Protection of the Environment Operations (Clean Air) Regulation 2010*
- *Protection of the Environment Operations (General) Regulation 2009, Part 5.4 Air pollution.*

Relevant provisions of the above legislation are identified in the register of legal requirements included in Appendix A1 of the OACEMP.

3.1.2 Guidelines and standards

The main guidelines, specifications and policy documents relevant to this CAQMP, including the Construction Air Quality Monitoring Program provided in Annexure A, include:

- Roads and Maritime QA Specification G1 – Job Specific Requirements for The Northern Road Upgrade
- Roads and Maritime QA Specification G36 – Environmental Protection (Management System)
- Roads and Maritime QA Specification G38 – Soil and Water Management (Soil and Water Management Plan)
- Roads and Maritime QA Specification R272 – Automatic Weather Stations
- National Environment Protection Councils (NEPC) – National Environment Protection Measure (NEPM) for Ambient Air Quality Guidelines
- Australian Standard AS 3580.1.1-2007 Methods of Sampling Analysis of Ambient Air. Part 1.1 Guide to Siting Air Monitoring Equipment
- Australian Standard AS 3580.10.1-2016 Methods of Sampling Analysis of Ambient Air. Determination of Particulate Matter – Deposited Matter - Gravimetric Method
- Approved Methods for Modelling and Assessment of Air Pollutants in NSW (NSW Environment Protection Authority (EPA), 2016)
- Approved Methods for the Sampling and Analysis of Air Pollutants in NSW (Department of Environment and Conservation (DEC), 2006)
- Technical Framework: Assessment and management of odour from stationary sources in NSW (DEC, 2006)
- Managing Urban Stormwater: Soils and Construction, Volume 1 (Landcom, 2004) and Volume 2 (Department of Environment and Climate Change (DECC), 2008) (the “Blue Book”)

- Air Quality Monitoring Criteria for Deposited Dust (DEC Guideline)
- Government Resource Efficiency Policy (NSW Office of Environment and Heritage (OEH), 2014).

Roads and Maritime specifications are a key source of environmental protection management processes relevant to this CAQMP. The specifications set out environmental protection requirements, including Hold Points, which must be complied with by the Construction Contractors during Construction of the Project. A Hold Point is defined as a point beyond which a work process must not proceed without express written authorisation from Roads and Maritime.

3.2 Conditions of approval

This overarching CAQMP provides a consistent approach to address the requirements of both the State and Federal approvals in the one document. The Project is located on both the NSW and Federal (Stages 4 and 5 only) land. However, the NSW Infrastructure Approval conditions apply to both NSW and Federal land within the Project. The Federal approval conditions also apply to both NSW and Federal land within the Project. The extent of Federal land located in the vicinity of the Project is shown on Figure 1-1 and Figure 1-2.

The State (NSW-CoA) and Federal (Federal-CoA) conditions of approval relevant to this CAQMP and their applicability to each stage of the Project are listed in Table 3-1. A cross reference is also included to indicate where the condition is addressed in this CAQMP or other project management documents.

Table 3-1: Conditions of approval relevant to the CAQMP

CoA no.	Condition requirement	Applicability					Reference
		Stage 4		Stage 5		Stage 6	
		Cth	NSW	Cth	NSW	NSW	
Federal conditions of approval							
Federal-CoA 1	The approval holder must undertake the action, including those parts of the action that occur on Commonwealth Land, in accordance with all conditions in the NSW Infrastructure Approval.	✓	✓	✓	✓	✓	This CAQMP
Federal-CoA 11	The person taking the action must maintain accurate records substantiating all activities associated with or relevant to the conditions of approval, including measures taken to implement all management plans required by this approval, and make them available upon request to the DoEE. Such records may be subject to audit by the DoEE or an independent auditor in accordance with section 458 of the EPBC Act, or used to verify compliance with the conditions of approval. Summaries of audits will be posted on the DoEE's website. The results of audits may also be publicised through the general media.	✓	✓	✓	✓	✓	Section 8.9
State conditions of approval							
NSW-CoA C16	Where a relevant **CEMP Sub-plan** exists, the relevant **Construction Monitoring Program** may be incorporated into that **CEMP Sub-plan**.	✓	✓	✓	✓	✓	Annexure A – Construction Air Quality Monitoring Program
NSW-CoA E1	In addition to the performance outcomes, commitments and mitigation measures specified in the documents listed in Condition A1, all reasonably practicable measures must be implemented to minimise the emission of dust and other air pollutants during the Construction and operation of the CSSI.	✓	✓	✓	✓	✓	Section 7

3.3 Environment protection licence

The Project is subject to a number of Environment protection licences (EPLs) for Scheduled Activities for extractive activities and road construction. The EPLs prescribe air quality management requirements that must be complied with. These requirements will be managed by the planned management measures specified in Table 7-1 and the Construction Air Quality Monitoring Program (refer Annexure A).

While the EPLs do not specify threshold air quality criteria for the Project, the EPLs do prescribe air quality management requirements that must be complied with. The EPL conditions relevant to the management of air quality are provided in Table 3-2.

The EPLs also prescribe requirements for complaints handling, reporting and record keeping. These requirements will be implemented in accordance with the incident and complaints reporting outlined in Section 8 and Section 5.3 of the OACEMP.

Table 3-2: EPL requirements relevant to the management of air quality

Ref.	Relevant requirement	Reference
O3	**Dust**	
O3.1	The licensee must ensure that construction work at the premises is carried on by such practicable means as may be necessary to minimise dust emissions on the premises, and implement all feasible and reasonable mitigation measures to minimise the release of dust from the premises.	This CAQMP Section 7 Section 8.5 Annexure A
O3.2	All trucks carrying dry bulk material that enter and leave the premises must: (a) have their loads covered at all times, except during unloading and loading; and (b) prevent spillage of any material from the load that may generate dust during truck unloading and loading events. Note: For the purposes of this Condition, 'load' is defined as material contained within the body/trailer/bin of the truck, and on the gunnels of the truck	Appendix B4 - CSWMP
O4	**Processes and management**	
O4.11	All feasible and reasonable erosion and sediment controls are to be implemented to minimise sediment (including dust) leaving the premises. These controls are to be implemented before any soil disturbance commences and maintained until disturbed areas are stabilised.	Appendix B4 - CSWMP

4 Air quality criteria

Air quality criteria are used to access the potential for ambient air quality to give rise to adverse health or nuisance effects. Emissions from construction equipment and vehicles have the potential to impact on local air quality. Construction activities will also generate dust and other particulate matter.

The Contractors will monitor deposited dust. The acceptable increment in annual average dust deposition depends on the existing deposition level. Table 4-1 details the air quality monitoring criteria for deposited dust for the Project. The criteria in Table 4-1 relate to the 100th percentile, total cumulative concentration of dust in the air and not just contributions from Project-specific sources. As such, ambient dust concentrations must also be considered when evaluating against these criteria.

Table 4-1: Air quality criteria for deposited dust (DECCW, 2005)

Pollutant	Averaging time	Criteria	Source
Deposited dust[a]	Annual (max increase)	2 g/m^2/month	NERDDC, 1988
	Annual (max total)	4 g/m^2/month	NERDDC, 1988

Source: Adapted from Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (DECCW, 2005)

Notes:

a. Dust is assessed as insoluble solids as defined by AS 3580.10.1-1991 (AM-19)

b. Maximum increase in deposited dust level

c. Maximum total deposited dust level. Air quality monitoring procedures

4.1 Mobile non-road diesel plant and equipment

The Contractors will identify the relevant United States Environmental Protection Agency, European Union (EU) standards or approved equivalent emission standards for mobile non-road diesel plant and equipment, in accordance with the requirements of Roads and Maritime Specification G36.

