



Air Quality and Greenhouse Gas Management Plan

August 2023

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DOCUMENT CONTROL

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	3	Myuna Independent Environmental Audit	Minor amendments to incorporate audit recommendations
	4	Northern Coal Services Independent Environmental Audit	Amendment to Trigger Response Action Plan following audit recommendations.
	5	Awaba Colliery Annual Review	Inclusion of Awaba Colliery within the Regional Management Plan.
	6	Myuna Independent Environmental Audit 2022	Update to Myuna Colliery monitoring program
	7	Change of operations at Awaba Colliery	Update to Awaba Colliery monitoring program

Abbreviations

AR	Annual Review (formerly known as Annual Environmental Monitoring Report)
AQGHGMP	Air Quality and Greenhouse Gas Management Plan
CCL	Consolidated Coal Lease
CO₂	Carbon dioxide
CO₂e	Carbon dioxide equivalent
DPIE	Department of Planning, Industry & Environment (formally the Department of Planning and Environment)
EIS	Environmental Impact Assessment
EPA	Environment Protection Authority
EPL	Environment Protection Licence
EMS	Environmental Management Strategy
GHG	Greenhouse Gas
LGA	Local Government Area
ML	Mining Lease
Mtpa	Million Tonnes per Annum
NGER	National Greenhouse and Energy Reporting Act 2007
NSW	New South Wales
PM	Particulate Matter
PM₁₀	Particulate Matter with an equivalent aerodynamic diameter of 10 microns (one millionth of a metre) or less
PM_{2.5}	Particulate Matter with an equivalent aerodynamic diameter of 2.5 microns (one millionth of a metre) or less
POEO Act	Protection of the Environment Operations Act 1997
ROM	Run of Mine
TEOM	Tapered Element Oscillating Microbalance
TSP	Total Suspended Particulate matter
µg/m³	micrograms (one millionth of a gram) per cubic metre

1.1 Introduction

1.2 Commitment and policy

Centennial Coal Company (Centennial) is a coal mining company supplying thermal and coking coal to the domestic and export markets. Centennial is a major fuel supplier to the New South Wales (NSW) energy industry, fuelling approximately 40% of the State's coal-fired electricity.

Centennial is one of the largest underground coal producers in NSW and, as part of Banpu, a member of the largest independent pan-Asian coal group. Centennial's northern region operations, located in the Lake Macquarie and Wyong Local Government Areas (LGAs), include Mandalong Mine, Myuna Colliery, Awaba Colliery, Newstan Colliery, and Northern Coal Services.

1.3 Objectives

The purpose of this Air Quality and Greenhouse Gas Management Plan (AQGHGMP) is to ensure that operational and construction air quality impacts on the local community are minimised, appropriate management measures identified and response protocols detailed should air quality criteria be exceeded. This AQGHGMP has been developed to:

- address the Conditions of Approval (CoA) and Environmental Protection Licence (EPL) for the northern region operations in relation to air quality and greenhouse gas;
- identify air quality impact pathways from Centennial operations in the northern region;
- provide a description of air quality management measures implemented across these operations;
- outline air quality monitoring requirements and standards; and
- provide a procedure to manage and respond to complaints relating to air quality or a measured air quality incident;

1.4 EMS integration

This AQGHGMP is part of the Environmental Management Strategy (EMS) that has been developed for each operation.

1.5 Management plan approach

Air quality and greenhouse gas emissions from Centennial's operations within the northern region have, historically, been individually managed. A 'regional' approach has been adopted in preparation of this AQGHGMP. The aims of adopting a regional approach to the management and monitoring of air and greenhouse gas emissions include the following:

- provide consistent and consolidated management measures and procedures across all sites;
- management of 'airshed' emissions, rather than focusing on individual operations; and

- rationalise monitoring procedures and locations with consideration of ‘airshed’ emissions.

A ‘short term’ and ‘long term’ approach has also been adopted, acknowledging that some changes will take time and require discussions and approval from the relevant authorities. The short term plans would be implemented immediately, with a transitional period for some operations to achieve the long term approach.

The AQGHGMP outlines the management and monitoring measures that will be implemented at all operations. Specific requirements for each operation are provided in **Appendix A** to **Appendix C** and **Appendix E**.

1.6 Scope

This AQGHGMP has been prepared in accordance with the respective operations CoA and requirements of the sites EPL to manage air quality impacts to private receivers and the wider environment from mining operations and associated mining related activities within Centennial’s northern region.

1.7 Site operations

Figure 1 shows the location of each operation within the northern region.

A brief overview of each operation within Centennial’s northern region is provided in the sub-sections below.

1.7.1 Awaba Colliery

Awaba Colliery is a former underground coal mine operation owned by Centennial Newstan Pty Ltd (Centennial Newstan). It is located on the western side of Lake Macquarie approximately 30 km south-west of Newcastle. The mine was originally state owned and began operating in 1947 supplying coal to Wangi Wangi Power Station for state-wide electricity generation. Coal production at Awaba Colliery ceased in March 2012. Awaba Colliery is now closed with all coal reserves exhausted. The mine is sealed and there is no access to the underground workings.

1.7.2 Mandalong Mine

Mandalong Mine is an existing underground coal mine operation located approximately 35 kilometres south-west of Newcastle and approximately 130 kilometres north of Sydney within the Lake Macquarie and Wyong Local Government Areas. Underground longwall mining operations commenced at Mandalong Mine in January 2005. Current approvals authorise the extraction of up to 6.5 million tonnes of coal per annum using a combination of continuous miner and longwall mining methods. The key infrastructure at the Mandalong Mine comprises the surface infrastructure including administration buildings, workshop and mine ventilation facilities at the Mandalong Mine Access Site, the ventilation facilities at the Cooranbong Entry Site and proposed new ventilation and mine support infrastructure at the Mandalong South Surface Site. An underground coal delivery system links Mandalong Mine to Delta Entry Site, where coal is handled before being transported to the Vales Point Power Station by the Delta Electricity overland conveyor. The underground coal

delivery system and the handling and transport of coal at Delta Entry Site are approved under separate Development Consents.

1.7.3 Myuna Colliery

Myuna Colliery is an underground coal mine located approximately 25 kilometres south-west of Newcastle, and approximately 135 kilometres north of Sydney within the Lake Macquarie and Wyong Local Government Areas. The development of Myuna Colliery commenced in 1979 and underground mining using bord and pillar mining methods commenced in 1982. Current approvals authorise the extraction of up to 3 million tonnes of coal per annum using bord and pillar mining methods. The key infrastructure at the Myuna Colliery surface facilities area comprises administration buildings, bathhouse, workshop, coal handling infrastructure and mine ventilation infrastructure. All coal is transported directly from the Myuna Colliery surface facilities area to the Eraring Power Station via a dedicated overland conveyor owned and operated by Origin Energy.

1.7.4 Newstan Colliery

Newstan Colliery is an existing underground coal mine located approximately 25 kilometres south-west of Newcastle and 140 kilometres north of Sydney within the Lake Macquarie Local Government Area. Newstan Colliery began mining operations in 1887. Current approvals authorise the extraction of up to 4 million tonnes of coal per annum using a combination of continuous miner and longwall mining methods. The key infrastructure at the Newstan Colliery comprises the ventilation facilities at the Newstan Colliery Surface Site and at the Main Ventilation Fan Site which is located approximately 365 metres west north-west of the Awaba Colliery Surface Site. Additional mine support infrastructure is located at the Newstan Services compound (located approximately 550 metres north north-west of the Awaba Colliery Surface Site) and at the Forest Road Site located off Forest Road at Awaba.

1.7.5 Northern Coal Services

Northern Coal Services operations are located on the western side of Lake Macquarie approximately 25 kilometres south-west of Newcastle and 140 kilometres north of Sydney in New South Wales (NSW). The Northern Coal Services operations comprises the water management and surface coal handling and processing facilities at the Newstan Colliery Surface Site and Mandalong Mine - Cooranbong Entry Site (Cooranbong Entry Site), along with existing private haul roads and rail loading infrastructure. The facilities of the Northern Coal Services operations are used by Centennial to process and wash coal from Mandalong and Newstan mines and to facilitate the distribution of coal to local power stations via private haul roads and rail, and also transport coal for export to the ports of Newcastle or Port Kembla by rail.



Service Layer Credits: © Land and Property Information (a division of the Department of Finance and Services) 2012

1:120,000 for A4 0 500 1,000 2,000 3,000 4,000 Metres Map Projection: Universal Transverse Mercator Horizontal Datum: Geodetic Datum of Australia 1994 Grid: Map Grid of Australia, Zone 56		LEGEND Suburb Haul Road Sensitive receiver	
© 2016. Whilst every care has been taken to prepare this map, Centennial Coal Company Limited and GHD (DATA CUSTODIAN) make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.		Centennial Coal Northern Region Environmental Monitoring Operation Locations and Sensitive Receivers	
LOCATION - DRAWN T.M CHECKED A.R APPROVED SCALE refer to scalebar		Centennial Coal DATE 17/03/2016 Figure 1	

GIS Filename: G:\2218129\GIS\Maps\Deliverables\LongTerm\2218129_NLT007_LongTerm_Overview_ReceiversOnly_0.mxd

Data source: LPI: DTDB / DCDB / Aerial Imagery, 2012. Created by:tmorton

1.8 Approvals and licensing requirements

Centennial conducts its operations in accordance with relevant legislation and regulatory requirements. Legislative and regulatory requirements are generally recognised through the imposition of CoA and various licences or mining approvals.

Centennial operates under a number of different approvals including:

- CoA issued by the Department of Planning and Environment (DPE);
- Environment Protection Licence (EPL) issued by the NSW Environment Protection Authority (EPA);
- a Rehabilitation Management Plan (RMP) in accordance with the requirements of the Resources Regulator (RR);
- mining tenements issued by the RR; and
- water licences and approvals issued by Water NSW.

1.8.1 Development Consents and Planning Approvals

A summary of the relevant Development Consents and Planning Approvals for each respective northern operation is listed in **Table 2-1**. The site specific development consent and approval conditions that the AQGHGMP has been prepared to address appear in the site specific Appendices A to C and Appendix E.

Table 2-1 - Development Consents/Planning Approvals

Site	Development Consent/Planning Approval ID
Awaba Colliery	PA 10_0038
Mandalong Mine	SSD 5144
	DA 35-2-2004
Myuna Colliery	PA 10_0080
Newstan Colliery	DA 73-11-98
Northern Coal Services	SSD 5145

Table 2-2 details the Management Plan requirements condition in the development approvals and where these are addressed in the Management Plan. Note the wording of this condition may vary slightly in different approvals.

Table 2-2 - Development Approval Management Plan Condition

Development Approval Management Plan Requirements	
The Applicant / Proponent must / shall ensure that the management plans required under this consent / approval are prepared in accordance with any relevant guidelines, and include:	
detailed baseline data;	Section 2
a description of: - the relevant statutory requirements (including any relevant approval, licence or lease conditions); - any relevant limits or performance measures/criteria; - the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the project or any management measures;	Section 1.8 Section 1.9 Site specific appendices
a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;	Section 3 Site specific appendices
a program to monitor and report on the: - impacts and environmental performance of the project; - effectiveness of any management measures (see c above);	Section 4 Site specific appendices
a contingency plan to manage any unpredicted impacts and their consequences (<i>and to ensure that ongoing impacts reduce to levels below relevant impact assessment criteria as quickly as possible</i>)*;	Section 5
<i>a program to investigate and implement ways to improve the environmental performance of the development over time</i> *;	Sections 5 and 6 Site specific appendices
a protocol for managing and reporting any: - incidents; - complaints; - non-compliances with statutory requirements; and - exceedances of the impact assessment criteria and/or performance criteria; and	Section 6

a protocol for periodic review of the plan.	Section 9
<i>Note: The Secretary may waive some of these requirements if they are unnecessary or unwarranted for particular management plans.</i>	Note

* requirement not in every development approval.

1.8.2 Environment Protection Licences

A summary of the relevant EPLs for each respective northern operation is listed in **Table 2-3**.

Table 2-3 - Environment Protection Licences

Site	EPL ID
Awaba Colliery	EPL 443
Mandalong Mine	EPL 365
Myuna Colliery	EPL 366
Newstan Colliery	EPL 395
Northern Coal Services	EPL 395 and EPL 365

1.8.3 Mining Leases

A summary of the relevant Mining Leases and Exploration Licences for each respective northern operation is listed in **Table 2-4**.

Table 2-4 - Mining Leases and Exploration Licences and Mineral Authorities

Site	ML/EL and Mineral Authority ID
Mandalong Mine	MPL191, ML1744, ML1543, CCL762, ML1443, ML1553, ML1431, ML1722, EL4968, A404, EL4969, EL5892, EL6317, EL4443
Myuna Colliery	ML1370, ML1632, MPL 334, EL4444, EL6640
Northern Coal Services	CCL727, CCL746, CCL762, CCL763, CCL764, ML1480, ML1587, MPL191, MPL304, MPL305, MPL327, MPL329
Awaba Colliery/Newstan Colliery	CCL746, MPL328, ML1380, ML1480, ML1452, CCL764, ML1586, CCL727, CCL763, PLL497,

	ML1587, EL5138, A399, EL6641, MPL304, MPL305, MPL327
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1.9 Performance criteria, limits and goals

Air quality and GHG performance criteria are provided in the Development Consent or Project Approval for each operation.

1.9.1 Air quality

The same air quality criteria apply across all operations in the northern region consistent with the National Environment Protection (Ambient Air Quality) Measure (NEPM) and *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (DEC 2005) (*Approved Methods*).

The desired outcomes of the NEPM goals are for “ambient air quality that allows for the adequate protection of human health and well-being”. The ambient air quality NEPM has been developed for the protection of human health. Whilst exceedence of these levels may not lead to unacceptable health outcomes (as reflected in the PM₁₀ standard itself, which allows for five exceedences per year), it is appropriate that the NEPM standards be used as a platform for developing regulatory limits and management targets.

The air quality criteria contained within the various Development Consent or Project Approval is shown below. As noted above the same criteria applies to all operations:

The Applicant must ensure that all reasonable and feasible avoidance and mitigation measures are employed so that particulate matter emissions generated by the development do not cause exceedances of the criteria at any residence on privately-owned land.

Table 2-5 - Air quality criteria

Pollutant	Averaging period	Criteria
Particulate Matter < 10 µm (PM ₁₀)	Annual	^{a,d} 30 µg/m ³ (SSD-5145 25 µg/m ³)
Particulate Matter < 10 µm (PM ₁₀)	24 hour	^b 50 µg/m ³
Total suspended particulates (TSP)	Annual	^{a,d} 90 µg/m ³
^c Deposited dust	Annual	^b 2 g/m ² /month above background ^{a,d} 4 g/m ² /month cumulative

Notes to **Table 2-5**:

a) Cumulative impact (i.e. increase in concentrations due to the development plus background concentrations due to all other sources).

b) *Incremental impact (i.e. increase in concentrations due to the development alone, with zero allowable exceedances of the criteria over the life of the development.*

c) *Deposited dust is to be assessed as insoluble solids as defined by the NSW EPA Approved Method AM-19 and Standards Australia, AS/NZS 3580.10.1:2003: Methods for Sampling and Analysis of Ambient Air - Determination of Particulate Matter - Deposited Matter - Gravimetric Method.*

d) *Excludes extraordinary events such as bushfires, prescribed burning, dust storms, fire incidents or any other activity agreed by the Secretary.*

e) *“Reasonable and feasible avoidance measures” includes, but is not limited to, the operational requirements in conditions 9 and 10 to develop and implement an air quality management system that ensures operational responses to the risks of exceedance of the criteria.*

1.9.1.1 PM_{2.5}

Exposure to particulate Matter < 2.5 µm (PM_{2.5}) is a concern due to the potential for adverse health impacts. The *Approved Methods* do not set assessment goals for PM_{2.5} and no limits are provided in CoA for the Northern operations. However, many CoA require PM_{2.5} monitoring. As such, an assessment reference is required.

The NEPM standards provide an Interim Advisory Reporting Standard for PM_{2.5}, shown in **Table 2-6**. These goals have been adopted by Centennial in the assessment of measure PM_{2.5} concentrations.

Table 2-6 – PM_{2.5} NEPM Advisory Reporting Standard

Pollutant	Averaging period	Criteria
Particulate Matter < 2.5 µm (PM _{2.5})	Annual	8 µg/m ³
Particulate Matter < 2.5 µm (PM _{2.5})	24 hour	25 µg/m ³

1.9.2 Greenhouse Gas

The legislative framework for Greenhouse and Energy reporting is the:

- *National Greenhouse and Energy Reporting Act 2007*
- *National Greenhouse and Energy Reporting Regulations 2008; and*
- *National Greenhouse and Energy Reporting (Measurement) Determination 2008 (as amended).*

The National Greenhouse and Energy Reporting Act 2007 (NGER Act) introduced a single national framework for reporting and providing company information regarding greenhouse gas emissions, energy production and energy consumption. The NGER Measurement Determination (as amended) was made under the NGER Act to provide for the measurement of greenhouse gas emissions arising from the operation of facilities and the energy production and energy consumption arising from the operation of facilities.