5 Existing environment

The following sections summarise existing air quality conditions within and adjacent to the Project corridor, based on information contained in the Section 8.6 and Appendix P of the EIS.

5.1 Surrounding receivers

Land-use in the vicinity of the Project is low-density residential at the northern extent and generally rural/residential land south of Orchard Hills. Approximate distances to sensitive receivers (nearest and typical) along each segment of the route are summarised in Table 5-1. The closest properties are located approximately 20 m from the Project.

Table 5-1: Distances to sensitive receivers

Segment	Description	Distances to receivers (m)	
		Nearest	Typical
1	The Northern Road between Glenmore Parkway and Bradley Street (contains Commonwealth land)	~50 m	>100 m
2	The Northern Road between Bradley Street and Chain-O-Ponds Road (contains Commonwealth land)	~20 m	50 to 100 m
3	The Northern Road between Chain-O-Ponds Road and Kings Hill Road (contains Commonwealth land)	~20 m	~50 m
4	The Northern Road between Kings Hill Road and Littlefields Road (contains Commonwealth land)	~20 m	~40 m
5	The Northern Road between Littlefields Road and Elizabeth Drive (M12)	~40 m	>50 m
6	The Northern Road between Elizabeth Drive (M12) and Park Road (former Northern Road)	~100 m	~100 m
7	The Northern Road between Park Road (former Northern Road) and Western Sydney Airport access	>100 m	>100 m
8	The Northern road south of Western Sydney Airport access	~50 m	~100 m

The Contractors will show the locations of the sensitive receivers on the updated stage specific Sensitive Area Plans (refer to Appendix A6 of the OACEMP).

5.2 Air quality index

The OEH has developed a metric known as the 'air quality index' (AQI). The AQI provides an indication of overall air quality by considering pollutant data measurements for ozone (O_3), nitrogen dioxide (NO_2), carbon monoxide (CO), sulphur dioxide (SO_2) and PM_{10}, as well as visibility against criteria presented in the Variation to the National Environment Protection (Ambient Air Quality) Measure and OEH standard for visibility. These readings are converted to a single overall value, known as the AQI. The AQI value classifications are:

- 0 - 33 Very good
- 34 - 66 Good
- 67 - 99 Fair
- 100 - 149 Poor
- 150 - 199 Very poor
- >200 Hazardous

The OEH operates a state wide air quality monitoring network which provides information on current and historical air quality. The nearest OEH air quality monitoring stations to the Project are:

- St Marys (about 7.0 km to the north-east)
- Bringelly (about 5.0 km to the east)
- Prospect (20 km to the east)
- Liverpool (about 19 km to the east).

A summary of the statistics generated from historic daily AQI values for the air quality monitoring stations closest to the Project (St Marys and Bringelly) is provided in Table 5-2. The statistics indicate that daily AQI values are generally considered 'good', with occasional days of 'poor' air quality or worse.

Table 5-2: AQI statistics for monitoring sites in the vicinity of the Project

Period	St Marys AQI value statistics			Bringelly AQI value statistics		
	Annual daily average	95th percentile of daily values	Annual daily maximum	Annual daily average	95th percentile of daily values	Annual daily maximum
2013	57	105	670	53	92	1274
2014	50	88	272	48	82	263
2015	45	79	220	47	77	225

5.3 Climatic conditions

Long term mean climate data recorded at the Penrith Lakes automatic weather station (AWS) (BoM station no. 67113) has been adopted to represent the climatic conditions at the Project site. The Penrith Lakes AWS is located approximately 8.5 km north-west of the Project. A summary of key monthly climate data statistics from the Penrith Lakes AWS for the period 1995-2018 is provided in Table 5-3.

Table 5-3: Monthly climate data (Penrith Lakes AWS)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Mean max. temperature (°C)	31.0	29.6	27.6	24.5	21.1	18.1	17.8	19.9	23.3	25.9	27.4	29.5
Mean min. temperature (°C)	18.6	18.5	16.8	13.1	9.3	7.0	5.4	6.2	9.4	12.2	15.1	17.1
Mean rainfall (mm)	94.8	116.9	76.6	50.1	37.5	51.3	29.3	30.4	30.6	51.3	80.0	62.0
Mean number of rain days (>1 mm)	7.4	7.7	7.8	5.6	4.3	5.6	4.0	3.5	4.6	5.3	7.8	7.3
Mean 9 am wind speed (km/h)	9.3	9.2	7.7	8.1	7.2	7.7	7.4	8.7	10.5	10.6	10.4	9.3

Table 5-3 provides historic data for the typical climatic factors that contribute to the proliferation of dust particles. In addition to the exposure of unconsolidated material during Construction eg earthworks, climatic factors such as prolonged dry weather, combined with high winds and high evaporation, can increase the likelihood of dust particulate emissions.

Records from the Penrith Lakes AWS show that the area in the vicinity of the Project experiences warm and wet summers, with rainfall typically highest in mid-late summer. Winter and spring are generally cooler and drier.

Seasonal data collected from wind roses over a three year period from 2013-2015 indicate that the wind direction is generally from the south-west. Therefore sensitive receivers most likely to be affected by dust emissions would be located north-east of The Northern Road. There were more days with calm conditions (i.e. wind speeds <0.5 m/s) during autumn and winter.

5.4 Soil characteristics

Soils within the Project area are generally highly or moderately erodible and are reported to be moderately reactive. The soil types in the Project area are summarised in Table 5-4.

Table 5-4: Characteristics of soils in the Project area

Soil unit	Soil type	Soil characteristics
Luddenham	Shallow podzolic soils and massive clays on crests. Moderately deep red podzolic soils on upper slopes and moderately deep yellow podzolic soils and prairie soils on lower slopes and drainage lines.	Highly erodible Impermeable Highly plastic subsoil Moderately reactive
Blacktown	Shallow to moderately deep soils. Hardsetting mottled texture contrast soils. Red and brown podzolic soils on crests grading to yellow podzolic soils on lower slopes and in drainage lines.	Highly plastic subsoil Moderately reactive Low fertility Poor draining
South Creek	Deep layered sediments over bedrock or relic soils. Structured plastic slays and loams in and adjacent to drainage lines. Red and yellow podzolic soils on terraces.	Moderately erodible Prone to flooding

6 Environmental aspects and impacts

6.1 Construction activities

Emissions to the atmosphere during Construction that could result in adverse impacts to air quality are typically divided into two categories:

- dust and particulates
- gaseous emissions.

Key aspects of the Project that could result in dust emissions include:

- earthworks, particularly during site establishment
- installation of Construction signage and environmental controls
- geotechnical and soil investigations
- establishment and operation of ancillary facilities and compounds
- demolition activities
- vegetation clearing and grubbing
- excavation
- pavement construction
- preparation of road subgrade and grade
- landscaping and finishing works
- bridge preparation and installation
- spray painting of the road for line marking
- drainage works
- operation of concrete / asphalt batching plant / pug mill
- topsoil / material handling including stripping, stockpiling, material loading and material haulage
- vehicular movements over unpaved surface (including unsealed access roads)
- wind erosion of exposed areas and temporary stockpiles
- tracking of dirt onto roads.

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

- vehicle and plant exhaust emissions, which may be excessive if vehicles and plant are poorly maintained.
- odours / gases released during:
    - excavations of organic or contaminated materials
    - during sealing works
    - operation of concrete / asphalt batching plant / pugmill
    - road line marking.

Refer also to the Aspects and Impacts Register included in Appendix A2 of the OACEMP.