The objectives of the NGER Act are to:

- inform government policy;
- inform the Australian public;
- help meet Australia's international reporting obligations;
- assist Commonwealth, state and territory government programs and activities; and
- avoid duplication of similar reporting requirements in the states and territories.

Centennial is the 'Controlling Corporation' and exceeds the controlling corporation emissions threshold (50,000 CO_{2e}T) and therefore is required to report its greenhouse gas (GHG) emissions, energy used and produced from all facilities in accordance with the NGER Act (see Section 4.6.3).

2 Existing environment

2.1 Meteorology

The geographical area of the northern region operations is within a 'temperate' climatic zone. The subclass for the region is mostly 'no dry season', due to the low variation month to month in average rainfall, and 'hot summer'. Otherwise, the 'no dry season' sub-class has isolated pockets of 'warm summer' due to proximity to the coast.

While the northern region operations are close to the coast, the Great Dividing Ranges themselves are capable of providing some protection of prevailing winds.

Winter westerly winds are a dominate feature as the sub-tropical ridge migrates to the north before spending a greater time to the south for the warmer months. Local winds associated with funnelling through valley systems produces local effects that mask the more regional to synoptic scale weather patterns. Therefore, most winds during the cooler months (winter plus the latter part of autumn and the earlier part of spring) are from the south-west or north-west quadrant, depending on local valley funnelling effects.

A reversal occurs for the warmer months with a more easterly component as the sub-tropical ridge migrates to the south and land surfaces warm up (to give a greater contrast to the Tasman Sea water temperature). East to north-east winds become dominant, with some localised valley funnelling to the south-east quadrant, and can be quicker than in winter in areas with coastal exposure bringing sea breezes and sheltering from any pre-frontal westerlies (the same Great Dividing Ranges protection also diminishes the winter westerlies average wind strength).

Average annual rainfall is over the 1 m mark mostly due to the coastal influence and any moist easterlies experiences orographic lifting (winds forced higher by the ranges to the west) leading to enhanced precipitation. Summer rain events can be heavier due to enhanced convective activity, assisted by warmer surface temperatures, and result in these months having slightly higher monthly rainfall averages than the rest of the year. East coast lows may form at any time of the year and provide extreme rainfall events when they occur on an ad-hoc basis.

2.2 Sensitive receivers

Sensitive receivers within the northern region predominantly consist of residential properties. Other sensitive receivers include educational facilities such as Fassifern Public School.

Residential areas or rural properties are located around all operations within the northern region, as shown in **Figure 1**. More urbanised residential properties are concentrated in areas such as Fassifern (Newstan Colliery) and Wangi Wangi (Myuna Colliery).

A detailed map of residential properties surrounding each operation within the northern region is provided in each site appendix – **Appendix A to Appendix E**.

2.3 Baseline dust levels

Dust monitoring has been undertaken by Centennial in the northern region for many years. Long term trends in deposited dust have been established around all operations, inclusive of background reference levels.

Baseline dust levels are measured to provide an indication of regional 'airshed' dust levels, without direct impact from mining operations. Results from dust gauges located to measure impacts from mining operations can then be compared to baseline dust levels in order to determine the incremental impact from mining operations. Baseline dust gauges are typically located upwind from a mine or separated from operations in order to minimise the impact from local mining operations.

Dust monitoring sites that have been established to specifically monitor background/baseline dust levels are detailed in the individual site appendices.

2.4 Baseline GHG levels

The Australian Government introduced the Emissions Reduction Fund (ERF) in December 2014. It comprises three elements:

- crediting – incorporating identification of potential emission reductions and estimate them using approved “methods” (additional to business- as-usual);
- purchasing – sell these credits at auction; and
- Safeguard Mechanism – to ensure that reduction paid for through the crediting and purchasing elements of the ERF are not displaced by increases above Business as usual (BAU) elsewhere in the economy.

The Safeguard Mechanism applies to facilities with scope 1 (direct) emissions of >100,000 CO_{2e}T per annum.

The Safeguard Mechanism commenced on 1 July 2016 and requires those facilities that meet the threshold to keep emissions within baseline levels. Simple baselines will be set at the highest level of reported emissions for a facility over the historical period 2009-10 to 2013-14.

Multi-year monitoring will allow a facility to exceed its baseline in one year, so long as average emissions over two or three years are below the baseline. A process for new investments and expansions also exists under the scheme.

3 Management measures

Dust is a generic term used to describe fine particles that are suspended in the atmosphere. Deposited dust refers to any dust that falls out of suspension from the atmosphere. Activities that have been identified as possible sources of dust emissions are identified through the Annual Environmental Risk Assessment and include:

- wind erosion from coal stockpiles;
- wind erosion from disturbed areas and non-coal stockpiles;
- wheel generated dust from vehicle movements;
- fugitive emissions from coal handling and processing;
- fugitive emissions through mine ventilation fans as a result of underground mining operations;
- rail loading operations;
- coal transporting activities (conveyor, truck, rail); and
- operation of mobile equipment.

The sections below outline the air quality management measures which are ‘common’ across all operations within the northern region.

Air quality management or mitigation measures which are specifically required at individual operations that are not addressed in these common measures are provided in **Appendix A** to **Appendix E**.

3.1 “Common measures”

3.1.1 Air quality

The measures outlined in **Table 3-1** are currently being implemented to minimise to the greatest extent practicable emissions to air. These measures are implemented across all operations, where applicable. Following industry-leading practice, these are a mixture of routine design and operational controls. Any operation-specific measures are provided in the relevant appendix.

Table 3-1 - Common air quality management and mitigation measures

Emission source	Emission type	Control measure
Unsealed roads	Dust	• Use of water carts to dampen trafficable areas. • Truck speeds restricted to 40 km/hour.
Coal stockpiles	Dust	• Use of water cannons/water sprays on coal stockpile, as required.
Train loading operations	Dust	• Maintaining the moisture content of the coal above the dust extinction moisture (DEM) levels. • Under loading the wagons (i.e. not fill them to capacity) to ensure the top of the coal profile is below the wagon gunwhale (sill). • Train wagons are cleaned using a water cart to remove any parasitic coal prior to the train leaving site. • Training on the risks and the correct train loading procedures are provided to all staff involved in the train loading operations.
Overland Conveyors	Dust	• A combination of partial and fully enclosed conveyors and conveyor transfer points.
Mobile Equipment	Exhaust emissions	• Regular maintenance of plant and equipment in accordance with the manufacturer's specifications to ensure optimal operating conditions.
Ventilation fans	Dust, Exhaust emissions	• Use of low sulfur diesel and diesel engines that conform to the United States EPA Tier 3 standards for exhaust emissions. • Implementation of an underground dust suppression system involving the use of water sprays on coal cutting machinery and rubber conveyor belts.
Disturbance Areas	Dust	• Timely rehabilitation of disturbed areas wherever practical

Emission source	Emission type	Control measure
Truck haulage	Dust, Exhaust emissions	• All haulage trucks entering and leaving the sites have their loads covered. • Use of low sulfur diesel in coal haulage trucks.

3.1.2 Greenhouse Gas

The following measures are currently being implemented to minimise to the greatest extent practicable GHG emissions.

An Energy and Greenhouse Management System monitors and reports energy usage. Key Performance Indicators that are tracked include energy demand and GHG emissions per tonne of ROM coal produced.

Additional measures that are implemented include:

- cost effective measures to improve energy efficiency;
- regular maintenance of plant and equipment to minimise fuel consumption; and
- consideration of energy efficiency in plant and equipment selection.

Centennial has been investigating greenhouse emission reduction options for a number of years. Greenhouse emissions arise from our operations from the use of energy (fuel and electricity) and the release of dilute methane gas from ventilation fans to the atmosphere known as Ventilation Air Methane (VAM).

Centennial has a Climate Change Management Strategy and System that aims to achieve the Climate Change Policy objectives.

The overall Strategy is to:

- minimise emissions at least cost; and
- maximise the value from beneficial reuse of gas.

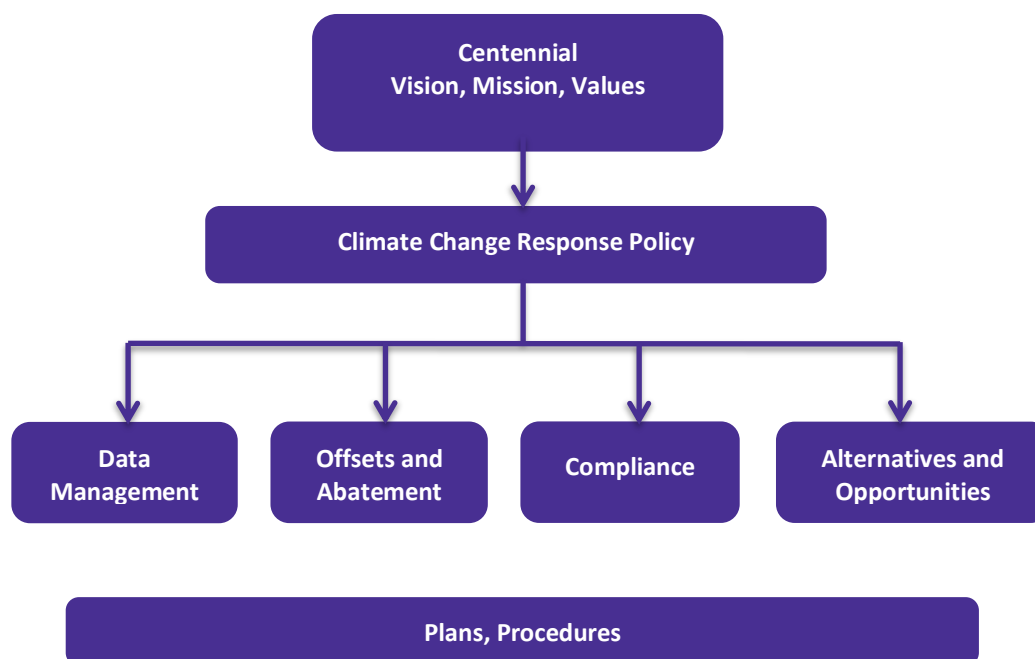


Figure 2 - Centennial GHG management system framework

3.2 Proactive planning

3.2.1 Air quality

A number of measures are implemented to proactively plan and manage air quality emissions from the northern region operations. Measures implemented by Centennial include:

- a region-wide monitoring rationalisation to make more use of real-time dust monitoring to provide more informative data and enable more timely response to incidents;
- regular (annual) reviews of monitoring and management measures; and
- impact assessments of future changes/expansions
- Pollution Reduction Programs.

3.2.2 Greenhouse Gas

As part of Centennial's Sustainability Strategy, Centennial has set its "Vision 2020", the platform to tangibly deliver the Company Vision and Values. Vision 2020 incorporates a target for GHG, being to reduce our greenhouse gas emissions by 25% by 2020. An action plan and roadmap is in place to deliver this goal.

4 Monitoring program

4.1 Objective

The objective of the dust monitoring programme is to provide data, both real time and long term (trend data), to identify the dust impact and to assist with the identification and management of dust emissions from Centennial's northern region operations.

Dust monitoring enables Centennial to assess compliance with the legislative and regulatory requirements.

The results of the monitoring programme will be used to review and improve Centennial's operational dust management practices.

4.2 Monitoring standards

Dust monitoring is undertaken in accordance with the following standards:

- NSW EPA Approved Method AM-1;
- NSW EPA Approved Method AM-19;
- AS/NZS 3580.10.1:2003 Methods for sampling and analysis of ambient air Determination of particulate matter Deposited matter Gravimetric method
- NSW EPA Approved Method AM-15;
- NSW EPA Approved Method AM-18;
- NSW EPA Approved Method AM-22;
- NSW EPA Approved Method TM-11;
- NSW EPA Approved Method TM-32;
- NSW EPA Approved Method TM-34;
- AS/NZS 3580.9.11:2008 Methods for sampling and analysis of ambient air - Determination of suspended particulate matter – PM10 beta attenuation monitors.

Meteorological monitoring is undertaken in accordance with the following standard and guideline:

- NSW EPA Approved Method AM-2; and
- NSW EPA Approved Method AM-4

NATA accredited laboratories are used for analysis of field samples where required.

4.3 Monitoring methods

Dust monitoring is undertaken to assist in quantifying the impact of dust from operations and assess incremental and cumulative dust levels against regulatory requirements. Monitoring is typically undertaken nearby site boundaries, at sensitive receiver (i.e. residence) locations, or at a representative location on the transect between the source and receptor.

Off-site dust monitoring locations are selected based on those sensitive receivers predicted to have the highest level of impact (typically based on predictive modelling from impact assessment reports).

The sections below outline the types of dust monitoring utilised by Centennial.

4.3.1 Real time dust monitoring

Real time dust monitoring allows instantaneous feedback of dust concentrations at the monitoring site. Real time feedback can allow for immediate ameliorative action to be taken if elevated dust levels are recorded and linked back to a source that can be 'managed'.

Real time monitoring is used to guide the level of dust mitigation and management implemented on site.

4.3.2 Long term dust monitoring

Long-term amenity and health impact dust impacts (over annual average) are measured using a combination of dust deposition gauges (measuring dust fall-out) and high volume air sampling (TSP/PM₁₀/PM_{2.5}) typically operated on a 1-in-6 day cycle.

Deposited dust is an indicator of the effectiveness of site dust management practices and the potential for off-site dust nuisance. Deposited dust is typically monitored in a number of locations around the site. Monitoring is conducted with dust deposition gauges that should be located both upwind and downwind of the activity area to reflect the impact of the operations during the most predominant wind directions. A more remote (from the site) dust deposition gauge(s) can be deployed to ascertain the regional (non-local, mine impacted) background levels.

Results of monitoring should not exceed 4 g/m²/month and/or no more than 2 g/m²/month above background as a rolling annual average (average of the previous 12 months). When using a network of monitors, the lowest recorded monthly value is taken to be the background (this may well be the 'background' site or the most upwind gauge for the month). If dust levels exceed this value, then site management practices should be reviewed and dust controls implemented to reduce dust levels to within these limits.

The criteria for deposited dust have been successfully used at numerous sites in New South Wales to protect the amenity of populations near landfills and quarries. The criteria in the *Approved Methods* were originally developed (and 'calibrated') using experience from coal mining operations and impacts in the Hunter Valley. Although the assessment criterion is a rolling 12-month average, the shorter-term averaging interval is set at a monthly average to enable an assessment of nuisance dust in a timely manner to ensure that people's amenity is not adversely impacted and a review of the AQGHGMP. If the criteria are exceeded, management actions can be identified and implemented to reduce dust levels to avoid further nuisance being created.

High volume air sampling can measure total particles (TSP) or fine particulates (PM₁₀ or PM_{2.5}), depending on the sampling inlet used. The size selective inlet ensures the correct 'equivalent aerodynamic diameter' particles are captured on the filter media. Because of the high-volume nature of the inlet air (automatic flow control set at a volumetric flow of 1.3 m³/min – range 1.0 to 1.6 m³/min – for TSP and 1.13 m³/min ±10% for PM₁₀), these samplers perform far superior to low-volume

samplers. Alternative regulatory approved sampling includes a Tapered Element Oscillating Microbalance (TEOM) or Beta Attenuation Monitor (BAM) – these are particularly useful at the PM₁₀ range and to provide real-time feedback at time scales of less than 24-hour.

When assessing the regulatory requirements of daily or annual dust-in-air concentrations, the real-time nature of the measurement technique is less important – this favours high-volume sampling over TEOM or BAM.

4.3.3 Meteorological monitoring

Meteorological monitoring is used to determine prevailing regional and local weather conditions. In some situations, the monitoring can be used to guide the level of mitigation implemented on site (e.g. high winds; low rain; prevailing wind from an adverse impact direction). Historical information provides useful data in assisting in determining the source of dust (e.g. downwind/upwind) especially during the analysis of any dust events.

A standard Automatic Weather Station (AWS) used for ambient air quality purposes most often measures wind speed and direction, (dry bulb) temperature (optionally with a temperature gradient – typically 2m and 10m) and global solar radiation (optionally net radiation but this is not in the Australian Standard). Non-essential, for dust dispersion purposes, parameters included in the Australian Standard are relative humidity, atmospheric pressure and rainfall. The exposure requirements under the Australian Standards also require a minimum 10 m mast and un-fetted exposure to prevailing conditions.

4.4 Monitoring devices

Dust monitoring is typically undertaken using one or more of the following devices:

- dust deposition gauges;
- high volume air samplers;
- low volume air samplers; and
- real-time monitors of dust in air concentrations.

The following sections provide a summary of dust monitoring devices and the standard procedures for use for Centennial operations.

4.4.1 Dust deposition gauges

Dust deposition is measured using gauges. This method measures dust deposition rate and involves the passive deposition and capture of dust within a funnel and bottle arrangement. Data is usually collected over monthly periods and results are expressed in g/m²/month (i.e. the mass of dust deposited per square metre per month – the ‘standard’ month being 30 ± 2 days).

The NSW EPA Approved Method AM19-and Australian Standard AS/NZ 3580.10.1:2003 Methods for sampling and analysis of ambient air Method 10.1: Determination of particulate matter – Deposited

matter – Gravimetric method defines the measurement of deposited matter by collection in a vessel and retained (together with any rainwater over the monthly exposure period).