6.2 Factors likely to affect dust generation and impacts

In addition to the inherent risks of specific Construction activities creating the potential to generate dust, a number of other environmental factors also affect the likelihood of dust emissions. These include:

- wind direction – determines whether dust and suspended particles are transported in the direction of the sensitive receivers
- wind speed – governs the potential suspension and drift resistance of particles
- soil type - more erodible soil types have an increased soil or dust erosion potential
- soil moisture – increased soil moisture reduces soil or dust erosion potential
- rainfall or dew – rainfall or heavy dew that wets the surface of the soil and reduces the risk of dust generation
- evaporation – dries out the surface of the soil and leads to increased risk of dust generation
- exposed surfaces - during Construction non-vegetated surfaces will be exposed prior to revegetation, which is a key factor influencing dust emissions.

6.3 Impacts

Construction activities have the potential to increase airborne particulate matter and cause nuisance impacts where Construction is in close proximity to sensitive receivers such as residential dwelling and community areas. The potential for impacts on air quality will depend on a number of factors. Primarily impacts will be dependent on the nature, extent and magnitude of Construction activities and their interaction with the natural environment.

Potential air quality impacts during Construction are mainly associated with the generation of dust. The settlement of dust may impact on properties located near the Project and substantial dust generation could result in health impacts to nearby receivers. Air quality impacts as a result of dust generation are anticipated to be minor as they will be limited to the Construction phase and will be minimised through the implementation of management measures. The management of dust will be undertaken to ensure that the air quality criteria are met at sensitive receivers.

Construction activities that involve handling, disturbance and management of materials have the highest potential to generate air quality impacts during Construction. The impact of exhaust fumes from machinery and other Construction vehicles will be limited to the Construction phase of the Project. Operation of machinery and other Construction vehicles will be undertaken to meet the relevant criteria.

Potential impacts attributable to Construction include:

- temporary increase in air emissions from dust and products of combustion (from equipment operations)
- temporary increased windborne dust emanating from disturbed/exposed surfaces
- increased dust and debris arising from haulage of materials during Construction
- odours arising from uncovered contaminated and/or hazardous materials

- deposition of dust on surfaces where it may cause damage and/or lead to a need for increased cleaning or repair
- aesthetic effects that arise from visible airborne dust plumes and from deposits of dust on surfaces
- need for increased maintenance of air filtering systems (eg air conditioners etc)
- potential adverse health effects including eye, nose and throat irritation from excessive inhalation of fine particles
- impacts on water quality and/or vegetation health from dust deposition
- impacts on residential sensitive receivers, including impacts on living areas, swimming pools and general amenities
- dust deposition impacts on sensitive agricultural receivers
- complaints from the public relating to dust or odours.

Overall, potential air quality impacts during Construction are expected to be short-term and minor, provided the safeguards and management measures identified in Section 7 are implemented.

7 Environmental mitigation and management measures

A range of environmental requirements and management measures are identified in the EIS and SPIR, the conditions of approval and relevant Roads and Maritime documents.

Specific measures and requirements to address air quality impacts are outlined in Table 7-1.

Table 7-1: Air quality revised environmental management measures

ID	Measure / requirement	When to implement	Responsibility	Applicability					Reference
				Stage 4 Cth	Stage 4 NSW	Stage 5 Cth	Stage 5 NSW	Stage 6 NSW	
AQ-1	Plant and equipment would be operated in a proper and efficient manner by:								
	• Inspecting the plant/equipment prior to commencement of works on site	Construction	Contractor Environmental Site Representative / Contractor Superintendent	✓	✓	✓	✓	✓	Section 8.5
	• Conducting routine servicing and maintenance, and subsequent inspections to ensure that equipment continues to operate efficiently.	Construction	Contractor Environmental Site Representative / Contractor Superintendent	✓	✓	✓	✓	✓	Section 8.5
AQ-2	Dust and emissions generation at compounds would be managed by:								
	• Installation of perimeter screening around compound sites	Construction	Contractor Construction Manager	✓	✓	✓	✓	✓	Ancillary Facilities Management Plan (AFMP)
	• Impose low speeds limits around compound sites to limit the generation of dust from vehicle movements	Construction	Contractor Construction Manager	✓	✓	✓	✓	✓	AFMP
	• Apply wheel-wash or rumble grid facilities at access points to limit the tracking of materials beyond the site boundary	Construction	Contractor Construction Manager	✓	✓	✓	✓	✓	AFMP

ID	Measure / requirement	When to implement	Responsibility	Applicability					Reference
				Stage 4		Stage 5		Stage 6	
				Cth	NSW	Cth	NSW	NSW	
	• Ensure that compound area surfaces are well compacted or sealed to limit the potential for dust generation	Construction	Contractor Construction Manager	✓	✓	✓	✓	✓	AFMP
	• Regularly water stockpiles and limit the amount of materials stockpiled around the site	Construction	Contractor Construction Manager	✓	✓	✓	✓	✓	Appendix B4 - CSWMP
	• Position stockpiling areas as far as possible from surrounding receivers	Construction	Contractor Construction Manager	✓	✓	✓	✓	✓	Appendix B4 - CSWMP
	• Limit stockpiling activities during conditions where winds are blowing strongly in the direction(s) from the stockpiling location to nearby receivers	Construction	Contractor Construction Manager	✓	✓	✓	✓	✓	Appendix B4 - CSWMP
	• Consultation would be carried out consistent with the Community Consultation Framework in relation to air quality near ancillary sites and relevant incident management process during construction.	Construction	Contractor Community Relations Manager	✓	✓	✓	✓	✓	AFMP CCS
AQ-3	Dust generation and emissions from construction activities and materials haulage would be managed by: • Impose low speeds limits across all site haulage routes	Construction	Contractor Construction Manager	✓	✓	✓	✓	✓	Appendix B1 - CTMP

ID	Measure / requirement	When to implement	Responsibility	Applicability					Reference
				Stage 4		Stage 5		Stage 6	
				Cth	NSW	Cth	NSW	NSW	
	• Ensure that all loads are covered when materials are being hauled to and from site	Construction	Contractor Construction Manager	✓	✓	✓	✓	✓	Appendix B4 - CSWMP
	• Wherever possible, position internal haulage routes away from surrounding receivers	Construction	Contractor Construction Manager	✓	✓	✓	✓	✓	Appendix B1 - CTMP
	• Regular watering of exposed and disturbed areas especially during inclement weather conditions	Construction	Contractor Construction Manager	✓	✓	✓	✓	✓	Appendix B4 - CSWMP
	• Wherever possible, minimise the extent of disturbed and exposed surfaces, and restore as soon as possible	Construction	Contractor Construction Manager	✓	✓	✓	✓	✓	Appendix B2 - CFFMP
	• Adjust the intensity of activities based on measured dust levels, weather forecasts and the proximity of and direction of the works in relation to the nearest surrounding receivers	Construction	Contractor Construction Manager	✓	✓	✓	✓	✓	Section 8.5 Annexure A Construction Air Quality Monitoring Program
	• Ensure that any material exposed areas are secured during project shutdown periods to prevent any dust emanating over adjacent roads	Construction	Contractor Construction Manager	✓	✓	✓	✓	✓	Section 8.5 Contractor's CAQMP / EWMS

ID	Measure / requirement	When to implement	Responsibility	Applicability					Reference
				Stage 4		Stage 5		Stage 6	
				Cth	NSW	Cth	NSW	NSW	
	• Install depositional dust gauges to quantify dust levels and determine whether control measures are adequate or whether further actions are required • These gauges should be installed at regular intervals along the project alignment at representative receiver locations. Gauges should also be installed around major construction compound and stockpiling locations.	Construction	Contractor Environmental Site Representative	✓	✓	✓	✓	✓	Annexure A Construction Air Quality Monitoring Program
AQ-4	Windborne dust emanating from non-vegetated surfaces would be managed by:								
	• Stage work to ensure that finished areas are revegetated as soon as possible	Construction	Contractor Construction Manager	✓	✓	✓	✓	✓	Appendix B2 - CFFMP
	• Regularly maintain and water revegetation areas to aid the establishment of adequate vegetation cover.	Construction	Contractor Construction Manager	✓	✓	✓	✓	✓	Appendix B2 - CFFMP
AQ-5	Application of odour supressing agents to materials as necessary to minimise related impacts should any contaminated or hazardous materials be uncovered during the works.	Construction	Contractor Construction Manager	✓	✓	✓	✓	✓	Contractor's CAQMP/ EWMS

ID	Measure / requirement	When to implement	Responsibility	Applicability					Reference
				Stage 4		Stage 5		Stage 6	
				Cth	NSW	Cth	NSW	NSW	
AQ-6	Develop construction program in consultation with the contractor(s) developing the Western Sydney Airport site. Maintain consultation through the course of both projects to plan activities in a manner which limits potential air quality-related impacts. Wherever possible and practical, co-ordinate activities with a high potential to generate dust so that they do not occur at the same time. Stop activities if dust is observed to be emanating from the airport.	Pre-construction Construction	Contractor Construction Manager / Contractor Environmental Site Representative/ Contractor CRM	✓	✓	✓	✓	✓	Construction Program CCS Contractor's CAQMP/ EWMS
CI-2	Where relevant, consultation would be undertaken with proponents of other nearby developments to increase the overall awareness of project timeframes and impacts.	Construction	Contractor Construction Manager / Contractor Environmental Site Representative/ Contractor CRM	✓	✓	✓	✓	✓	Section 8.2
G36 S4.4.2	Implement strategies to minimise air emissions from off road diesel equipment and plant. Aim to achieve compliance with mobile non-road diesel plant and equipment used for Construction with the relevant United States Environmental Protection Agency, European Union (EU) standards or approved equivalent emission standards.	Pre-Construction Construction	Contractor Construction Manager	✓	✓	✓	✓	✓	Contractor's CAQMP/ EWMS

8 Compliance management

8.1 Roles and responsibilities

The Project organisational structure and overall roles and environmental responsibilities are outlined in Section 5.1 of the OACEMP. Specific responsibilities for the implementation of air quality management are detailed in Section 7 of this CAQMP and Section 2 of the Construction Air Quality Monitoring Program (Annexure A).

8.2 Communication

Roads and Maritime will prepare and implement a Community Communication Strategy (CCS) in accordance with the requirements of NSW-CoA B1 to document the approach to stakeholder and community communications for the Project. The CCS will identify opportunities and tools for providing information and consulting with the community and stakeholders during the Construction of the Project. The Contractors will support the delivery of the CCS.

Air quality management information will be communicated to the community and stakeholders in accordance with the principles and procedures outlined in the CCS.

Consultation will be undertaken with local communities potentially affected by the impacts of multiple projects in addition to the Project.

The CCS provides details on the requirements for coordination and communication between the Contractors working on the Project stages which will include:

- liaison meetings
- mailing list for all communications (including Community Updates)
- email communication
- Project briefings.

Where relevant, the Roads and Maritime Community and Stakeholder Engagement Advisor and the Contractor CRMs will undertake consultation with proponents of other nearby developments to increase the overall awareness of project timeframes and impacts.

Further detail about the CCS is provided in Section 5.5.3 of the OACEMP.

8.3 Complaints management

Roads and Maritime will develop a Complaints Management System (CMS) to document the overall approach to complaints management for the Project. The Contractors will adopt the requirements of the CMS, including reporting requirements. The CMS will include a Complaints Register which will record the details of all complaints relating to the Project.

Further detail about the CMS is provided in Section 5.5.3 of the OACEMP.

8.4 Training

To ensure that this CAQMP is effectively implemented, all site personnel (including sub-contractors) will undergo site induction training that includes Construction air quality management issues prior to Construction commencing. The induction training will address elements related to air quality management, including:

- existence and requirements of this CAQMP, the Contractor's CAQMP and all plans and procedures prepared under the CAQMPs
- relevant legislation, regulations and EPL conditions
- incident response, management and reporting
- location of sensitive receivers
- complaints response and reporting
- general air quality management controls
- specific responsibilities to minimise air quality impacts on the community associated with the works.

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 or those undertaking an activity with a high risk of environmental impact. Site personnel will undergo refresher training at not less than six monthly intervals.

The ER will review and approve the induction and training program prior to the commencement of Construction and monitor implementation.

Daily pre-start meetings conducted by the Contractor Foreman will inform the site workforce of any environmental issues relevant to air quality that could potentially be impacted by, or impact on, the day's activities.

Further details regarding staff induction and training are provided in Section 5.3 of the OACEMP.

8.5 Monitoring and inspection

8.5.1 Monitoring

An overarching Construction Air Quality Monitoring Program has been prepared in accordance with NSW-CoA C9(a) and is provided in Annexure A.

Monitoring will include, but not be limited to:

- monthly dust monitoring in accordance with *Approved Methods for Modelling and Assessment of Air Pollutants in NSW* (EPA, 2016) and AS 3580.10.1-2003
- daily monitoring of weather data
- odour monitoring
- daily visual surveillance
- monitoring of emissions from mobile non-road diesel plant and equipment.

8.5.2 Inspections

Regular inspections of sensitive areas and activities will occur for the duration of the Project. The Contractor Environmental Site Representatives will carry out weekly site inspections. Roads and Maritime will also conduct independent inspections to confirm the Contractors' compliance with air quality management requirements.

Weekly and other routine inspections by the Roads and Maritime Environmental Manager (or delegate), Environmental Review Group (ERG) representatives and ER will occur throughout Construction. Detail on the nature and frequency of these inspections are documented in Section 6.1 of the OACEMP.

Proposed inspections to be carried out by Contractors that are relevant to air quality are contained in Table 8-1.

Table 8-1: Air quality inspections

Inspection	Frequency	Responsibility
Visual surveillance for dust emissions or mud tracking off-site	Daily	Contractor Site Environmental Representative Contractor Site Engineer Contractor Superintendent
Inspection of dust controls to ensure implemented and working effectively	Daily	Contractor Site Environmental Representative Contractor Site Engineer Contractor Superintendent
Site inspection for visible dust emissions, dust deposits on surfaces, no continuous visible vehicle/plant/equipment emissions for >10s (POEO (Clean Air) Regulation 2010)	Weekly	Contractor Site Environmental Representative Contractor Superintendent / ERG representatives
Haul road integrity	Weekly	Contractor Superintendent
Plant / equipment inspections including maintenance and emissions	As required, prior to use	Contractor Superintendent

8.6 Incident planning and response

Response to incidents will be undertaken as described in Section 5.6 of the OACEMP and in accordance with the Environmental Incident Classification and Reporting Procedure (refer to Appendix A7 of the OACEMP).

8.7 Auditing

Audits (both internal and external) will be undertaken to assess the effectiveness of air quality management measures, compliance with this CAQMP, conditions of approval and other relevant approvals, licenses and guidelines.

Audit requirements are detailed in Section 6.4 of the OACEMP.

8.8 Non-conformances

A non-conformance is the failure or refusal to comply with the requirements of project system documentation, including this CAQMP and Construction Air Quality Monitoring Program. Any member of the Contractors' Project team may raise a non-conformance or improvement opportunity.

Where a non-conformance is detected or monitoring results directly attributable to the Project exceed the target set in the Construction Air Quality Monitoring Program, the process described in the Monitoring Program and Section 6.6 of the OACEMP will be implemented. The Contractor's Quality Plan will describe the process for managing non-conforming work practices and initiating corrective / preventative actions or system improvements in accordance with the process outlined in Section 6.6.1 of the OACEMP.