Dust deposition gauges are sited in accordance with the NSW EPA Approved Method AM-1. The 'vessel' in this instance is a wide mouth glass bottle of at least 4 litres. The collection funnel has a 150 mm diameter 'mouth' (with a tolerance of ± 10 mm but measured to within the nearest mm for calculation purposes). The nominal angle of the cone sides is 60 degrees. A stopper is used to seal the funnel to the collection bottle but has a groove to allow for water overflow during excessively wet months. A sturdy stand is required to support the deposition gauge so that the funnel mouth is in a horizontal plane, with minimal 'sway' and is 2.0 ± 0.2 m above ground level. An optional bird ring may be used if this is an issue at the site.

The monitoring sites will meet the requirements of the NSW EPA Approved Method AM-1 and ensure the key elements of:

- a clear sky cone of a minimum of 120 degrees (no tree branches for example above the gauge); and
- unrestricted airflow coming from the general area of the sources wishing to be measured (free of obstacles such as buildings, for example).

The principle of the technique is that, over a given sampling period, particles that settle from the ambient air are collected in a vessel together with any rainwater. The sampled mass deposition rate of deposited matter is calculated from the mass of solids obtained, the funnel cross-sectional area and the exposure period (i.e. one month).

As per the NSW EPA Approved Method AM-1 "deposited matter adhering to the inside of the funnel" is washed down into the sampling glass bottle. It is usual at this stage to exclude extraneous matter such as insects and other organic matter (e.g. leaves/twigs). As a measure of amenity impact, the *Approved Methods for Modelling and Assessment of Air Pollutants* in New South Wales uses a dust criterion which is "assessed as insoluble solids". Hence, insoluble solids from nearby sources are deposited in the gauge while comparison to background sites gives a measure of contribution from sources associated with the Project.

An example of a dust deposition gauge is shown in **Figure 3**.

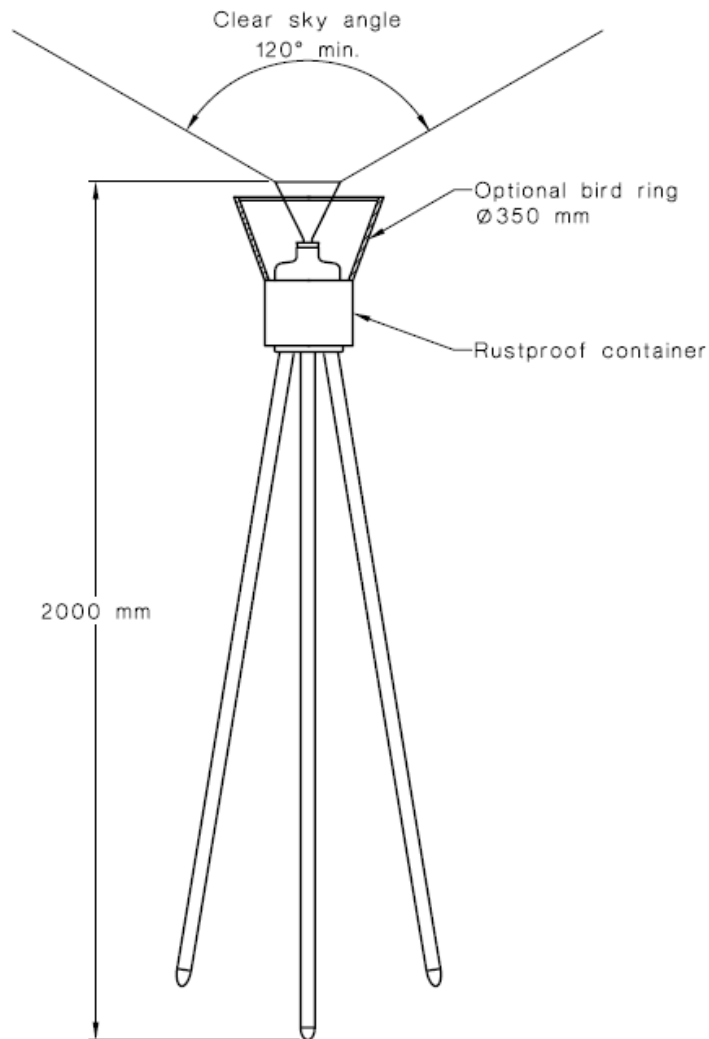


Figure 3 - Typical dust deposition stand with gauge

4.4.1.1 Monitoring procedure

Each monitoring period requires the concurrent exposure of all gauges for 30 +/- 2 days.

The following outlines the steps involved in collection of samples:

- at the end of the exposure period, remove the sample bottle and funnel from the holder;
- wash any deposited matter adhering to the inside of the funnel into the deposit gauge bottle using a minimum volume of distilled water;
- remove the funnel and seal the bottle with a lid. Identify the bottle with a label or ID (linked to the monitoring site, period of exposure and funnel diameter);
- with a chain of custody, deliver the bottle to a NATA registered laboratory for analysis. The analysis to include both soluble and insoluble matter; and
- insert the clean funnel into a fresh bottle and leave exposed for the next sample period.

Over time, a rolling 12-month average will be able to be calculated. These values for each gauge are required to be below 4.0 g/m²/month for insoluble dust. To satisfy the incremental impact criterion, the gauge with the lowest recorded value will be used as the indicator of 'background'. The calculation of the increase in deposited dust can then be made at the remaining gauge(s), so that any increase exceeding 2.0 g/m²/month above the adopted background is identified and that event is used as a trigger to audit the dust management practices for the site or region.

4.4.2 High volume samplers

High-volume air samplers (HVAS) draw precise volumes of air through a filter paper of known weight for a set period of time. Filter papers are then re-weighed so the particulate loading of the air (in mg/m³) can be calculated. The paper contents can also be examined and analysed for characteristics of the mass collected – such as metal content).

HVAS draw precise volumes of air through a filter paper. The filter paper is weighed before and after the exposure period to calculate the quantity of particulates collected in a measured mass (this can then be converted to µg/m³ by knowing the volume of air sampled over the exposure period). The exposure period under NSW EPA Approved Method AM-15 is 24 hours every 6 days. The HVAS can measure Total Suspended Particulates (TSP) or be fitted with a selective inlet to measure other particle sizes, such as those less than 10 microns (PM₁₀) or less than 2.5 microns (PM_{2.5}).

4.4.3 Continuous particle monitors

Continuous or 'real-time' particle monitors can come in various forms. These measurements rely on in-direct measurement techniques as the 'standard' approved technique of direct measurement of both mass and volume is the HVAS but this is an integration over a (usually 24-hour ± 1-hour) time interval.

The fastest response, real-time indirect measurement can be achieved by light (or laser) scattering due to the particles in the air. This instrument is rather bulky and less suited to field measurement (outside of an integrated ambient Air Quality Monitoring Station (AQMS) with bottled clean air for calibration) than more compact, compromised instruments that use light or laser over shorter path lengths (DustTrak or TES Dust Master Pro, for example) The technique is reliant on the light scattering characteristics of the particles involved and this can vary significantly with particle size and density as well as prevailing atmospheric humidity. Some on-board compensation can be achieved by sample in-let heating or reference to particle counting. Moreover, generally low-volume sampling is used for field instruments and this can restrict true sampling of all passing particles.

Regulatory approval is given to the indirect measurement techniques involving TEOM's and BAM's (oscillating frequency of mass attached to a tapered element and beta attenuation, respectively). These have had equivalence studies done to compare to the robust HVAS and are deemed to be accurate enough for sub-hourly sampling (but not as short a time frame as instantaneous light scattering). Ten to thirty minute sample intervals are enough to provide data that can be used in near real-time.

The monitor(s) may be fitted with PM₁₀ size (10 micron) selective inlets. The monitor/s can be configured to record 10-minute averages of in-air PM₁₀ concentration. A "trigger level" will be

determined, an indicative level being 100 µg/m³ over a 10-minute average. These values may be 'fine-tuned' over a period of time to suit the application and site-specific characteristics. The unit/s will provide a warning via an audible or visible signal, or as a communication link (such as SMS text) when the pre-set level is triggered. If the alarm is raised, this would be a trigger to identify the source of dust generation and implement additional dust control measures immediately.

4.4.4 Meteorology stations

Installed weather stations must conform to the requirements of the NSW EPA Approved Method AM-2 and NSW EPA Approved Method AM-4. **Table 4-1** provides the instrument types and component specifications required for fully integrated Automatic Weather Stations (AWS). Specifications are applicable only where required, as per each operations CoA.

Note that an ultrasonic anemometer may optionally be used for wind speed and direction but this is for the rarely needed situation when the contribution of small eddies is important.

Exposure (to the Australian Standard) and data logging are key considerations. A minimum of a 10 m mast is required and may be a permanent fixture or temporary/relocatable as either a telescopic aluminium type (requires guy-wires 4-5 m radius from the base of the mast) or hinged steel on a pre-installed concrete base/pad.

Table 4-1 - Component specifications for an AWS

Parameter (weather element)	Instrument	Specification
Temperature – dry bulb (DBT)	Resistance Temperature Detectors (RTD)	Two – to be place at 2 m and 10 m. Each with radiation shield. Range: -10 to 50 °C Total accuracy (at 20 °C): ±0.1 °C Time constant: <45 s
Relative humidity	Hygrometer	In a naturally ventilated radiation shield at 2 m. Range: 5 to 100% RH Total accuracy (at <90%): ±2 % Total accuracy (at >90%): ±4 % Resolution: 1% Operating temperature: -10 to 55 °C

Parameter (weather element)	Instrument	Specification
Wind speed	Anemometer – mechanical device	Cups on cross-arm at 10 m Range: 0.5 to 30 m/s Total accuracy (greater of): 3% or ± 0.2 m/s Resolution: ≤ 0.25 m/s Starting threshold: ≤ 0.4 m/s Distance constant: ≤ 3 m Maximum averaging interval: 10 min Data sampling frequency: ≤ 5 s
Wind direction	Wind Vane – mechanical device	Wind vane on cross-arm at 10 m Range: 0. to 360° (output deadband $\leq 5^\circ$) Total accuracy (excluding deadband): $\pm 3^\circ$ Resolution: 1° Starting threshold: ≤ 0.5 m/s Damping ratio: 0.25 to 0.6 Maximum averaging interval: 10 min Minimum number of data samples (Yamartino calculation better at 720 over ~15 minutes): >360 @ 10 min
Rain	Tipping bucket rain gauge	Able to be mounted on level ground (small concrete slab) away from main mast. Minimum Range: 0 to 400 mm/h Total accuracy: $\pm 5\%$ (0 to 120 mm/h) Minimum resolution: 0.5 mm

Parameter (weather element)	Instrument	Specification
Net radiation	Net radiometer	Able to be arm mounted on mast at ~2 m (extending true north). Heating not required. Spectral range (overall): 200 nm to 100 μm Sensitivity: 10 μV/W/m² Response time: < 20 s Operational temperature range: -30 °C to +70 °C Field of view: 180° upper and lower sensor Non-linearity (over full range): <1 %
Barometric pressure	Barometer	Electronic device preferably with triple redundancy with automatic temperature compensation. Continuous direct-reading able to be data logged. Range: 750 to 1050 hPa Total accuracy: $\pm$3 hPa Resolution: 1 hPa Operating temperature: -10 to 55 °C

Parameter (weather element)	Instrument	Specification
Solar radiation	Pyranometer	Preferred pyranometer is a thermopile radiometer with a silicon photovoltaic detector mounted in a fully cosine-corrected miniature head. Continuous direct-reading able to be data logged. Second class (photovoltaic) pyranometers are acceptable. Response time: <60 s Zero offset (net thermal radiation): +30 W/m² Zero offset (ambient temperature): ±8 W/m² Non-stability: ±3.0 % Non-linearity: ±3.0 % Directional response: ±30 W/m² Spectral sensitivity: ±10 % Temperature response: ±8 % Tilt response: ±5 %
Instrument mast		10 m guyed or stand-alone hinged steel. Able to be guyed either on vendor supplied base plate of site constructed concrete pad (2 m by 2m). Instrument enclosure and data logger suitably housed at 1-2 m. 10 m cross arm for wind, Pyranometer and 10m DBT sensors. Lightning protection and earthed to AS/NZS 1768.

Parameter (weather element)	Instrument	Specification
Data logger		Data Acquisition System Wind speed data recorded as zero when wind speed below starting threshold. Wind direction flagged as missing when wind speed below starting threshold. Able to measure and adjust for any open space in wind vane potentiometer. Scalar and vector averaging of wind speed. Standard deviations of wind speed and wind direction (sigma-theta via Yamartino).

4.4.5 Equipment calibration

Monitoring equipment will be maintained and calibrated on a regular basis in accordance with the relevant Australian Standard. The calibration requirements for monitoring equipment are summarised below in **Table 4-2**.

Table 4-2 - Monitoring equipment calibration requirements

Equipment	Relevant Standard	Calibration frequency	Calibration description
Dust gauge	NSW EPA Approved Method AM-19 AS/NZS 3580.10.1:2003	-	N/A – NATA laboratory responsible for calibration of measuring equipment used.
HVAS	NSW EPA Approved Method AM-15 (TSP)	Various, as required	Flow calibration performed once instrument installed/relocated or following significant maintenance or repair.
		2 months	On-going recalibration of the sampler is “at intervals not exceeding two months.”

Equipment	Relevant Standard	Calibration frequency	Calibration description
	NSW EPA Approved Method AM-18 NSW EPA Approved Method AM-22 (PM10)	Annual	Annual check on Programmable time clock and elapsed time meter. Analytical balance instruments responsibility of NATA laboratory.
BAM	AS/NZS 3580.9.11	Quarterly	Check: Particle mass and Volumetric flow rate.
		Quarterly	Clean: Routine maintenance includes three-monthly cleaning of PM ₁₀ size selective air inlet and
		Annual	Check and clean: Leak check; Vacuum pump check; Clean air inlet system.
		Annual	Particle mass calibration; Volumetric flow rate calibration; Pressure transducer check and calibration; Temperature sensor check and calibration; Zero check.
		As required	The measurement chamber should be changed after advice from BAM manufacturer (depends on 'dustiness' of ambient conditions).
TEOM	NSW EPA Approved Method AM-22	6 months	Flow controller software calibration; Flow audit (main and auxiliary).
		Annual	A mass transducer calibration occurs whenever the instrument is relocated to a new site and then annually.
		Annual	Annually: Analog input/output calibration; Flow controller hardware calibration; Ambient pressure and temperature calibrations; Mass calibration verification; Zero air noise level check.

Equipment	Relevant Standard	Calibration frequency	Calibration description
Other real-time dust monitors. E.g. TES Dust Master Pro	ISO12103-1 international standards	Annual	Fully calibrated to ISO12103-1 international standards by supplier before leaving factory. Fully sealed and pre-calibrated field replaceable optics block. Annual factory calibration of replacement optical engine and two new pumps. Additionally, if the laser diode fails or the laser light level falls below a set threshold, then a new optics block is retro-fitted. 37 mm filter cartridges used for periodic gravimetric sampling to calibrate site specific 'K-Factor'. A total of 6 different dust/aerosol user-stored, specific calibration factors can be easily switched to optimize measurements of different dusts on different sites/situations.
Meteorological station	NSW EPA Approved Method AM-2 And NSW EPA Approved Method AM-4	As required	Wind sensor orientation to true north at installation/changeover.
		Monthly	Sensor inspection and cleaning (material deposited on the 'upward' facing surface) shall occur no longer than monthly.
		3 months	A site inspection should be conducted at an interval not exceeding three months: review recorded data; physical damage; anemometer zero check; true north alignment
		3 months	Rainfall: The tipping bucket funnel and tipping apparatus shall be checked and cleaned at an interval not exceeding three months.
		6 months	Ambient temperature: Single point <i>in situ</i> every 6 months.

Equipment	Relevant Standard	Calibration frequency	Calibration description
		6 months	Relative humidity. Operational precision check every 6 months.
		6 months	Atmospheric pressure. Electronic barometers shall undergo an initial calibration (certificate at time of installation). An operational precision check shall be carried out at an interval not exceeding six months . This in situ single point precision test can be via using a remote barometer (nearest BoM station adjusted for height) or with a transfer standard barometer.
		Annual	Global solar radiation. Pyranometers shall undergo an initial calibration (certificate at time of installation). Pyranometers shall be recalibrated at an interval not exceeding 12 months. This is performed by returning the sensor to the manufacturer so just swap instruments annually.
		Annual	Ambient temperature: Three point annually.
		Annual	Relative humidity. Three point calibration with test atmosphere annually. Alternatively, swap RH probe on an annual basis with calibration certificate from supplier.

Equipment	Relevant Standard	Calibration frequency	Calibration description
		Annual	Rainfall. An operational precision check upon installation and then annually (by introduction of known volumes of water at a controlled rate).
		2 years	Wind speed and direction. Once an initial calibration has been performed, wind speed and direction sensors shall be checked and recalibrated at an interval not exceeding two years.

4.5 Monitoring program summary

Centennial operate a comprehensive monitoring program in the northern region involving numerous dust gauges, HVAS, real-time dust monitors and meteorological stations. This monitoring program allows Centennial to quantify dust impacts from northern region operations at sensitive receiver locations for analysis and comparison of the environmental performance against relevant CoA and EPL's. The monitoring program also allows for the effectiveness of environmental management measures to be measured.