8.9 Reporting

Reporting requirements and responsibilities are documented in Section 6.5 of the OACEMP.

The Construction Contractors will report on air quality monitoring in accordance with the Construction Air Quality Monitoring Program provided in Annexure A.

The Contractors will be required to maintain accurate records substantiating all Construction activities associated with the Project or relevant to the conditions of approval, including measures taken to implement this CAQMP. Records will be made available to the DP&E and DoEE upon request, within the timeframe nominated in the request.

9 Review and improvement

9.1 Continuous improvement

Continuous improvement of this CAQMP and Construction Air Quality Monitoring Program provided in Annexure A will be achieved by the ongoing evaluation of environmental management performance against environmental policies, objectives and targets for the purpose of identifying opportunities for improvement.

The continuous improvement process will be designed to:

- identify areas of opportunity for improvement of air quality management and performance
- identify environmental risks not already included in the risk register
- determine the cause or causes of non-conformances and deficiencies
- develop and implement a plan of corrective and preventative action to address any non-conformances and deficiencies
- verify the effectiveness of the corrective and preventative actions
- document any changes in procedures resulting from process improvement
- make comparisons with objectives and targets.

The Contractors will be responsible for ensuring Project environmental risks are identified and included in the risk register and appropriate mitigation measures implemented throughout the Construction of the Project as part of the continuous improvement process. The process for ongoing risk identification and management during Construction is outlined in Section 4.3.2 of the OACEMP.

9.2 CAQMP update and amendment

The processes described in Section 6.8 of the OACEMP may result in the need to update or revise this CAQMP, including the Construction Air Quality Monitoring Program provided in Annexure A.

Any revisions to this CAQMP or Construction Air Quality Monitoring Program will be in accordance with the process outlined in Sections 1.6 and 6.8 of the OACEMP.

A copy of the updated CAQMP and Construction Air Quality Monitoring Program and changes will be distributed to all relevant stakeholders in accordance with the approved document control procedure (refer to Section 1.5 of the OACEMP).

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Annexure A - Construction Air Quality Monitoring Program

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Contents

Tables

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1 Introduction

1.1 Purpose and scope

This overarching Construction Air Quality Monitoring Program has been developed in accordance with NSW-CoA C9(a). It describes the environmental air quality monitoring to be undertaken by Construction Contractors for the Project. The purpose of this Construction Air Quality Monitoring Program is to:

- provide a procedure to monitor air quality impacts during Construction of the Project
- meet the requirements of the relevant conditions of approval for the Project
- meet any relevant legal and other requirements and Environment Protection Licence (EPL) requirements for the Project (refer to Section 1.5).

The Contractors will be required to develop a detailed Construction Air Quality Monitoring Program to address specific requirements in accordance with this overarching Construction Air Quality Monitoring Program. The Contractors will supplement this overarching Construction Air Quality Monitoring Program with stage specific information and include the updated Construction Air Quality Monitoring Program in their CAQMPs.

1.2 Responsibilities

Site personnel or sub-contractors with suitable experience and qualifications will undertake the monitoring outlined in this Construction Air Quality Monitoring Program.

The Contractors' Construction Managers are responsible for ensuring that all legal and other requirements described in this Construction Air Quality Monitoring Program are met.

1.3 Approval, review and modification

This Construction Air Quality Monitoring Program will be endorsed by the ER and submitted to the Secretary for approval at least one month before commencement of Construction or within another timeframe agreed with the Secretary. Construction will not commence until the Secretary has approved the required Construction Air Quality Monitoring Program and all relevant baseline data for the specific Construction activity has been collected. The Construction Air Quality Monitoring Program will be implemented for the duration of Construction and for any longer period set out in this Construction Air Quality Monitoring Program or specified by the Secretary, whichever is the greater.

This Construction Air Quality Monitoring Program will be reviewed annually by Roads and Maritime in consultation with the Construction Contractors. Minor amendments to this Construction Air Quality Monitoring Program may be approved by the ER. Any amendments to the Construction Air Quality Monitoring Program will be documented in subsequent revisions of this Construction Air Quality Monitoring Program. A copy of the updated Construction Air Quality Monitoring Program and changes will be distributed to all relevant stakeholders in accordance with the approved document control procedure outlined in the Contractors' CEMPs. Site personnel with responsibilities relevant to air quality monitoring will be informed of any amendments to the Construction Air Quality Monitoring Program and training provided where required.

Roads and Maritime will review the Contractors' Construction Air Quality Monitoring Programs to confirm compliance with the requirements of the CAQMP and specifications.

1.4 Consultation

No consultation under the NSW Minister's Infrastructure Approval was required for the preparation of this Construction Air Quality Monitoring Program.

1.5 Environment protection licence

The Project is subject to a number of EPLs as a Scheduled Activity for extractive activities and road construction. The EPLs prescribe climate monitoring requirements that must be complied with for the Project. The EPL condition relevant to climate monitoring is provided in Table 1-1.

Table 1-1: EPL requirements relevant to climate monitoring

Ref.	Relevant requirement	Reference
M4	**Weather monitoring**	
M4.1	The licensee must monitor hourly temperature, humidity, wind velocity and rainfall at either the project weather station, or through analysis of equivalent weather information obtained from the Australian Bureau of Meteorology.	Section 4.1

1.6 Conditions of approval

The State (NSW-CoA) and Federal (Federal-CoA) conditions of approval relevant to this Construction Air Quality Monitoring Program and their applicability to each stage of the Project are listed in Table 1-2. A cross reference is also included to indicate where the condition is addressed in this Construction Air Quality Monitoring Program or other project management documents.

Table 1-2: Conditions of approval relevant to the Construction Air Quality Monitoring Program

CoA no.	Condition requirement	Applicability					Reference
		Stage 4		Stage 5		Stage 6	
		Cth	NSW	Cth	NSW	NSW	
NSW-CoA C9 (a)	The following **Construction Monitoring Programs** must be prepared in consultation with the relevant government agencies identified for each **Construction Monitoring Program** to compare actual performance of construction of the CSSI against performance predicted performance.						This Construction Air Quality Monitoring Program
	Air quality Nil	✓	✓	✓	✓	✓	Section 1.4
NSW-CoA C10	Each Construction Monitoring Program must provide:						
	(a) details of baseline data available	✓	✓	✓	✓	✓	Section 2
	(b) details of baseline data to be obtained and when	✓	✓	✓	✓	✓	Section 2
	(c) details of all monitoring of the project to be undertaken	✓	✓	✓	✓	✓	Section 4
	(d) the parameters of the project to be monitored	✓	✓	✓	✓	✓	Section 4
	(e) the frequency of monitoring to be undertaken	✓	✓	✓	✓	✓	Section 4
	(f) the location of monitoring	✓	✓	✓	✓	✓	Section 4
	(g) the reporting of monitoring results	✓	✓	✓	✓	✓	Section 5
	(h) procedures to identify and implement additional mitigation measures where results of monitoring are unsatisfactory	✓	✓	✓	✓	✓	Section 6
	(i) any consultation to be undertaken in relation to the monitoring programs.	✓	✓	✓	✓	✓	Section 1.4

CoA no.	Condition requirement	Applicability					Reference
		Stage 4		Stage 5		Stage 6	
		Cth	NSW	Cth	NSW	NSW	
NSW-CoA C11	The **Construction Monitoring Programs** must be developed in consultation with relevant government agencies as identified in **Condition C9** of this approval and must include, to the written satisfaction of the Secretary, information requested by an agency to be included in a **Construction Monitoring Programs** during such consultation. Details of all information requested by an agency including copies of all correspondence from those agencies, must be provided with the relevant **Construction Monitoring Program**.	✓	✓	✓	✓	✓	Section 1.4
NSW-CoA C12	The **Construction Monitoring Programs** must be endorsed by the ER and then submitted to the Secretary for approval at least one (1) month before commencement of construction or within another timeframe agreed with the Secretary.	✓	✓	✓	✓	✓	Section 1.3
NSW-CoA C13	Construction must not commence until the Secretary has approved all of the required **Construction Monitoring Programs**, and all relevant baseline data for the specific construction activity has been collected.	✓	✓	✓	✓	✓	Section 1.3 Section 2
NSW-CoA C14	The **Construction Monitoring Programs**, as approved by the Secretary 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 Secretary, whichever is the greater.	✓	✓	✓	✓	✓	Section 1.3
NSW-CoA C15	The results of the **Construction Monitoring Programs** must be submitted to the Secretary, and relevant regulatory agencies, for information in the form of a **Construction Monitoring Report** at the frequency identified in the relevant **Construction Monitoring Program**.	✓	✓	✓	✓	✓	Section 5

2 Baseline data

2.1 Air quality index

The OEH has developed a metric known as the 'air quality index' (AQI). The AQI provides an indication of overall air quality by considering pollutant data measurements for ozone (O_3), nitrogen dioxide (NO_2), carbon monoxide (CO), sulphur dioxide (SO_2) and PM_{10}, as well as visibility against criteria presented in the Variation to the National Environment Protection (Ambient Air Quality) Measure and OEH standard for visibility. These readings are converted to a single overall value, known as the AQI. The AQI value classifications are:

- 0 - 33 Very good
- 34 - 66 Good
- 67 - 99 Fair
- 100 - 149 Poor
- 150 - 199 Very poor
- >200 Hazardous

The OEH operates a state wide air quality monitoring network which provides information on current and historical air quality. The nearest OEH air quality monitoring stations to the Project are:

- St Marys (about 7.0 km to the north-east)
- Bringelly (about 5.0 km to the east)
- Prospect (20 km to the east)
- Liverpool (about 19 km to the east).

A summary of the statistics generated from historic daily AQI values for the air quality monitoring stations closest to the Project (St Marys and Bringelly) is provided in Table 2-1 to characterise the baseline air quality in the area. The statistics indicate that daily AQI values are generally considered 'good', with occasional days of 'poor' air quality or worse.

Table 2-1: AQI statistics for monitoring sites in the vicinity of the Project

Period	St Marys AQI value statistics			Bringelly AQI value statistics		
	Annual daily average	95th percentile of daily values	Annual daily maximum	Annual daily average	95th percentile of daily values	Annual daily maximum
2013	57	105	670	53	92	1274
2014	50	88	272	48	82	263
2015	45	79	220	47	77	225

2.2 Dust deposition

There is no existing information about background dust emission levels in the Project area. The Contractors will install dust deposition gauges at least one month prior to commencement of bulk earthworks for each stage of Construction to collect baseline data on ambient dust levels in the vicinity of the Project. The Contractors will update their Monitoring Programs with this baseline data.

3 Air quality criteria

The acceptable increment in annual average dust deposition depends on the existing deposition level. Table 3-1 details the air quality monitoring criteria for deposited dust for the Project. The criteria in Table 3-1 relate to the 100th percentile, total cumulative concentration of dust in the air and not just contributions from Project-specific sources. As such, ambient dust concentrations must also be considered when evaluating against these criteria.

Table 3-1: Air quality monitoring criteria for deposited dust[a]

Pollutant	Averaging time	Criteria	Source
Deposited dust[b]	Annual (max increase)	2 g/m^2/month[c]	NERDDC, 1988
	Annual (max total)	4 g/m^2/month[d]	NERDDC, 1988

Notes:

a) Adapted from *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (DECCW, 2005)

b) Dust is assessed as insoluble solids as defined by AS 3580.10.1-1991 (AM-19)

c) Maximum increase in deposited dust level

d) Maximum total deposited dust level. Air quality monitoring procedures

4 Monitoring procedures

The overarching air quality and climate monitoring procedures to be adopted for the Project are provided in Table 4-1. Air quality and climate monitoring will be undertaken by the Contractor Environmental Site Representative. Further details are provided in the following sections.

Table 4-1: Summary of air quality and climate monitoring procedures

Monitoring details	Frequency	Test procedure
Prevailing wind conditions and weather forecast	Daily	Weather conditions and forecasts will be obtained from the Bureau of Meteorology as detailed in Section 4.1 of this MP.
Climate monitoring	Daily	Daily rainfall monitoring will be undertaken via automatic weather stations installed at ancillary facilities or Construction sites and confirmed with manual rainfall gauges installed across the Project. Refer Section 4.1 of this MP.
	Hourly	Hourly temperature, humidity, wind velocity and rainfall from either the project weather station, or through analysis of equivalent weather information obtained from the Australian Bureau of Meteorology will be monitored in accordance with EPL condition M4.1. Refer Section 4.1 of this MP.
Dust deposition monitoring	Monthly	Monitoring to be undertaken in accordance with the guidelines in Section 3.1.2 of the CAQMP, including *Approved Methods for Modelling and Assessment of Air Pollutants in NSW* (EPA, 2016) and *AS 3580.10.1:2016 Methods for sampling and analysis of ambient air Method 10.1: Determination of particulate matter—Deposited matter—Gravimetric method*. Samples will be collected every 30 days in accordance with *AS 3580.10.1:2016* and analysed for Total Insoluble Matter by a NATA accredited company to be engaged by the Contractor. Details of site activity and equipment usage at each monitoring location, any visible land use conditions adverse to local air quality, and weather conditions will be noted during collection of samples from dust gauges and included in monitoring reports. Refer Section 4.2 of this MP.
Investigation in response to recurring or major complaints, or authorised agency request, regarding exceedance of air emissions	As required	Ongoing monitoring to be undertaken in accordance with the guidelines in Section 3.1.2 of the CAQMP at the dust deposition gauges identified above. Contractor will respond to complaints in accordance with the CCS and CMS Contractor will undertake an investigation of the complaint including an assessment of operations, weather conditions and visual observation of impact. Contractor will review efficiency of dust mitigation measures and detail additional mitigation measures if required.

Monitoring details	Frequency	Test procedure
Visual surveillance	Daily	Dust control measures are in an adequate condition No long term visible dust emissions from the site No mud-tracking off-site from haul roads
Odour monitoring	Daily, or in response to complaints	No detectable odours beyond the site boundary, or at the nearest sensitive land use downwind *Technical Framework: Assessment and management of odour from stationary sources in NSW* (DEC, 2006) provides a framework for assessing odours Contractor will respond to complaints in accordance with the CCS and CMS
Mobile non-road diesel plant and equipment	As required	Compliance with the relevant United States Environmental Protection Agency, European Union (EU) standards or approved equivalent emission standards

4.1 Climate monitoring

Rainfall at the Construction sites will be measured and recorded in millimetres per 24-hour period at the same time each day from the time that the site office associated with the activities is established. The Contractors will install automatic rainfall intensity / automatic weather stations (AWS) to record hourly rainfall, temperature, relative humidity, wind speed, wind direction and bathometric pressure. Manual rain gauges will also be used across the Project to assist with assessment of rainfall data accuracy.

The location of AWS and manual rainfall gauges will be determined by the Contractor prior to the commencement of Construction and details provided in the Contractors' Construction Air Quality Monitoring Programs.