A summary table of all existing dust monitoring undertaken in Centennials northern region is provided in **Table 4-3** and shown on **Figure 4**. The values in **Table 4-3** represent the short-term monitoring program. The long term dust monitoring programme is summarised in **Table 4-4** and shown on **Figure 5**. As of January 2023 Myuna Colliery has adopted the long-term monitoring program.

Table 4-3 - Short term dust monitoring summary

Operation	Location	Dust gauges	HVAS	Real-time monitor	Meteorology station
Awaba Colliery	Awaba Colliery	NA	NA	NA	NA
Mandalong Mine	Mandalong Mine Access Site (incl. Delta Entry Site)	10	2	-	1
	Mandalong South Surface Site	3	-	-	-

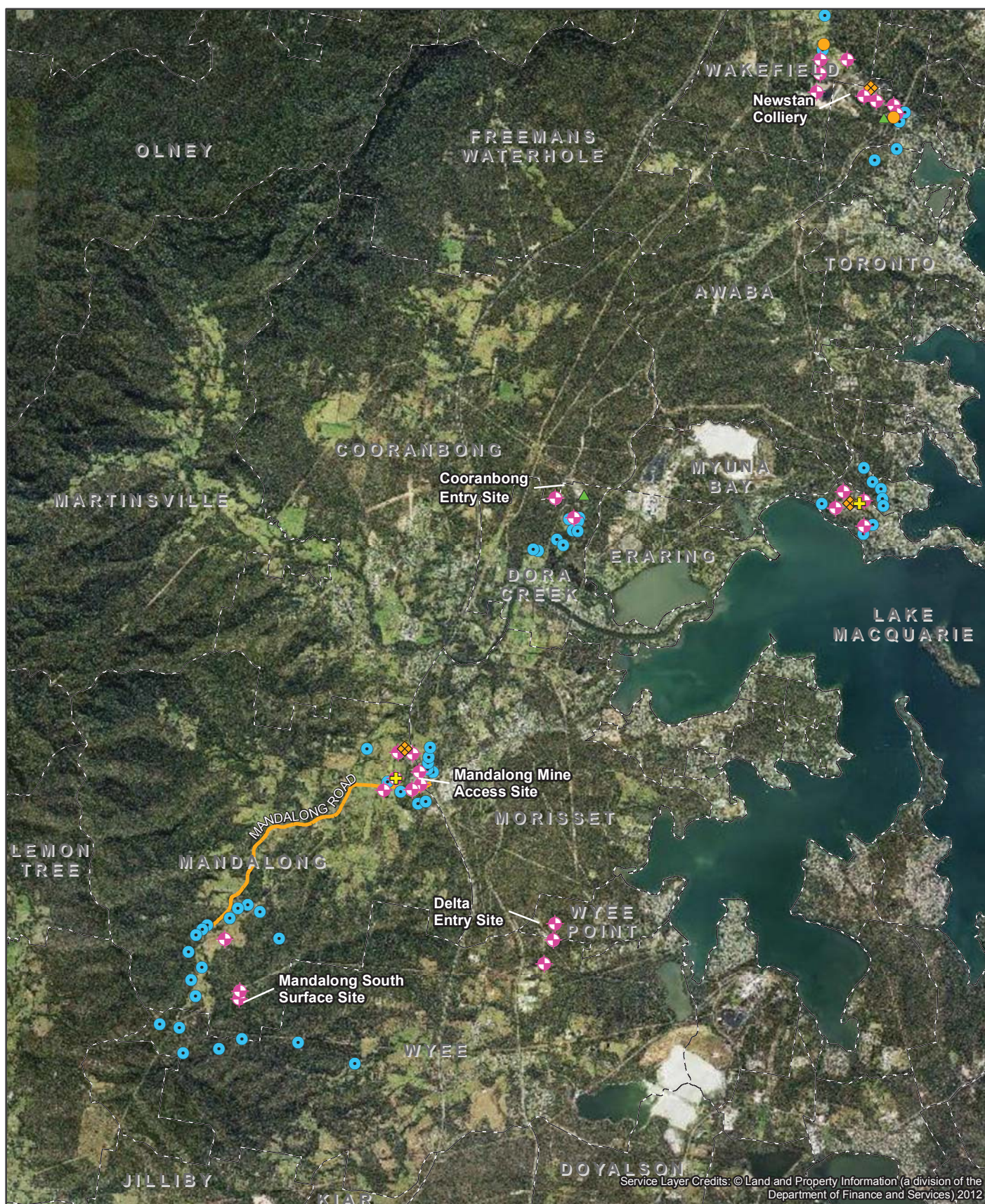
Operation	Location	Dust gauges	HVAS	Real-time monitor	Meteorology station
Myuna Colliery	Myuna Colliery	NA	NA	-	NA
Northern Coal Services*	Cooranbong Entry Site	2	-	2	-
	Newstan Colliery	8	6	1	1

* Haul roads have not been identified as a significant dust source. No additional dust monitoring required.

Table 4-4 - Long term dust monitoring summary

Operation	Location	Dust gauges	HVAS	Real-time monitor	Meteorology station
Awaba Colliery	Awaba Colliery	4	1	0	0
Mandalong Mine	Mandalong Mine Access Site (incl. Delta Entry Site)	4	2	-	1
	Mandalong South Surface Site	2	-	-	-
Myuna Colliery	Myuna Colliery	3	1	-	1
Northern Coal Services*	Cooranbong Entry Site	1	-	1	-
	Newstan Colliery	2	3	1	1

* Haul roads have not been identified as a significant dust source. No additional dust monitoring required.

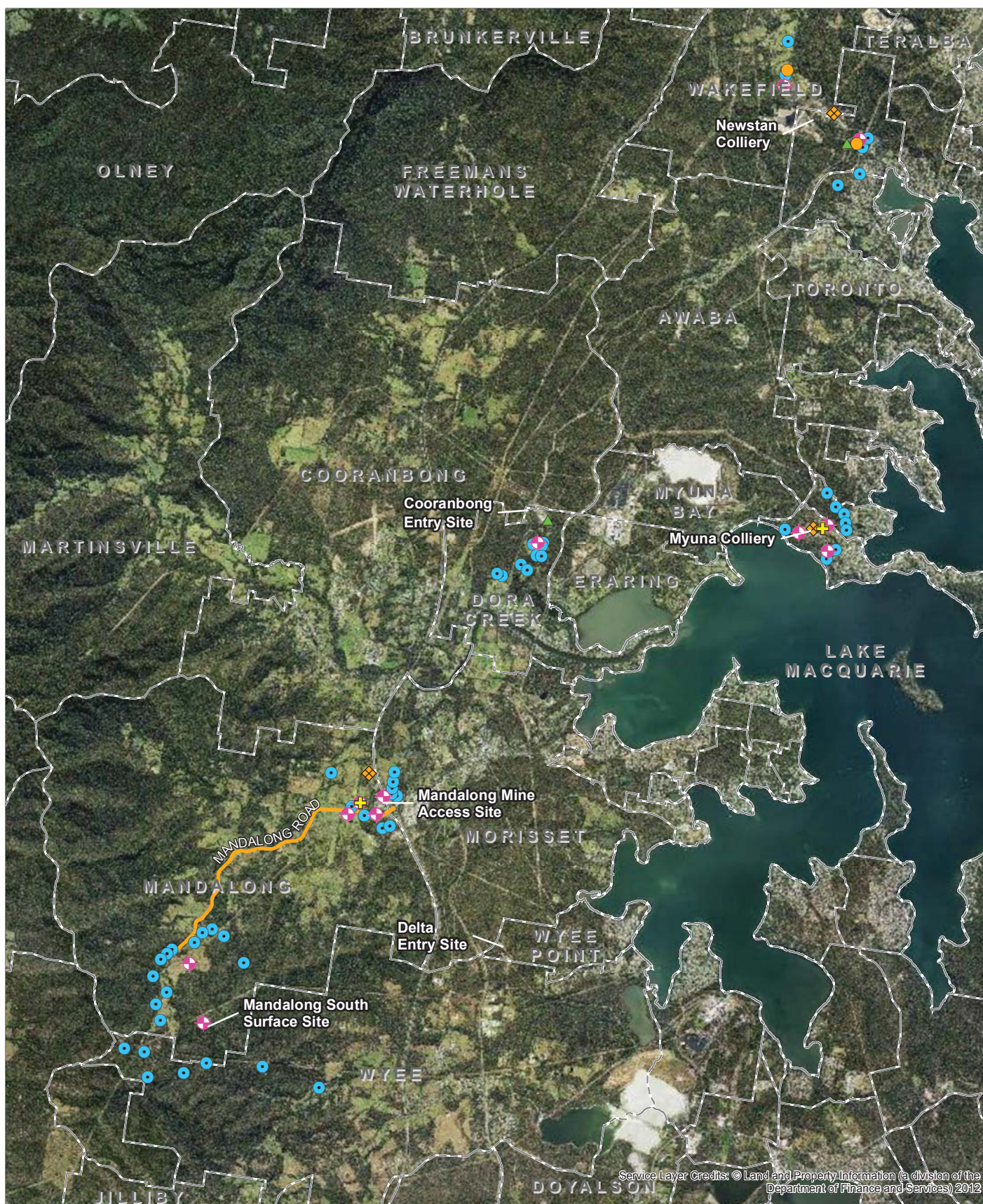


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1:120,000 for A4 0 500 1,000 2,000 3,000 4,000 Metres Map Projection: Universal Transverse Mercator Horizontal Datum: Geodetic Datum of Australia 1994 Grid: Map Grid of Australia, Zone 56		LEGEND Suburb Haul Road Dust gauge HVAS MET station Real-time monitor Sensitive receiver	
© 2016. Whilst every care has been taken to prepare this map, Centennial Coal Company Limited and GHD (DATA CUSTODIAN) make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.		Centennial Coal Northern Region Environmental Monitoring Overview Short Term dust monitoring	
LOCATION	-	DATE	17/03/2016
DRAWN	T.M	Figure 4	
CHECKED	A.R		
APPROVED			
SCALE	refer to scalebar		

GIS Filename: G:\2218129\GIS\Maps\Deliverables\ShortTerm\2218129_NST005_ShortTerm_Dust_Overview_0.mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:tmorton



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1:120,000 for A4 0 500 1,000 2,000 3,000 4,000 Metres Map Projection: Universal Transverse Mercator Horizontal Datum: Geodetic Datum of Australia 1994 Grid: Map Grid of Australia, Zone 56		LEGEND Suburb Haul Road Dust gauge HVAS MET station Real-time monitor Sensitive receiver	
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LOCATION DRAWN CHECKED APPROVED SCALE		- T.M A.R refer to scalebar	
		DATE 17/03/2016 Figure 5	

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4.6 Reporting

4.6.1 Annual Review

An Annual Review is to be completed in accordance with the requirements of the conditions of approval for each operation. The Annual Review includes:

- information on the development and activities carried out in the past calendar year;
- information on the activities proposed to be carried out over the current calendar year;
- a comprehensive review of the monitoring results and complaint records of the development over the past calendar year;
- a comparison of monitoring results against:
 - the relevant statutory requirements, limits or performance measures/criteria;
 - the monitoring results of previous years; and
 - the relevant predictions in the EIS.
- information on any non-compliances over the past year, and what actions were (or are being) taken to ensure compliance;
- an identification of any trends in the monitoring data;
- identification of any discrepancies between the predicted and actual impacts of the development, and an analysis of the potential cause of any significant discrepancies; and
- a description of what measures will be implemented over the next calendar year to improve the environmental performance of the development.

Any dust monitoring undertaken under this management plan, that are not a requirement of the EPL are to be reported annually through the Annual Review. The Annual Review is to be made available on the Centennial Coal website.

4.6.2 Annual Return

An annual return stating the sites compliance with the conditions of its EPL is completed and submitted to the EPA on an annual basis. This is done in compliance with the EPL conditions and by the due date as stated in the EPL.

4.6.3 NGER reporting

Centennial exceeds the controlling corporation emissions threshold (50,000 CO_{2e}T) and therefore is required to report its greenhouse gas (GHG) emissions, energy used and produced from all facilities in accordance with the NGER Act. This is termed a NGER section 19 Energy and Emissions Report (NGER Report) and is submitted to the Clean Energy Regulator (CER). The NGER Report includes all of the greenhouse emissions from each facility under the operational control of entities of Centennial. GHG emissions are calculated from input data from facilities (mine sites, support services, offices). These

emissions are reported as Scope 1 (direct) and Scope 2 (indirect), giving rise to total GHG emissions, energy consumed and energy produced for each financial year reporting period.

The NGER Report requires submission by 31 October each year.

The CER is required to publish this data on its website.

4.6.4 Sustainability reporting

The progress towards Vision 2020 will be monitored by the Sustainability Steering Committee and reported in the annual published Sustainability Report.

4.6.5 Monthly website environmental monitoring report

A monitoring report is published on the website to satisfy the requirements under the Protection of the Environment Legislation Amendment Act 2011 (POELA Act) to publish or make pollution monitoring data available to members of the public.

4.6.6 Community Consultative Committee

The Community Consultative Committee (CCC) meets on a regular basis. Some of the information reported at the CCC includes:

- operational issues;
- monitoring and environmental performance; and
- community complaints and the response to complaints.

5 Contingency measures

5.1 Managing unpredicted impacts

Unpredicted air quality impacts may include such things as:

- observed dust plumes moving off-site,
- material spillage e.g. on haul route or public road and,
- sudden adverse weather which could generate a sudden increase in dust generation.

When unpredicted air quality impacts are noted, suppression measures would be implemented immediately. These include:

- increased use of water sprays and dust suppressants,
- reduced vehicle speed on haul/access roads; and/or
- reduced intensity of dust-generating operations until effective dust control measures can be applied.

The following procedure will be implemented following recognition of an unexpected air quality impact:

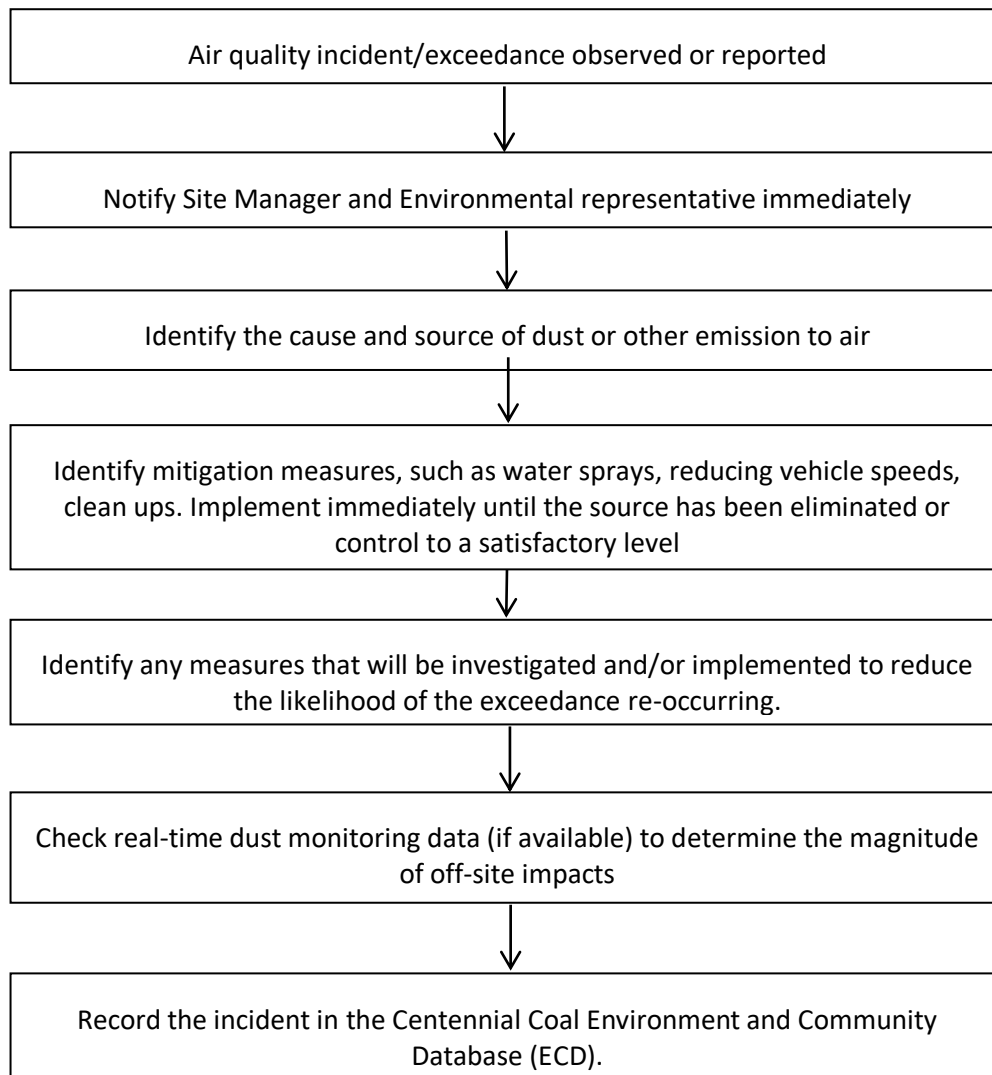


Figure 6 – Procedure for unexpected air quality impacts

5.2 Trigger Action Response Plans

The trigger action response plan (TARP) defines the minimum set of corrective actions that are required by site personnel in response to unpredicted impacts or deviation in the mine conditions from normality.