The AWS will conform to Roads and Maritime Specification R272 for the design and location of such devices. AWS will be located within a secured compound area fully protected by fencing, likely to be at major site compounds, where not constrained by land use. AWS instrumentation, communication or power cabling contained within conduits will be buried to a depth of at least 100 mm.

AWS will be installed on land owned by Roads and Maritime or publicly owned land where feasible. If AWS are to be located on private land, permission must be granted by the land owner to access the AWS on a monthly basis.

Prior to establishment of AWS, the Contractor will prepare a report identifying suitable locations for AWS and other weather gauges in consultation with a suitably qualified person with experience installing and operating AWS, and any relevant stakeholders. The Roads and Maritime Environmental Manager (or delegate) will review the proposed locations of AWS for consistency with specifications and this CAQMP.

In accordance with normal standard construction practices, weather forecasts will be used to guide work activities undertaken on-site. The Contractor will review the weather forecasts at the start of each day and prior to undertaking new work activities that may be affected by rainfall or adverse weather.

The Beaufort Wind Scale will be used to determine wind conditions. The Beaufort Wind Scale is detailed in Table 4-2. If wind conditions are classified as “strong winds” or greater, all dust generating activities are to cease. For wind categories less than “strong winds”, the Contractor will assess dust generating activities and either implement additional mitigation measures or reschedule the activity to when dust can be contained on-site.

Table 4-2: Beaufort wind scale (adapted from BoM)

Beaufort scale number	Descriptive term	Wind speed (km/h)	Wind speed (knots)	Description on land
0	Calm	0	0	Smoke rises vertically
1-3	Light winds	≤19	≤10	Wind felt on face; leaves rustle; ordinary vanes moved by wind
4	Moderate winds	20 - 29	11 - 16	Raises dust and loose paper; small branches are moved
5	Fresh winds	30 - 39	17 - 21	Small trees in leaf begin to sway; crested wavelets form on inland waters
6	Strong winds	40 - 50	22 - 27	Large branches in motion; whistling heard in telephone wires; umbrellas used with difficulty
7	Near gale	51 - 62	28 - 33	Whole trees in motion; inconvenience felt when walking against wind
8	Gale	63 - 75	34 - 40	Twigs break off trees; progress generally impeded
9	Strong gale	76 - 87	41 - 47	Slight structural damage occurs -roofing dislodged; larger branches break off
10	Storm	88 - 102	48 - 55	Seldom experienced inland; trees uprooted; considerable structural damage
11	Violent storm	103 - 117	56 - 63	Very rarely experienced - widespread damage
12+	Hurricane	≥118	≥64	Very rarely experienced - widespread damage

In addition to the daily monitoring described above, the Contractor will monitor hourly temperature, humidity, wind velocity and rainfall from either the Project weather station, or through analysis of equivalent weather information obtained from the Australian Bureau of Meteorology, in accordance with EPL condition M4.1.

4.2 Dust deposition monitoring

4.2.1 Site selection and positioning of dust deposition gauges

The siting of dust deposition gauges will consider the following:

- dust deposition gauges will be positioned in accordance with *AS 3580.1.1:2007: Methods of Sampling and Analysis of Ambient Air, Part 1.1: Guide to Siting Air Monitoring Equipment*

- dust deposition gauges will be located at regular (1 km where possible) intervals along the alignment at representative receiver locations and also around site facilities and stockpile locations to monitor potential air quality impacts from the Construction activities
- dust gauges will be located in low or sparsely built up areas
- locations of dust gauges will consider the proximity to sensitive receivers and location of threatened species or EECs
- positioning will consider typical wind direction
- positioning of dust gauges will take into account the scale of Construction activities and proposed establishment of ancillary facilities
- locations will be avoided where:
    - airflow is restricted, including behind trees or structures, with a minimum clear sky angle of 120º required
    - objects might alter the pollution concentration by adsorption or absorption, such as leafy vegetation and some building materials
    - chemical interference may interfere with dust monitoring, such as near vehicle or plant emissions or other unrelated local emissions
    - physical interference may produce atypical results or where electrical interference to sampling equipment could occur from nearby high voltage power lines
- monitoring sites will, to the extent possible, be located where:
    - there is a low potential for vandalism
    - there is adequate access for transporting equipment
    - personnel can perform their activities in a safe environment
    - the priority for siting of dust deposition gauges will be on Roads and Maritime or publicly owned land first, then private land second. If dust gauges are located on private property, permission must be granted by the land owner to access the gauges on a monthly basis.

The Contractors will identify the specific locations of dust deposition gauges, including control sites, in consultation with a NATA Accredited company, whose scope of accreditation includes *AS 3580.1.1:2007* to site the equipment prior to the commencement of Construction. The company must be NATA Accredited to *ISO/IEC 17025: 2005 General requirements for the competence of testing and calibration laboratories*.

The exact locations of dust deposition gauges will be identified prior to the commencement of Construction and details provided in the Contractors' Construction Air Quality Monitoring Programs.

Monitoring equipment will remain in place until completion of Construction works.

4.2.2 Visual surveillance

Public roads will be inspected each day at main entry and exit points to and from areas where Construction activities are taking place, including Project compounds and ancillary facilities. In the event of any spillage or tracking on the road pavement, the material will be removed within 24 hours.

Erosion control structures will be checked regularly for build-up of silt and other materials to ensure deposits do not become a dust source.

All new plant, equipment or machinery brought to Construction sites will be inspected and verified to ensure that it is in good working order. Any plant, equipment or machinery will be immediately switched off should there be visible signs of smoke emissions emitting from equipment/machinery.

4.2.3 Monitoring equipment

Dust deposition gauges measure dust deposition rates by passive deposition and capture of dust using a funnel and bottle arrangement. The equipment required for dust deposition gauges includes:

- Grade A volumetric glassware, complying with *AS 2164* and its use complying with *AS 2162.1*
- pipettes complying with *AS 2166*
- glass deposition gauges consisting of a 150 ± 10 mm diameter funnel (with a 60º angle of cone sides). The internal diameter of the funnel stem needs to be sufficient to permit passage of particulate matter during washing. It will be supported in the neck of a wide-mouth, glass bottle of a suitable size, preferably of minimum volume 4 L, by means of a rubber or plastic stopper with a groove or outlet pipe to allow water overflow under excessive rainfall conditions. The funnel diameter shall be known to the nearest millimetre when used in calculating results
- tight fitting, impermeable, non-reactive lid for deposition gauge collection and transportation.
- a stand supporting the horizontal plane of the funnel at a height of 2 ± 0.2 m above the ground. The stand generally incorporates a container or beaker to protect the bottle contents from sunlight. A hole at the base should be provided to prevent rainwater build up
- filtration apparatus consisting of silica crucibles with porous filter bases (porosity 3) or Gooch crucible of porcelain, silica or alundum with filter pads of equivalent retention are acceptable for separation of the insoluble fraction from the soluble fraction. Alternatively, Buchner funnels with an appropriate filter pad of glass, quarts or ashless filter paper and membrane filters may be used
- a bird ring made of inert or corrosion-resistant metal wire (diameter 4-6 mm) with a suitable design to prevent birds perching on the funnel (optional)
- a test sieve with a 1 mm aperture complying with *AS 1152*
- dust deposit gauge bottles will be prepared in accordance with *AS 3580.10.1:2016.*

4.2.4 Sampling and analysis

Results will be captured on a monthly basis and collected in accordance with the *Approved Methods for the Sampling and Analysis of Air Pollutants in NSW* (DEC, 2006) guidelines by a NATA Accredited company to be engaged by the Contractor. All monitoring results will be presented in a NATA endorsed Test report.

4.2.5 Maintenance and calibration

The Contractor will develop and implement a monthly maintenance / calibration program to ensure effective operation of dust gauges in accordance with AS 3580.10.1:2003. Details will be provided in the Contractor's Construction Air Quality Monitoring Program.