The TARP defines what is “normal” by way of a set of criteria for a range of aspects and are shown as green in the TARP. Criteria relating to abnormal conditions including trigger values are also defined in the TARP and are rated based on increased risk and potential impact and shown as orange or red. Corresponding corrective actions for each risk level are also clearly defined. The trigger levels are based on previous monitoring, CoA and EPL criteria.

It is important to note that corrective actions do not have to wait until a trigger is exceeded. Site personnel may notice abnormal air quality behaviour and initiate corrective actions earlier than required under the TARP.

Table 5-1 - TARP – Air Quality

Aspect	Condition Green	Condition Orange	Condition Red
PM ₁₀	Trigger	Trigger	Trigger
	Monitoring results within criteria. PM ₁₀ trigger level not exceeded.	Real time monitoring indicates PM₁₀ level exceeds trigger level of 50 µg/m³ over a 1 hour period for more than 2 consecutive hours. (note once tripped, alarms will not reset until back under trigger level) OR HVAS Monitoring data exceeds 80% of the PM₁₀ 24-hour air quality criteria (40 µg/m³.) OR HVAS Annual average exceeds 80% of the PM₁₀ Annual Average air quality criteria (24 µg/m³ / 20 µg/m³ for SSD-5145).	HVAS or Real Time monitoring indicates an exceedance of the PM₁₀ 24-hour air quality criteria of 50 µg/m³. OR HVAS Monitoring indicates an exceedance of the PM₁₀ Annual Average criteria of 30 µg/m³ (25 µg/m³ for SSD-5145).
	Action	Action	Action
	No response required. Continue monitoring programme	Review operations to reduce dust emissions. Implement any additional	Complete incident investigation to determine the cause of the exceedance. Review

Aspect	Condition Green	Condition Orange	Condition Red
		mitigation measures as required. Modify operations if applicable.	effectiveness of mitigation measures. Modify operations if applicable. Notify relevant government agencies and impacted landowners in accordance with the procedure in the Management Plan. Consider review of Management Plan if required.
TSP	Trigger	Trigger	Trigger
	Monitoring results within criteria	Monitoring result exceeds a TSP value of $90 \mu\text{g}/\text{m}^3$. OR Monitoring indicates annual average TSP level exceeds 80% of criteria level ($72 \mu\text{g}/\text{m}^3$).	Monitoring results indicates an exceedance of the TSP Annual Average criteria of $90 \mu\text{g}/\text{m}^3$
	Action	Action	Action
	No response required. Continue monitoring programme	Review operations to reduce dust emissions. Implement any additional mitigation measures as required. Modify operations if applicable.	Complete incident investigation to determine the cause of the exceedance. Review effectiveness of mitigation measures. Modify operations if applicable. Notify relevant government agencies and impacted landowners in accordance with the procedure in the Management Plan. Consider review of Management Plan if required.

Aspect	Condition Green	Condition Orange	Condition Red
Depositional Dust	Trigger	Trigger	Trigger
	Monitoring results within criteria	Monitoring indicates monthly depositional dust levels exceeds 4 g/m ² /month of criteria. OR Monitoring indicates annual average Dust Depositional level exceeds 80% of criteria level (3.2 g/m ² /month).	Monitoring indicates annual average exceeds 4g/m ² /month
	Action	Action	Action
	No response required. Continue monitoring programme	Analyse data to determine source of dust. Review operations to reduce dust emissions. Implement any additional mitigation measures as required. Modify operations if applicable.	Complete incident investigation to determine the cause of the exceedance. Review effectiveness of mitigation measures. Modify operations if applicable. Notify relevant government agencies and impacted landowners in accordance with the procedure in the Management Plan. Consider review of Management Plan if required.
Odour	Trigger	Trigger	Trigger
	No complaints or odour reports from site personnel.	On site identification of odour source reported.	External complaint of odour emissions received.

Aspect	Condition Green	Condition Orange	Condition Red
	Action	Action	Action
	No response required.	Analyse information to determine source of odour emissions. Review operations to reduce odour emissions if source of odour emissions determined to be from site.	Analyse information to determine source of odour emissions. Review operations to reduce odour emissions if source of odour emissions determined to be from site. Notify relevant government agencies and report complaint and actions implemented in the Annual Review.

6 Incidents, complaints and exceedances

6.1 Incidents

An air quality incident is defined as an exceedance of the Development Consent or EPL air quality criteria detected by statutory air quality monitoring.

All air quality incidents that occur need to be reported in accordance with the Centennial Incident Reporting Standard (CIMOS-006), logged and corrective and preventable actions identified, including:

- minor incidents resulting in no off-site impact but requiring immediate mitigation and instigation of any mitigation action(s); and
- off-site impacts, such those which prompt complaints, requiring notification to the Site Manager or Environment & Community Coordinator.

In the event of an incident or complaint, the following procedure will be followed:

- investigate the incident including:
 - The likely source of emission including microscopic analysis of dust deposition samples to identify the source of the dust;
 - If the incident is a failure to monitor, then the cause of the failure, for example vandalism or power failure.
- mitigate the source immediately through
 - application of mitigation (water sprays), relocate dust generating activities or cease the operation if mitigation is not feasible;
 - Replace broken bottles, investigate other options for power sources etc
- log the complaint/incident; and
- create an incident report, including the corrective actions that were taken and who was involved, that documents preventative actions required to prevent a recurrence of the event and includes a sign-off by an authorised person at the site.

6.2 Community enquiries or complaints

Centennial will record and respond to any community enquiries or complaints received as described in the respective sites Community Complaints and Enquiries Procedure and investigate the nature of the complaint / enquiry.

Complaints will be followed up by the Mine Manager or Environment & Community Coordinator as soon as the outcomes of the investigation have been completed.

All community complaints and enquiries will be recorded in the Centennial Coal Environment and Community Database (ECD). Complaints will be entered into the Community Complaints Register and listed on the Centennial Coal website.

6.3 Non-compliance notification procedure

The following procedure will be implemented following a measured exceedance of an air quality indicator:

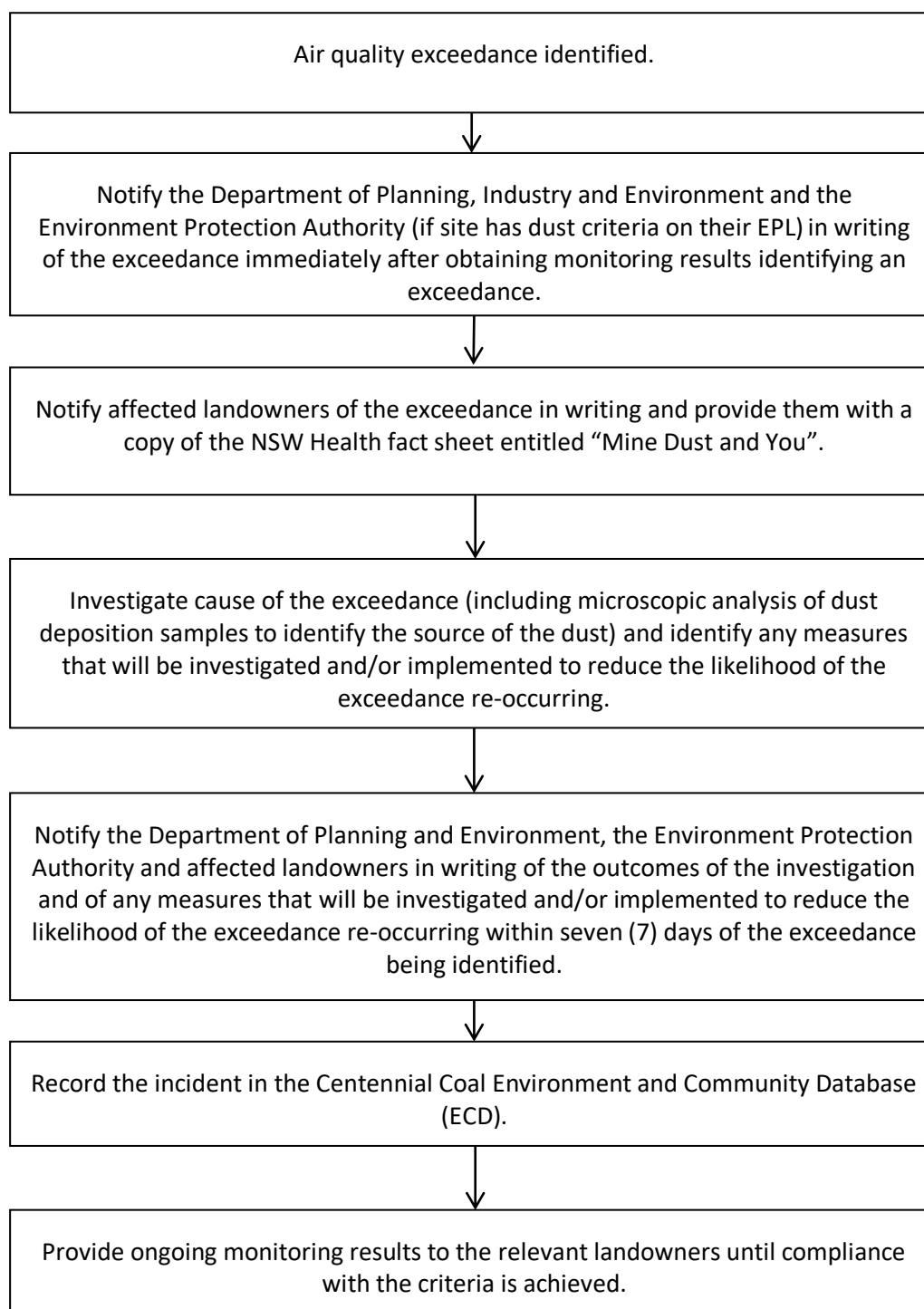


Figure 7 – Procedure for air quality exceedance

7 Roles and responsibilities

Each employee and contactor is responsible for adhering to the Centennial Coal Environmental Policy. Whilst the obligation of complying with the Environmental Policy lies with the entire workforce, further environmental management responsibilities that are considered as a part of the normal functioning of some positions relevant to the EMS are described as follows:-

Mine Manager

- authorisation of the EMS;
- responsible for approving environmental and community objectives and targets for the operations Annual Strategic Plan;
- reporting of significant environmental incidents to external stakeholders as required;
- promoting compliance with the Environmental Policy and fulfilling relevant requirements of the EMS and this Management Plan;
- compliance with the requirements of the CoA and EPL.
- delegation of resources to ensure environmental risk mitigation strategies are implemented; and
- delegation of duties during the absence of the Environment & Community Coordinator.

Mine/Operations Superintendents

- maintaining the highest possible environmental standards within their designated areas of responsibility;
- make use of all resources available to prevent or reduce environmental risks; and
- immediately reporting environmental incidents and non-compliances to the Environment & Community Coordinator.

Environment & Community Coordinator

- compliance with the Centennial Environmental Policy;
- reporting of environmental incidents as required to external stakeholders;
- development and implementation of environmental strategies, plans, and procedures;
- regulatory and community consultation;
- registration of community complaints and regulatory liaison in the Environment & Community Database (ECD);
- development and implementation of environmental work procedures;
- development and implementation of environmental training and inductions;
- auditing the effectiveness of the EMS and this Management Plan; and
- compliance with all licences and approvals for environmental management of the site.

Employees and Contractors

- compliance with the Centennial Environmental Policy, standards and procedures;

- immediately reporting of environmental incidents and community complaints or enquiries to the Environment & Community Coordinator;
- conducting operations in compliance with the Centennial environmental management plans and procedures; and
- identifying and implementing appropriate controls for environmental risks from any risk assessments and job safety analysis and communicating these with responsible staff.

Health, Safety, Environment & Community Committee

- promoting environmental awareness within the workforce and contractors; and
- raising environmental issues and programs that will improve compliance with the Environmental Policy, standards and procedures at committee meetings for appropriate staff to consider.

Delegation of roles or responsibilities may be determined by the Mine Manager at any time.

8 Training

Training of Centennial staff and contractors may include, but need not be limited to:

- induction training;
- environmental and community awareness training; and
- toolbox training.

8.1 Induction training

All Centennial employees and contractors are inducted prior to commencing work on site. The environmental component of the new employees' induction includes:

- the importance of Centennial's Environmental Policy;
- regulatory requirements;
- overview of the framework of Centennial's EMS;
- roles and responsibilities;
- significant environmental aspects, impacts and consequences; and
- environmental procedures.

Additionally, site specific issues are incorporated into the new employee and contractor site inductions and the competency of inducted personnel assessed.

Visitors to Centennial operations will undertake a brief visitor induction, with an awareness section on key environment components.

8.2 Targeted environmental training

Targeted environmental training of key staff, workforce and contractors in environmental procedures and programs will also be conducted. Specific environmental training may be delivered in the form of toolbox talks, training and assessment packages and accredited training programs to update personnel on the Centennial procedures and environmental programs.

8.3 Environmental training competence

The Centennial induction and environmental awareness training incorporates a section to assess the competency of employees and contractors against environmental requirements.

9 Management plan review

Revisions of this AQGHGMP are to be coordinated by the site Environment & Community Coordinator or delegate. The outcomes of a review will be documented by updating sections of these documents where required. Revised documents will be approved by the Mine Manager and submitted to DPE for approval. Once approved, the revised Management Plan will be placed on the Centennial Coal Website.

9.1 Review following an environmental audit

Audits can provide an assessment of compliance with CoA, the EMS and management plans. They also allow for continual improvement and resource allocation.

The objectives of an audit are to:

- identify compliance with the statutory requirements; and
- to identify opportunities for improvement.

If required, this Management Plan may be reviewed following the completion of an environment audit.

9.2 Review following non compliance

Non-compliances may become evident as a result of inspections, monitoring, through audit findings or complaints. Non-compliances identified shall be investigated and consider:

- the cause of the non-conformance;
- a review of existing controls to identify modifications required to avoid repetition of the non-conformance; and
- identification of the appropriate corrective or preventative action.

This Management Plan may be reviewed following the completion of any non-compliance investigation.

9.3 Review following submission of Annual Review

This Management Plan may be reviewed, and if necessary revised following the submission of the Annual Review.

9.4 Event based review

Other events which may trigger a review of this Management Plan include:

- modifications / improvements to the system;
- changes in the operation;

- new approvals, guidelines or codes of practice that require a review of the strategy; and
- or as otherwise directed by the Secretary.

Appendix A – Mandalong Mine

Conditions of Consent – Mandalong (SSD 5144)

This Air Quality and Greenhouse Gas Management Plan has been prepared to satisfy the conditions of consent for the Mandalong Mine (SSD 5144). The conditions of consent that relate to this Air Quality and Greenhouse Gas Management Plan and where they have been addressed is provided below.

Table 1 - Conditions of Consent – Mandalong Mine

Condition No.	Condition of Consent	Where addressed
Schedule 3 Condition 10	The Applicant must prepare an Air Quality Management Plan for the development to the satisfaction of the Secretary.	This Air Quality and Greenhouse Gas Management Plan was approved by the Secretary on 10/10/17.
	This plan must:	
Schedule 3 Condition 10(a)	be prepared in consultation with EPA, by suitable qualified and experienced persons whose appointment has been approved by the Secretary;	This Air Quality and Greenhouse Gas Management Plan was prepared in consultation with the EPA. A consultation log is provided as Appendix E. Tristan Gribble of GHD was appointed by the Department of Planning and Environment as a suitably qualified and experienced person on 2 November 2015.
Schedule 3 Condition 10(b)	be submitted to the Secretary for approval prior to the commencement of construction of the MSSS, or by 31 March 2016, whichever is sooner;	This Air Quality and Greenhouse Gas Management Plan was submitted to the Secretary on 24 March 2016.
Schedule 3 Condition 10(c)	describe the measures that would be implemented to ensure compliance with the air quality criteria and operating conditions of this consent;	Section 3.1 Appendix A

Condition No.	Condition of Consent	Where addressed
Schedule 3 Condition 10(d)	describe the on-site air quality management system; and	Section 3 Appendix A
Schedule 3 Condition 10(e)	include an air quality monitoring program that:	
	adequately supports the air quality management system;	Section 4 Section 4.5
	evaluates and reports on:	
	compliance with the air quality criteria;	Section 4
	the effectiveness of the air quality management system; and	Section 4.5
	compliance with the air quality criteria and operating conditions in condition 9 above; and	Section 4.5
	defines what constitutes an air quality incident, and includes a protocol for identifying and notifying the Department and relevant stakeholders of any air quality incidents.	Section 6
Schedule 3 Condition 10	The Applicant must implement the approved management plan as approved from time to time by the Secretary.	

Overview

The Mandalong Mine CoA is applicable to construction activities associated with the Mandalong South Surface Site and Access Road and the ongoing operations of the Mandalong Mine Access Site (MMAS) and Mandalong South Surface Site (MSSS).

The sections below provide site specific information which supplements the information provided in the AQGHGMP around 'common' dust sources, mitigation and management measures. It is noted that an underground coal delivery system connects Mandalong Mine to Delta Entry Site, where coal is handled and then transported to the Vales Point Power Station by the Delta Electricity overland conveyor. The underground coal delivery system and the handling and transport of coal at Delta Entry Site are approved under DA 35-2-2004.

Site specific sources of dust are identified. Dust mitigation and management measures which are specific to Mandalong Mine operations are also outlined and discussed.

The dust monitoring network around Mandalong Mine is also outlined. As discussed in the AQGHGMP, a short term and long term approach has been taken when preparing the dust monitoring program for Centennial operations. The short term monitoring has been prepared to satisfy the existing regulatory requirements for Mandalong Mine. The long term program has been prepared as part of the regional management plan and may require a transitional period where changes from short term and long term are discussed with the relevant authorities, finalised and implemented.

Air Quality Conditions

Air quality criteria of SSD 5144 are provided in Schedule 3, Condition 8 and are duplicated in Section 1.9 of the AQGHGMP.

In addition to these criteria the following conditions are also provided in SSD 5144:

Odour

7. *The Applicant must ensure that no offensive odours are emitted from the site, as defined under the POEO Act.*

Operation Conditions

9. *The Applicant must:*
- (a) *implement best practice air quality management at the site to minimise the:*
 - *off-site odour, fume and dust emission of the development; and*
 - *release of greenhouse gas emission from the development;*
 - (b) *minimise any visible off-site air pollution generated by the development;*
 - (c) *minimise the surface disturbance of the site;*
 - (d) *operate a comprehensive air quality management system to ensure compliance with the relevant conditions of this consent;*
 - (e) *minimise the air quality impacts of the development during adverse meteorological conditions and extraordinary events to the satisfaction of the Secretary.*

Commitments

Appendix 8 of SSD 5144 outlines the “Applicant’s statement of commitments”. The commitments relevant to air quality are provided below in Table 2.

Table 2 – Air quality commitments – Mandalong Mine

Commitment	Details
Monitor air quality impacts	Centennial Mandalong will update the Air Quality and Greenhouse Gas Management Plan to include the following:

Commitment	Details
	- Additional deposited dust gauges around the proposed Mandalong South Surface Site for both the construction and operation phases. - A PM10 and PM2.5 monitoring system, which will be used for model verification purposes and particulate management at the Mandalong Mine Access Site. The optimal location for these additional monitoring activities, along with the method and frequency of the monitoring activities, will be determined in consultation with a suitable qualified consultant.
Mitigate air quality impacts	The fan evasee at the Mandalong South Surface Site will be designed and constructed to face away from nearby surrounding residential receivers.
	The proposed MSSS access road will be sealed.
	All trucks carrying bulk material (gravel, sand etc.) to the MSSS will have their loads covered.
Understand the source of particulate matter	Within six months following development consent, Centennial Mandalong will commission additional studies to establish the source of the particulate matter entering the mine and the contribution of this to the total emissions from the ventilation fans at the Mandalong Mine Access Site. These studies will inform the need for and scope of mitigation measures and management strategies considered necessary to address particulate matter emissions from the ventilation fans.

EPL 365

Condition 2 of EPL 365 lists air quality monitoring locations, including dust deposition gauges DD1, DD2 and DD3 (located for Delta Entry Site), Gas Flares and the VAM-RAB. Additional monitoring is undertaken by Centennial Mandalong, as detailed below.

Condition 4 of EPL 365 provides dust management measures:

O3 Dust

O3.1 *The premises must be maintained in a condition which minimises or prevents the emission of dust from the premises.*

O3.2 *Activities occurring in or on the premises must be carried out in a manner that will minimise the generation, or emission from the premises, of wind-blown or traffic generated dust.*

- O3.3 All trafficable areas, coal storage areas and vehicle manoeuvring areas in or on the premises must be maintained, at all times, in a condition that will minimise the generation, or emission from the premises, of wind-blown or traffic generated dust.*
- O3.4 Trucks transporting coal from the premises must be covered immediately after loading to prevent wind blown emissions and spillage. The covering must be maintained until immediately before unloading the trucks.*
- O3.5 The tailgates of all haulage trucks leaving the premises must be securely fixed prior to loading or immediately after unloading to prevent loss of material.*
- O3.6 Coal stockpiles must be maintained in a condition that will minimise the generation and emission of dust on the premises.*

Site specific dust sources

The following identified sources of dust emissions in the AQGHGMP are relevant for Mandalong Mine operations and construction activities:

- wind erosion from material stockpiles and disturbed areas;
- wheel generated dust from vehicle movements;
- fugitive emissions through mine ventilation fans as a result of underground mining operations;
- coal transporting activities (drift conveyor); and
- operation of mobile equipment.

There are no additional sources of dust specifically identified for Mandalong Mine operations.

Site specific dust mitigation and management measures

Mandalong Mine implements dust mitigation in accordance with the mitigation measures outlined in **Section 3.1** of the AQGHGMP.

A Best Management Practice (BMP) Assessment was performed for the Mandalong Mine site in 2012. This assessment identified and assessed dust mitigation measures which are implemented on site.

Key dust mitigation measures for Mandalong Mine operations include:

- signage to display speed limits on all unsealed roads (the access road to MSSS will be sealed);
- water sprays on unsealed areas during use or windy conditions; and
- the use of a road sweeper to control fine dust on sealed roadways or laydown areas.

All mitigation measures identified in the AQGHGMP are utilised as required and implementation of appropriate dust controls are triggered by a range of methods, including:

- dust monitoring results, indicating an elevated level of dust fall out;
- site inspections and observation of visible dust plumes; and
- meteorological data from the Mandalong Mine weather station, indicating a high wind event.

Mandalong Mine operates in accordance with the Trigger Action Response Plan (TARP) provided in **Section 5.2** of the AQGHGMP.

Site specific dust mitigation and management measures during construction

Table 3 below summarises the specific dust mitigation and management measures that will be implemented during construction activities associated with the Mandalong South Surface Site and Access Road.

Table 3 – Mitigation and Management Measures during Construction of the MSSS and Access Road

Type of Mitigation	Description of Measures to be Implemented
Competency, Training and Awareness	All Project personnel will be advised of the potential air quality impacts on sensitive receptors from construction activities during the compulsory site health, safety and environment induction delivered by the Contractor. The site induction will include an overview of the Project's air quality compliance limits and details of the practical measures that should be implemented to limit particulate matter generation during construction, as described in this AQGHGMP. Documentation of records of induction, competencies, and training will be maintained by the Contractor.
Maintenance	The following maintenance measures will be implemented during construction: • All machinery and vehicles with internal combustion engines will be maintained in good working order and made to comply with relevant exhaust standards; • Regular inspections of plant and equipment will be undertaken and where maintenance issues are identified, the item will be taken out of service. Equipment will not be operated until it is maintained or repaired, where maintenance or repair would address the particulate matter issue identified; and • Any hired equipment that is causing excessive particulate matter (e.g. smoke) will be returned to the hire company and replaced with a cleaner alternative.
Equipment	The following equipment management measures will be implemented during construction: • Dust suppression equipment will be fitted to on-site material batching plant (if used); and • Loaded trucks leaving the construction site will be covered to minimise the transport of dust off site.

Type of Mitigation	Description of Measures to be Implemented
Engagement of Contractors and Subcontractors	Centennial will include in tender specifications the requirement to minimise air quality impacts and compliance with directions from Centennial to minimise particulate matter.
Work Methods	The following work methods will be implemented to minimise air quality impacts during construction: • Water carts will be used to dampen exposed surfaces, trafficable areas and stockpiles to minimise windblown and traffic generated dust emissions; • A designated route will be established for deliveries of materials and equipment to site during construction and details of this route will be provided to all delivery drivers to ensure trucks and other vehicles remain on-route and avoid any unnecessary impacts on sensitive receptors along local roads. Truck drivers will also be informed of parking locations, acceptable delivery hours or other relevant practices via the Drivers' Code of Conduct (Appendix B of the Construction Traffic Management Plan); • Vegetation clearing and surface disturbance will be limited to the designated disturbance footprint required for construction; • Working areas, disturbance areas and access roads will be revegetated and/or stabilised as soon as practicable to prevent or minimise windblown dust; • Stockpiles and handling areas will be maintained in a damp condition that minimises windblown and traffic-generated dust; • Silt will be removed from behind sediment fences and other erosion control structures on a regular basis, so that collected silt does not become a source of dust; • Use of a wheel wash prior to exiting the Construction Zone; • Any dust, soil or mud that has been tracked on to public roads by construction activities and vehicle movements will be removed as soon as practicable; • Where possible, vehicles on site will be confined to designated roadways; and • The drop height on plant and equipment will be minimised when loading and unloading earthworks material.

Type of Mitigation	Description of Measures to be Implemented
Activities during adverse weather conditions	Construction activities will be modified during high or unfavourable wind conditions. When conditions are dry, dusty and/or windy, water sprays, sprinklers and/or additional water carts will be used.

Dust monitoring

Mandalong Mine has operated a dust monitoring program for several years, which consists of 10 dust deposition gauges (seven located at MMAS and three at Delta Entry Site (DES)), collected monthly, located within and around the mining operations. A review of this dust monitoring network was undertaken following issue of the Conditions of Approval (SSD_5144) for the Mandalong Southern Extension Project in 2015. The aim of this review was to include additional monitoring specific to the MSSS and to identify methods to improve the efficiency and value provided from the existing dust monitoring network at MMAS and Delta Entry Site. The review considered:

- changes in the regulatory requirements since the previous Consent and EPL;
- changes in operations and predicted dust impacts from environmental assessments;
- long term trends in monitoring data from Annual Reviews and monthly monitoring reports; and
- complaints relating to air quality.

The short term and long term monitoring programs are outlined below. The timing to implement the long term monitoring program depends on many factors, such as regulatory approvals, landholder consultation, procurement of equipment and installation.

Short term

Consent SSD 5144 does not specify dust monitoring locations. EPL 365 specifies dust gauge monitoring at Delta Entry Site only. This condition is satisfied and additional monitoring is also undertaken.

Appendix 8 of SSD 5144 contains the Statement of commitments. The commitment relating to air quality is provided below:

Centennial Mandalong will update the Air Quality and Greenhouse Gas Management Plan to include the following:

- *additional deposition dust gauges around the proposed Mandalong South Surface Site for both the construction and operational phases;*
- *a PM10 and PM2.5 monitoring system, which will be used for model verification purposes and particulate management at the Mandalong Mine Access Site.*

The short term monitoring program will remain unchanged from what is currently undertaken. The short term monitoring program consists of:

- three dust gauges around the Delta Entry Site (DDG 1, DDG 2, DDG 3);
- seven dust gauges around the MMAS (DG5 – DG11);
- three dust gauges around the MSSS (DG12 – DG14).; and
- two HVAS units – PM₁₀ and PM_{2.5} at the MMAS. The HVAS monitoring equipment operates on a one in six day cycle.

The short term dust monitoring network is shown in **Figure 1a, Figure 1b and Figure 1c.**

Long term

The long term dust monitoring locations have been selected based on the rationalisation of the short term monitoring network.

A number of dust gauges around the MMAS were determined to add little value to the dust monitoring network and their ability to determine compliance at sensitive receiver locations were limited. In particular:

- Monitoring location DG5 is near the vent fans with a history of low levels and has therefore been removed from the long term monitoring network.
- DG7 does not appear to add any value above DG6 and DG8 and has been removed
- DG11 is located a long distance from any sensitive receivers and does not appear to add any value, and has been removed from the long term monitoring network.

The three dust gauges (DDG1 to DDG3) around the Delta Entry Site will also be removed from Centennial dust monitoring network in the long term following an amendment to EPL365.

The location of dust gauges around the MSSS has also been reviewed and modified to better reflect amenity impact at sensitive receiver locations. DG13 has been removed from the long term monitoring network as it is close to DG12, not at a sensitive receiver location and not in a sensitive location.

There has also been a long history of compliance at all dust gauge locations, indicating that the Mandalong Mine operations are generally low risk in terms of amenity dust impacts. No air quality or odour complaints were received between 2014 to 2016.

These gauges will be removed from the dust monitoring network in the long term due to the lack of value they provide.

The HVAS of PM₁₀ and PM_{2.5} at the MMAS will continue in the long term in line with the ongoing studies into the source of fine particulate matter.

The long term dust gauge network is reduced to:

- four dust gauges around the MMAS (DG6, DG8, DG9 & DG10);
 - two dust gauges around the MSSS (DG12 & DG14); and
-

- two HVAS units – PM₁₀ and PM_{2.5} at the MMAS. The HVAS monitoring equipment operates on a one in six-day cycle.

The ability to assess compliance at the nearest sensitive receivers has not been compromised.

The long term dust monitoring network is shown in **Figure 2a** and **Figure 2b**.

This Management Plan forms part of the consultation process for moving from the short term monitoring program to the long term monitoring program. This management plan will need to be approved prior to the site moving to the long term monitoring program. If the Long term monitoring program is different to what is detailed in an EPL, then an EPL variation will also be sought prior to moving to the long term monitoring program.

A summary of the dust monitoring undertaken at Mandalong Mine is provided in **Table 3** and **Table 4**.

Table 3 - Mandalong Mine short term dust monitoring locations

Site ID	X (m)	Y (m)	Parameter	Instrument	Frequency	Purpose
DDG1	359686	6331358	Dust deposition	DDG	Monthly	Ambient
DDG2	359443	6330454	Dust deposition	DDG	Monthly	Background
DDG3	359643	6330980	Dust deposition	DDG	Monthly	Compliance
DG5	356460	6335198	Dust deposition	DDG	Monthly	Ambient
DG6	356613	6334777	Dust deposition	DDG	Monthly	Compliance
DG7	356645	6334510	Dust deposition	DDG	Monthly	Ambient
DG8	356452	6334387	Dust deposition	DDG	Monthly	Compliance
DG9	355817	6334378	Dust deposition	DDG	Monthly	Background
DG10	356079	6334651	Dust deposition	DDG	Monthly	Compliance
DG11	356135	6335229	Dust deposition	DDG	Monthly	Ambient
DG12	352541	6329663	Dust deposition	DDG	Monthly	Ambient
DG13	352563	6329832	Dust deposition	DDG	Monthly	Ambient
DG14	352217	6331003	Dust deposition	DDG	Monthly	Ambient
HVAS PM ₁₀	356085	6334645	PM10	HVAS	1-in-6	Compliance Source identification
HVAS	356085	6334645	PM2.5	HVAS	1-in-6	Compliance

Site ID	X (m)	Y (m)	Parameter	Instrument	Frequency	Purpose
PM _{2.5}						Source identification

Notes:

Ambient – the monitoring equipment is not at a sensitive receptor location. This monitoring location was selected to provide information regarding dust levels close to sources such as haul roads, ventilation fans or surface operations.

Background – the monitoring site is representative of ‘background’ levels since it is remote from dust generating activities.

Compliance – the monitoring site is at a sensitive receptor location and therefore used for compliance purposes.