5 Reporting

5.1 Monthly Environmental Report

The Contractor will prepare Monthly Environmental Reports for the duration of the Project for incorporation in Project Monthly Reports and submit to the Roads and Maritime Environmental Manager (or delegate) for review. Information to be detailed in the reports includes:

- results summary and analysis of the environmental monitoring
- performance of this Construction Air Quality Monitoring Program
- summary of any complaints received that are related to air quality complaints.

5.2 Air Quality Monitoring Report

In accordance with NSW-CoA C15, the Contractor will prepare Construction Air Quality Monitoring Reports detailing the results of the monitoring undertaken in accordance with this Construction Air Quality Monitoring Program for submission to the Secretary for inclusion in the Six Monthly Construction Compliance Reporting required under NSW-CoA A32, and relevant regulatory agencies for information. Reports will be prepared six monthly for the duration of Construction of the Project. Reports will include, but not be limited to, the following information:

- the locations and description of monitoring undertaken
- tabulations of monitoring data
- compliance with the criteria identified in Section 4 of the CAQMP
- identification of exceedances of the nominated criteria and descriptions of the causes of these exceedances
- details of any alteration to the monitoring program
- summary of any complaints received regarding air quality.

The Contractors will maintain accurate records of all air quality monitoring activities. These records will be made available to the DP&E and DoEE upon request, within the timeframe nominated in the request.

5.3 Reporting on non-conformances and exceedances

In the event that the criteria identified in Section 4 of the CAQMP are exceeded, the Contractor will report the exceedance to the Roads and Maritime Project Manager, Roads and Maritime Environmental Manager (or delegate) and ER within seven days of identification of the exceedance. Details of exceedances will be provided in the Monthly Environmental Reports and six monthly Construction Air Quality Monitoring Reports.

Where an exceedance has caused, is causing or is likely to cause, material harm to the environment, the environmental incident notification and reporting procedures detailed in Section 5.6 of the OACEMP and the Environmental Incident Classification and Reporting

Procedure (refer to Appendix A7 of the OACEMP) will apply. The Contractor Environmental Site Representatives are responsible for reporting on incidents.

The Contractor will immediately notify the Roads and Maritime Project Manager, Roads and Maritime Environmental Manager (or delegate) and the EPA (via the EPA environmental line) of any exceedance that has caused, is causing or is likely to cause, material harm to the environment. Roads and Maritime will notify the Secretary within 24 hours of notification of the event being provided to the EPA, as required by NSW-CoA A43. The notification will include the time, date and details of the incident and identify any non-compliance with the Infrastructure Approval.

The Contractor will provide a written report of the event to the EPA within seven days of the date on which the event occurred. The report will identify:

- the cause, time and duration of the event
- the type, volume and concentration of every pollutant discharged as a result of the event
- the name, address and business hours telephone number of the Contractor's personnel who witnessed the event
- the name, address and business hours telephone number of other witnesses to the event
- action taken by the Contractor in relation to the event, including any follow-up contact with any complainants
- details of any measure taken or proposed to be taken to prevent or mitigate against a recurrence of such an event and
- any other relevant matters.

The EPA may make a written request for further details in relation to any of the above matters if it is not satisfied with the report provided by the Contractor. The Contractor will provide such further details to the EPA within the time specified in the request.

The Contractor will also complete an incident form for submission to the Roads and Maritime Project Manager and Roads and Maritime Environmental Manager (or delegate) within three business days of the occurrence of the event.

Notification of incidents other than those relating to the POEO Act, will be provided to Secretary as soon as practicable and within 24 hours of the incident, in accordance with NSW-CoA A40.

Any notifications made under NSW-CoA 40 or 43 will also be provided to the Minister for DoEE.

5.4 EPL reporting

The EPL for the Project does not specify air quality thresholds for compliance reporting, however it does specify other requirements that must be complied with by the Contractor. Contractor Environmental Site Representatives will prepare a summary of air quality monitoring program results, a statement of compliance with the EPL requirements identified in Section 1.5, and a summary of complaints received related to air quality issues, for inclusion in the annual EPL return. EPL annual returns will be prepared for each stage of the

Project for which there is an EPL and submitted to the EPA within 60 days of the anniversary of the EPL for the duration of Construction.

5.5 Project Sustainability Reporting

As part of the Quarterly Project Sustainability Report, the Contractors will report on the conformity, or otherwise, of mobile non-road diesel plant and equipment used for Construction of the Project with the relevant United States Environmental Protection Agency, European Union (EU) standards or approved equivalent emission standards. The report will be prepared in in accordance with the GREP "Clean Air data management tool". The types of diesel plant and equipment that are to be included, or excluded, from the report are outlined in the GREP tool, which is available at: http://www.rms.nsw.gov.au/documents/about/environment/grepclean-air-data-management-tool.xlsm.

5.6 Complaints management and reporting

In response to dust complaints, the Contractors will undertake an investigation of the complaint including an assessment of operations, weather conditions and visual observation of impact. The Contractors will review the efficiency of dust mitigation measures and identify additional mitigation measures if required.

Recording and reporting of complaints will be undertaken in accordance with the Complaints Management System (refer to Section 5.5.3 of the OACEMP).

The Contractor will submit a report to the EPA that provides details of all complaints received in relation to Construction activities regulated by the Contractor on the telephone complaints line or through any other means by 2:00 pm each business day. The report will:

- be submitted to the email address nominated by the EPA
- include a unique identifier number for each complainant
- include date and time as reported by the complainant of the event that is the subject of the complaint
- include the method by which the complaint was made
- include any personal details of the complainant which were provided by the complainant or, if no such details were provided, a note to that effect
- include an outline of the work or activity that is the subject of the complaint
- include the complaints received between 12:00 am and 12:00 pm
- include the action taken in relation to the complaint, including any follow-up contact with the complainant, or if no action was taken, the reasons why no action was taken.

The Contractor is not required to submit a report for any reporting period during which no complaints have been received.

6 Adaptive management

Where air quality monitoring results directly attributable to the Project exceed the criteria set out in Section 2 of this Construction Air Quality Monitoring Program or where results of monitoring are unsatisfactory, the following steps will be undertaken:

- analysis of the results by the Contractor Environmental Site Representative in more detail with a view of determining possible causes for the exceedance, including identifying the Project stage (or stages) causing the issue
- site inspection by the Contractor Environmental Site Representative
- advising relevant personnel of the problem
- identifying and agreeing on actions and/or additional mitigation measures to resolve or mitigate the exceedance
- implementing actions to rectify or mitigate the exceedance, including stopping work where necessary or if directed by the ER
- identifying and implementing additional mitigation measures.

Where air quality criteria are exceeded, the source of excessive air pollutants will be identified and, where available, additional measures will be implemented to either reduce emissions or reduce the impacts on receivers. Mitigation measures and preventative / corrective actions will be developed in accordance with Roads and Maritime specifications and the procedure for dealing with non-compliance with environmental management controls outlined in Section 6.6 of the OACEMP. The Contractors will be required to verify and document the effectiveness of any management measures or preventative / corrective actions implemented to avoid further exceedances.

The Contractors will communicate regularly with other high risk Construction sites within 500 m of the site boundary, to ensure plans are co-ordinated and cumulative air quality (e.g. airborne and/or settled dust and emissions) impacts are minimised.

The timing for any improvement will be agreed between the relevant Contractor Project Engineer/Superintendent and Roads and Maritime Project Manager and Roads and Maritime Environmental Manager (or delegate) based on the level of risk or reoccurrence of the exceedance (e.g. a significant risk will require immediate action).

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