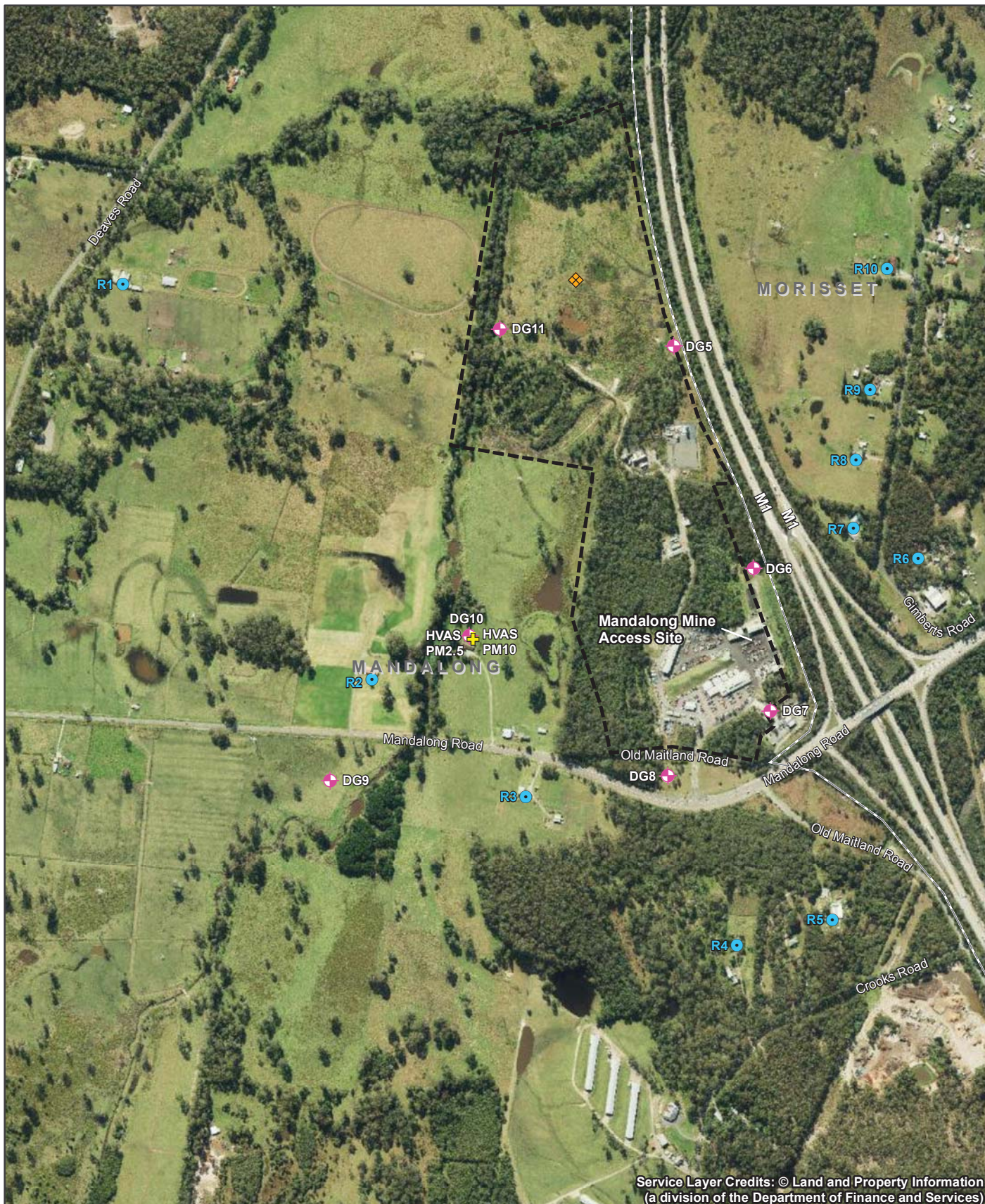
Table 4 - Mandalong Mine long term dust monitoring locations

Site ID	X (m)	Y (m)	Parameter	Instrument	Frequency	Purpose
DG6	356613	6334777	Dust deposition	DDG	Monthly	Compliance
DG8	356452	6334387	Dust deposition	DDG	Monthly	Compliance
DG9	355817	6334378	Dust deposition	DDG	Monthly	Background
DG10	356079	6334651	Dust deposition	DDG	Monthly	Compliance
DG12	351554	6329722	Dust deposition	DDG	Monthly	Compliance
DG14	352327	6331484	Dust deposition	DDG	Monthly	Compliance
HVAS PM ₁₀	356085	6334645	PM10	HVAS	1-in-6	Compliance Source identification
HVAS PM _{2.5}	356085	6334645	PM2.5	HVAS	1-in-6	Compliance Source identification

Notes:

Ambient – the monitoring equipment is not at a sensitive receptor location. This monitoring location was selected to provide information regarding dust levels close to sources such as haul roads, ventilation fans or surface operations.

Background – the monitoring site is representative of ‘background’ levels since it is remote from dust generating activities.

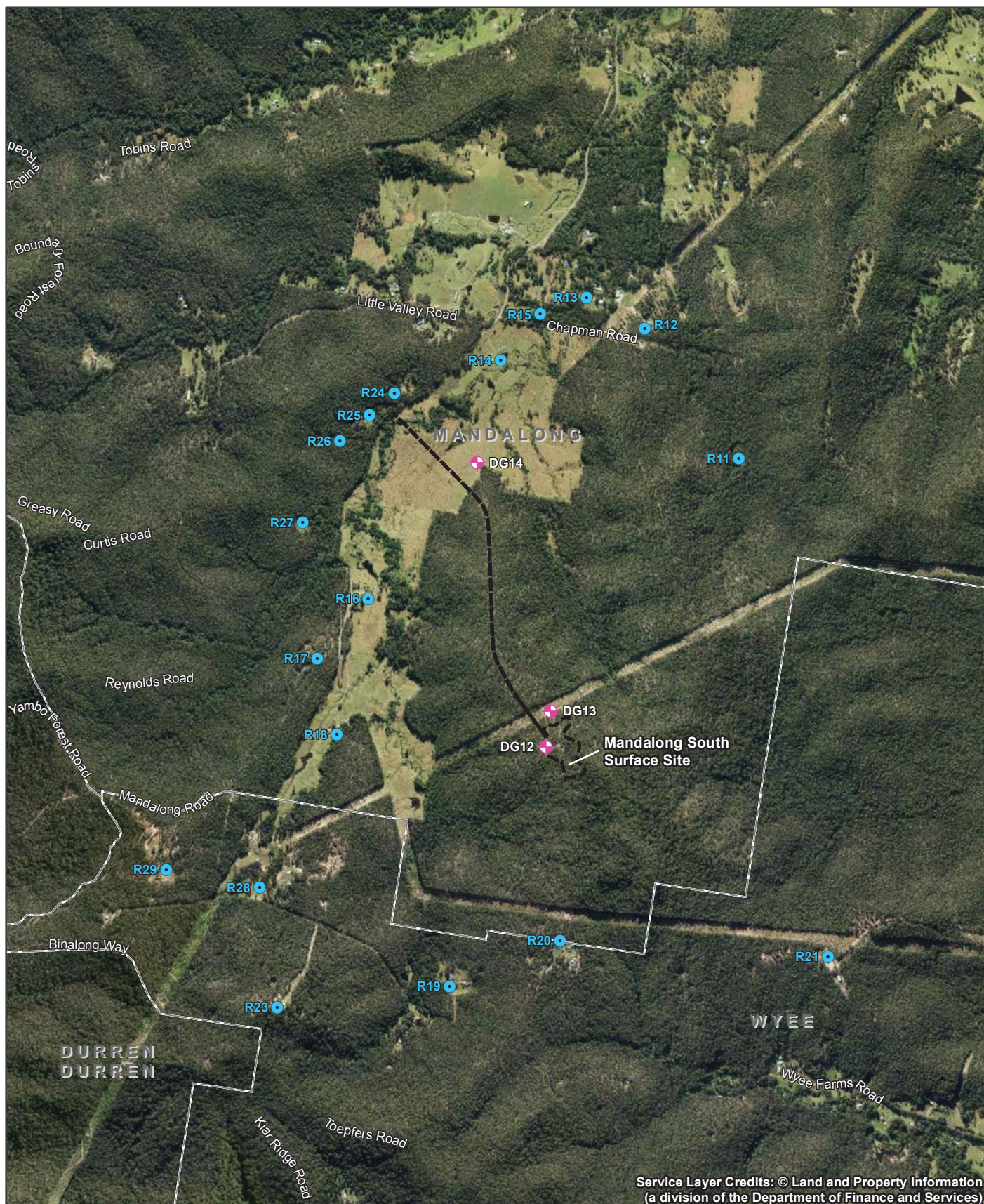


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1:10,000 for A4 0 40 80 160 240 320 Metres Map Projection: Universal Transverse Mercator Horizontal Datum: Geodetic Datum of Australia 1994 Grid: Map Grid of Australia, Zone 56		LEGEND Site boundary Suburb Dust gauge HVAS MET station Sensitive receiver	
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LOCATION -		DATE 18/03/2016	
DRAWN T.M		Figure 1a	
CHECKED A.R			
APPROVED			
SCALE refer to scalebar			

GIS Filename: G:\2218129\GIS\Maps\Deliverables\ShortTerm\2218129_NST002_ShortTerm_DDP_DustData_0.mxd

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1:25,000 for A4 0 105 210 420 630 840 Metres Map Projection: Universal Transverse Mercator Horizontal Datum: Geodetic Datum of Australia 1994 Grid: Map Grid of Australia, Zone 56		LEGEND Site boundary Suburb Dust gauge Sensitive receiver	
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LOCATION - DRAWN T.M CHECKED A.R APPROVED SCALE refer to scalebar		Centennial Coal DATE 18/03/2016 Figure 1b	

GIS Filename: G:\2218129\GIS\Maps\Deliverables\ShortTerm\2218129_NST002_ShortTerm_DDP_DustData_0.mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:tmorton

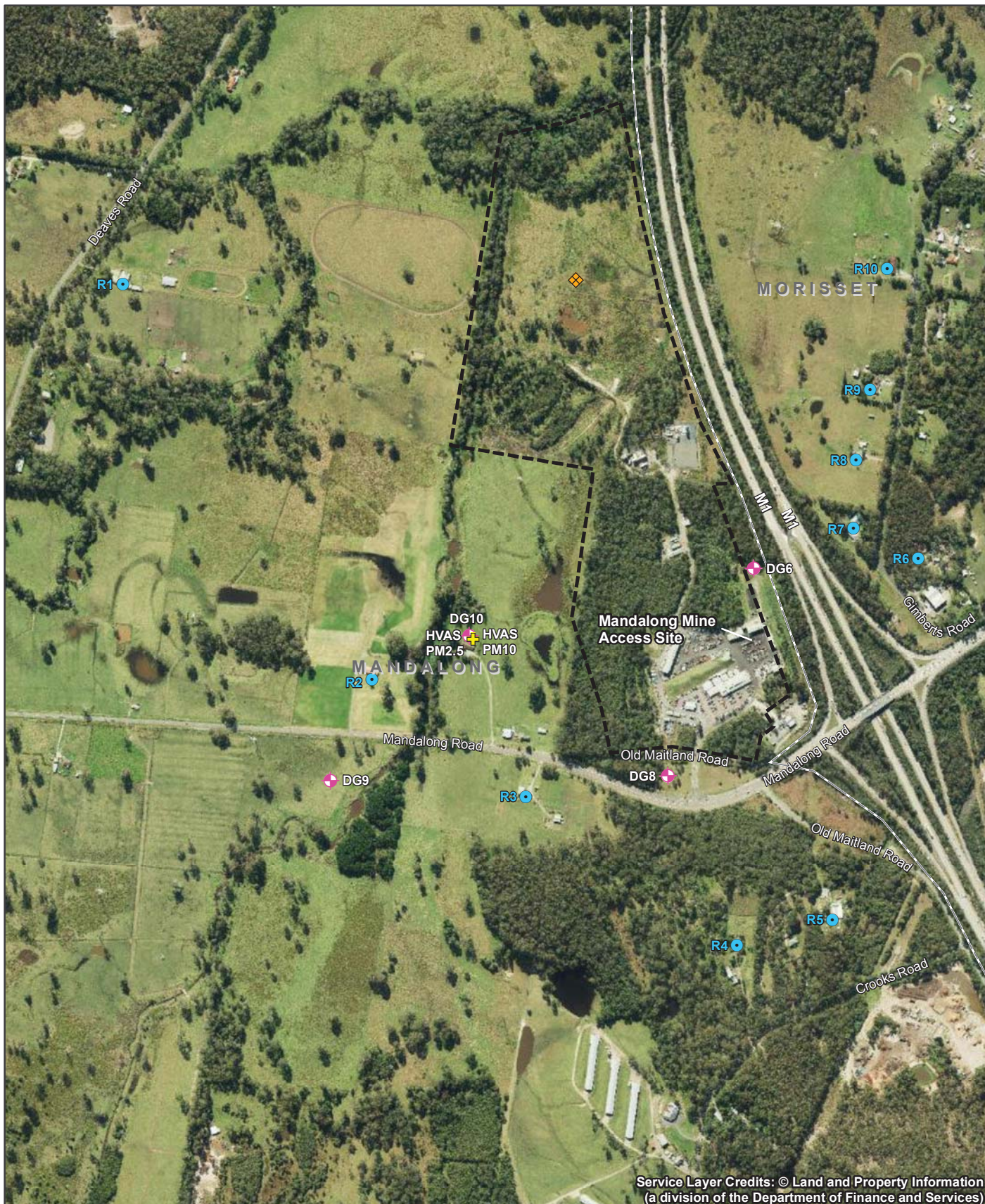


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1:20,000 for A4 085170340510680 Metres Map Projection: Universal Transverse Mercator Horizontal Datum: Geodetic Datum of Australia 1994 Grid: Map Grid of Australia, Zone 56		N		LEGEND Site boundary Suburb Dust gauge
© 2016. Whilst every care has been taken to prepare this map, Centennial Coal Company Limited and GHD (DATA CUSTODIAN) make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.	LOCATION	-	Centennial Coal Northern Region Environmental Monitoring Delta Entry Site Short Term dust monitoring	
	DRAWN	T.M		
	CHECKED	A.R		
	APPROVED			
SCALE	refer to scalebar		DATE 18/03/2016	
			Figure 1c	

GIS Filename: G:\2218129\GIS\Maps\Deliverables\ShortTerm\2218129_NST002_ShortTerm_DDP_DustData_0.mxd

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1:10,000 for A4 0 40 80 160 240 320 Metres Map Projection: Universal Transverse Mercator Horizontal Datum: Geodetic Datum of Australia 1994 Grid: Map Grid of Australia, Zone 56		LEGEND Site boundary Suburb Dust gauge HVAS MET station Sensitive receiver	
© 2016. Whilst every care has been taken to prepare this map, Centennial Coal Company Limited and GHD (DATA CUSTODIAN) make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.		Centennial Coal Northern Region Environmental Monitoring Mandalong Mine Access Site Long Term dust monitoring	
LOCATION	-	Centennial Coal	
DRAWN	T.M		
CHECKED	A.R		
APPROVED			
SCALE	refer to scalebar	DATE	17/03/2016
		Figure 2a	

GIS Filename: G:\2218129\GIS\Maps\Deliverables\LongTerm\2218129_NLT002_LongTerm_DDP_DustData_0.mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:tmorton

Dust monitoring during construction

In addition to the air quality monitoring network detailed above, the following monitoring will be undertaken during construction activities.

- Daily monitoring of work areas to identify areas requiring additional dust control.
- Weekly site-wide inspections to identify any ad-hoc air quality management issues.

Blast management

Blasting on the surface of the site will be carried out only between 9.00 am and 5.00 pm Monday to Saturday inclusive. No blasting will be undertaken on Sundays, Public Holidays, or at any other time, without the written approval of the Secretary.

Best blasting management practice will be implemented to minimise the dust and fume emissions of any blasting, to the satisfaction of the Secretary and detailed in any Construction Environment Management Plan required by the conditions of consent.

Meteorological monitoring

In accordance with Condition 11 of the CoA, meteorological data for Mandalong Mine is measured from the Mandalong Mine weather station.

EPL 365 provides monitoring parameter requirements in Condition M5.

The weather station continuously monitors weather parameters. Monitoring parameters are summarised in **Table 5**.

In addition, the weather station will be capable of continuous real-time measurement of the temperature lapse rate in accordance with the NSW Industrial Noise Policy.

Table 5 - Mandalong Mine meteorological monitoring

Site ID	X (m)	Y (m)	Parameter	Instrument	Frequency	Purpose
Mandalong Mine AWS	356278	6335320	Temperature Humidity Barometric Pressure Wind – speed and direction Rainfall Sigma-theta	Automatic weather station	15 minute data intervals	Proactive monitoring Weather analysis during noise monitoring Rainfall information

Greenhouse Gas

GHG management and monitoring procedures are documented in **Section 3.2.2** of the AQGHGMP.

In addition to these measures, Mandalong Mine have implemented and are investigating measures to reduce greenhouse gas emissions from the release of methane from its underground mining operations which comprise:

High Concentration Methane

A major capital works programme to install a gas flare at Mandalong was completed in 2014. This has resulted in the conversion of high concentration (pre drainage) methane gas at Mandalong to the less greenhouse potent (in terms of global warming potential) carbon dioxide. This equated to a reduction in overall emissions of about 190,000 TCO₂e per annum in 2014-15.

Ventilation Air Methane (dilute methane)

VAM emissions are technically much harder to address. Low concentrations of methane are emitted at high rates of volume. These form the majority of emissions from Centennial mines, at about 70% of total greenhouse emissions. There is currently no proven and accepted safe form of VAM abatement available, and this poses a significant challenge to the industry when trying to reduce greenhouse emissions. As fugitive methane from ventilation air is the greatest component of Centennial's greenhouse emission profile, and there is no proven, safe, commercially available technology to address these, investment in new technologies is highly weighted towards research and development. To address this, Centennial has engaged in two research and development programmes aimed at finding a safe solution for VAM abatement. Newcastle based technology company Corkys Sustainable Energy has developed a "VAM RAB®" (Ventilation Air Methane Regenerative After Burner) - a type of regenerative thermal oxidiser aimed at capturing and combusting VAM. Centennial hosted a demonstration scale VAM RAB® plant at its Mandalong Mine in 2014/15 and is now involved in an R&D programme with the Commonwealth Department of Industry and Science and the Australian Coal Association Low Emission Technology (ACALET) to safely connect and operate a commercial scale VAM RAB®. If the R&D project is successful it has the potential to abate in the order of 300,000 tonnes of CO₂e.

The successful completion of the Project would provide a technology option to the broader underground mining industry and see an approximate 30% reduction in annual greenhouse emissions from the Mandalong Mine Access Site. There are no specific management or monitoring requirements for GHG at Mandalong Mine.

Appendix B – Myuna Colliery

Conditions of Consent – Myuna Colliery (PA 10_0080)

This Air Quality and Greenhouse Gas Management Plan has been prepared to satisfy the conditions of consent for the Myuna Colliery (PA 10_0080). The conditions of consent that relate to this Air Quality and Greenhouse Gas Management Plan and where they have been addressed is provided below.

Table 1 - Conditions of Consent – Myuna Colliery

Condition No.	Condition of Consent	Where addressed
Schedule 3 Condition 19	The Proponent shall prepare and implement an Air Quality & Greenhouse Gas Management Plan for the project to the satisfaction of the Secretary.	The original Air Quality and Greenhouse Gas Management Plan was approved by the Secretary on 8 August 2012
	This plan must:	
Schedule 3 Condition 19(a)	be prepared in consultation with EPA, and submitted for approval to the Secretary within 7 months of the date of this approval;	This Air Quality and Greenhouse Gas Management Plan was prepared in consultation with the EPA. A consultation log is provided as Appendix E. The original Air Quality and Greenhouse Gas Management Plan was submitted to the Secretary on 6 August 2012. This Air Quality and Greenhouse Gas Management Plan was submitted to the Secretary on 24 March 2016.
Schedule 3 Condition 19(b)	describe the measures that would be implemented to ensure compliance with the relevant conditions of this approval, including the proposed air quality management system;	Section 3 Appendix B

Condition No.	Condition of Consent	Where addressed
Schedule 3 Condition 19(c)	uses a combination of volumetric sampling and dust deposition gauges to evaluate the performance of the project;	Section 4 Appendix B
	monitors greenhouse gas emissions, particularly methane; and	Appendix B
	includes a protocol for determining exceedances with the relevant conditions of this approval;	Section 6
Schedule 3 Condition 19(d)	describe the measures that would be implemented to minimise the release of greenhouse gas emissions from the site, particularly methane.	Section 3.1.2

Overview

The sections below provide site specific information which supplements the information provided in the AQGHGMP around 'common' dust sources, mitigation and management measures.

Site specific sources of dust are identified. Dust mitigation and management measures which are specific to Myuna Colliery operations are also outlined and discussed. As of January 2023, Myuna Colliery has adopted the Long Term monitoring program. A variation to EPL366 was approved by the EPA to accommodate this change.

Air Quality Conditions

Air quality criteria of PA 10_0080 are provided in Schedule 3 and are duplicated in **Section 1.9** of the AQGHGMP.

In addition to these criteria the following conditions are also provided in PA 10_0080:

Odour

15. *The Proponent shall ensure that no offensive odours, as defined under the POEO Act, are emitted from the site.*

Greenhouse Gas Emissions

16. *The Proponent shall implement all reasonable and feasible measures to minimise the release of greenhouse gas emissions from the site, to the satisfaction of the Secretary.*

Operation Conditions

18. *The Proponent shall implement best practice air quality management on site, including all reasonable and feasible measures to minimise off-site odour, fume and dust emissions generated by the project.*

EPL 366

Condition 2 of EPL 366 lists air quality monitoring locations, including dust deposition gauges (DG1, DG3 and DG4) and High Volume Air Sampling (TSP and PM₁₀).

Condition 4 of EPL 366 provides dust management measures:

O3 Dust

- O3.1 The premises must be maintained in a condition which minimises or prevents the emission of dust from the premises.*
- O3.2 All operations and activities occurring at the premises must be carried out in a manner that will minimise the emission of dust from the premises.*
- O3.3 Trucks entering and leaving the premises that are carrying loads of dust generating materials must have their loads covered at all times, except during loading and unloading.*
- O3.4 Coal stockpiles must be maintained in a condition that will minimise the generation and emission of dust on the premises.*

Site specific dust sources

The following identified sources of dust emissions in the AQGHGMP are relevant for Myuna Colliery operations:

- wind erosion from coal stockpiles;
- wind erosion from disturbed areas and coal stockpiles;
- wheel generated dust from vehicle movements;
- fugitive emissions from coal handling and processing;
- coal transporting activities (conveyors); and
- operation of mobile equipment.

There are no additional sources of dust specifically identified for Myuna Colliery operations.

Site specific dust mitigation and management measures

Myuna Colliery implements dust mitigation in accordance with the mitigation measures outlined in **Section 3.1** of the AQGHGMP.

Key dust mitigation measures for Myuna Colliery operations include:

- signage to display speed limits on all unsealed roads in the surface facilities area
 - water sprays on unsealed areas during use or windy conditions;
 - conveyors are enclosed and washed down regularly;
 - sweeping of hard stand areas;
 - maintaining an enclosure around coal processing operations;
-

- use of water cart when hauling coal to and from emergency coal stockpile area;
- water sprays on emergency stockpiles, when in use, including haul routes and material handling areas; and
- maintaining buffer zone and surrounding vegetation to act as a filter of airborne dust.

All mitigation measures identified in the AQGHGMP are utilised as required and implementation of appropriate dust controls are triggered by a range of methods, including:

- dust monitoring results, indicating an elevated level of dust beyond the site boundary;
- site inspections and observation of visible dust plumes; and
- meteorological data from the Myuna AWS, indicating a high wind event.

Myuna Colliery operates in accordance with the Trigger Action Response Plan (TARP) provided in **Section 5.2** of the AQGHGMP.

Dust monitoring

Project Approval 10_0080 specifies dust criteria for Myuna Colliery but does not nominate dust monitoring locations. Condition P1.1 of EPL 366 specifies the monitoring locations, which consists of:

- three dust deposition gauges, collected monthly; and
- PM₁₀ monitoring, operating every sixth day.

Myuna Colliery has operated this dust monitoring program for several years. A review of this dust monitoring network was undertaken in 2016. The aim of this review was to identify methods to improve the efficiency and value provided from the dust monitoring network. The review considered:

- changes in the regulatory requirements;
- changes in operations and predicted dust impacts from environmental assessments;
- long term trends in monitoring data from Annual Reviews and monthly monitoring reports; and
- complaints relating to air quality.

A detailed discussion around the rationalisation of the dust monitoring network is provided in *Centennial Northern Region Environmental Monitoring Rationalisation, Review and Recommendations* (GHD 2016).

The long term monitoring programs are outlined below. The short term monitoring program has been removed from this management plan as it is no longer relevant.

Long term

The long term dust monitoring locations have been selected based on the rationalisation of the short term monitoring network. Depositional Dust Monitoring - Dust gauge DG2 has been removed.

TSP and PM₁₀ HVAS monitoring:

The location of the HVAS cannot be used to determine compliance off-site, however, can provide useful information regarding dust generation close to surface operations.

Due to the established ratio between TSP and PM₁₀, TSP measurements have been removed.

The long term dust monitoring network consists of three dust deposition gauges (DG1, DG3 and DG4) and one HVAS with PM₁₀ inlet. The annual average limit for TSP is still applicable, however this is now modelled from PM₁₀ measurements using the formula $y=1.733x+4.97$, where 'y' represents TSP and 'x' represents the PM₁₀ measurement.

The long term dust monitoring network is shown in **Figure 1**.

An EPL variation was sought prior to moving to the long term monitoring program.

A summary of the dust monitoring to be undertaken at Myuna Colliery is provided in **Table 2**

Table 2 - Myuna Colliery long term dust monitoring locations

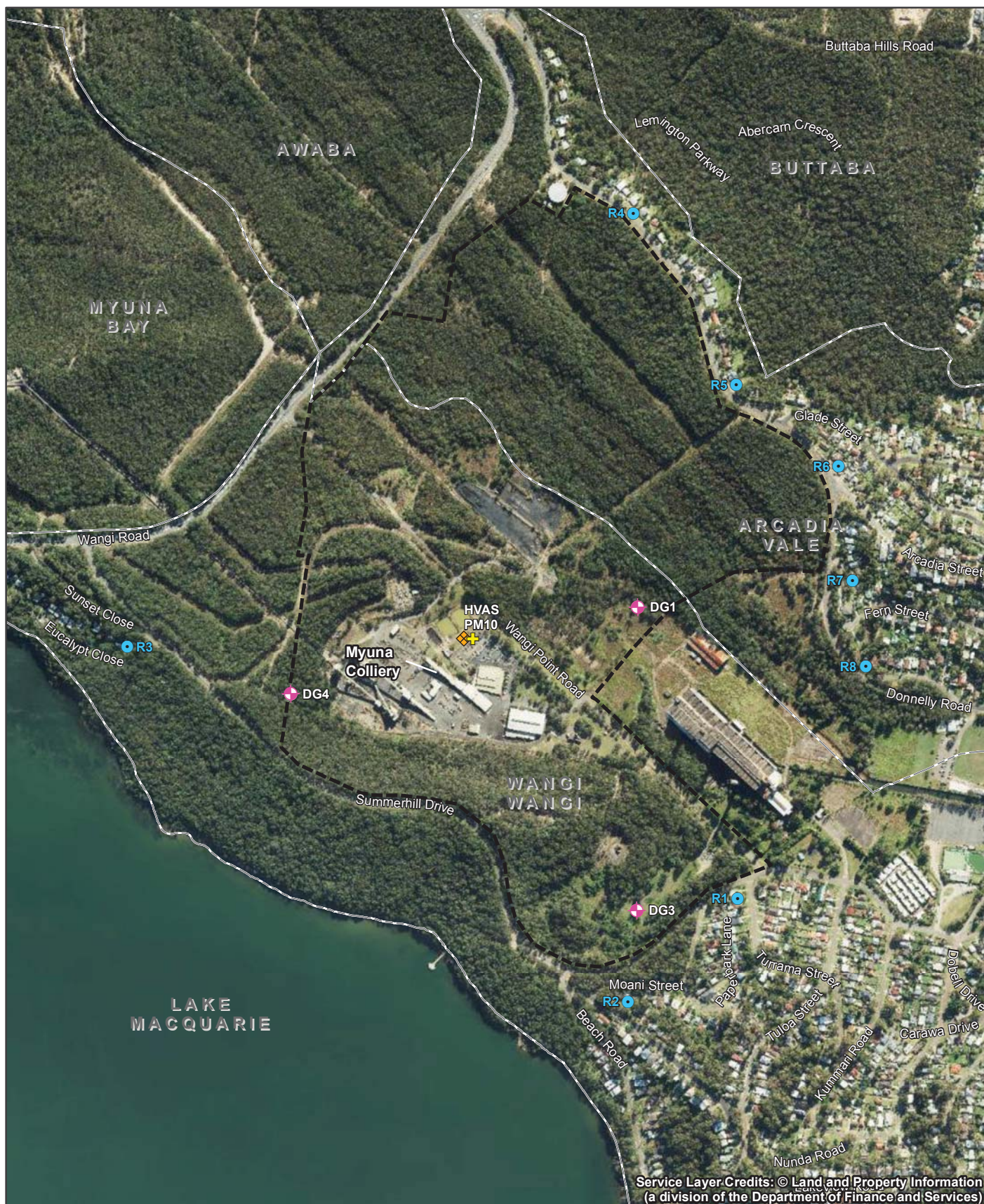
Site ID	X (m)	Y (m)	Parameter	Instrument	Frequency	Purpose
DG1	366672	6340919	Dust deposition	DDG	Monthly	Compliance
DG3	366669	6340350	Dust deposition	DDG	Monthly	Compliance
DG4	366020	6340755	Dust deposition	DDG	Monthly	Compliance
HVAS	366341	6340860	PM ₁₀	HVAS	1-in-6 day	Ambient

Notes:

Ambient – the monitoring equipment is not at a sensitive receptor location. This monitoring location was selected to provide information regarding dust levels close to sources such as haul roads, ventilation fans or surface operations.

Background – the monitoring site is representative of 'background' levels since it is remote from dust generating activities.

Compliance – the monitoring site is at a sensitive receptor location and therefore used for compliance purposes.



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1:10,000 for A4 0 40 80 160 240 320 Metres Map Projection: Universal Transverse Mercator Horizontal Datum: Geodetic Datum of Australia 1994 Grid: Map Grid of Australia, Zone 56		LEGEND Site boundary Suburb Dust gauge HVAS MET station Sensitive receiver	
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LOCATION	-	Centennial Coal	
DRAWN	T.M		
CHECKED	A.R		
APPROVED			
SCALE	refer to scalebar	DATE	17/03/2016
			Figure 2

GIS Filename: G:\2218129\GIS\Maps\Deliverables\LongTerm\2218129_NLT002_LongTerm_DDP_DustData_0.mxd

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Meteorological monitoring

To satisfy Condition 20 of Schedule 3, meteorological data for Myuna Colliery is measured on site.

The weather station continuously monitors weather parameters.

Table 4 – Myuna Colliery meteorological monitoring

Site ID	X (m)	Y (m)	Parameter	Instrument	Frequency	Purpose
Myuna AWS	366340	6340860	Temperature Humidity Barometric Pressure Wind – speed and direction Rainfall Solar radiation Sigma-theta	Automatic weather station	10 minute data intervals	Proactive monitoring Weather analysis during noise monitoring Rainfall information

Greenhouse Gas

GHG management procedures are documented in **Section 3.2.2** of the AQGHGMP.

Myuna Colliery will monitor greenhouse gas emissions and energy use in accordance with the National Greenhouse and Energy Reporting Act (NGER) requirements. This includes:

- Emissions from combustion of fuel (diesel, LPG and Acetylene) used on-site (Scope 1);
- Fugitive emissions from the extraction of coal (Scope 1);
- Leakage of SF6 from gas insulated equipment (Scope 1);
- Electricity use (Scope 2); and
- Energy consumed on site that is not combusted (petroleum based oils and greases).

The following will be monitored at Myuna Colliery.

- Electricity use.
- Diesel, LPG, Acetylene, oil and grease consumption.
- Stock of SF6 contained in equipment.

- Greenhouse gases from the Ventilation Shaft including:
 - Carbon dioxide (CO₂); and
 - Methane (CH₄).

Fugitive emissions of greenhouse gasses from the Ventilation Shaft at Myuna Colliery are monitored by the Ventilation Officer who completes a monthly statutory vent survey and bag sample of the shaft outlet gas.

Site specific measures which are being implemented to reduce the release of Scope 2 greenhouse gas emissions from Myuna include;

- Replacement of the aging ducted air conditioning unit in the administration building with individually controlled split systems in each office; and
- Replacement of fluorescent lights in the administration building with LED lights, where possible.

Appendix C – Newstan Colliery and Northern Coal Services

Conditions of Consent – Northern Coal Services (SSD 5145) and Newstan Colliery (DA 73-11-98)

This Air Quality and Greenhouse Gas Management Plan has been prepared to satisfy the conditions of consent for Northern Coal Services (SSD 5145) and Newstan Colliery (DA 73-11-98) as the air quality criteria for the Newstan Colliery Development are consistent with the air quality criteria requirements of the Northern Coal Services. The conditions of consent that relate to this Air Quality and Greenhouse Gas Management Plan and where they have been addressed is provided below.

Table 1 - Conditions of Consent – Northern Coal Services

Condition No.	Condition of Consent	Where addressed
Schedule 3 Condition 10	The Applicant must prepare and implement an Air Quality Management Plan for the development to the satisfaction of the Secretary.	This Air Quality and Greenhouse Gas Management Plan was approved by the Secretary on 10/10/17.
	This plan must:	
Schedule 3 Condition 10 (a)	Be prepared in consultation with EPA, by suitably qualified and experienced persons whose appointment has been approved by the Secretary;	This Air Quality and Greenhouse Gas Management Plan was prepared in consultation with the EPA. A consultation log is provided as Appendix E. Tristan Gribble of GHD was appointed by the Department of Planning and Environment as a suitably qualified and experienced person on 2 November 2015.
Schedule 3 Condition 10 (b)	be submitted to the Secretary for approval by 31 March 2016, unless otherwise agreed by the Secretary;	This Air Quality and Greenhouse Gas Management Plan was submitted to the Secretary on 24 March 2016.

Condition No.	Condition of Consent	Where addressed
Schedule 3 Condition 10 (c)	describe the measures that would be implemented to ensure compliance with the air quality criteria and operating conditions of this consent;	Section 3.1 Appendix C
Schedule 3 Condition 10(d)	describe the on-site air quality management system in detail; and	Section 3 Appendix C
Schedule 3 Condition 10(e)	include an air quality monitoring program that:	
	adequately supports the air quality management system;	Section 4 Section 4.5
	includes PM2.5 monitoring;	Appendix C
	Includes the use of real-time monitors to evaluate the performance of the development;	Appendix C
	evaluates and reports on:	
	compliance with the air quality criteria;	Section 4
	the effectiveness of the air quality management system; and	Section 4.5
	compliance with the air quality operating conditions in condition 9 above;	Section 4.5
	defines what constitutes an air quality incident, and includes a protocol for identifying and notifying the Department and relevant stakeholders of any air quality incidents.	Section 6
Schedule 3 Condition 10	The Applicant must implement the plan as approved by the Secretary.	

Table 2 – Conditions of Consent – Newstan Colliery

Condition No.	Condition of Consent	Where addressed
Schedule 2 Condition 6.1E	The Applicant shall prepare and implement an Air Quality Management Plan for the development to the satisfaction of the Secretary.	The original Air Quality and Greenhouse Gas Management Plan was approved by the Secretary on 30 January 2013. This Air Quality and Greenhouse Gas Management Plan was approved by the Secretary on 10/10/17.
	This plan must:	
Schedule 2 Condition 6.1E(a)	be prepared in consultation with the EPA, and be submitted to the Secretary for approval by the end of September 2012;	This Air Quality and Greenhouse Gas Management Plan was prepared in consultation with the EPA. A consultation log is provided as Appendix E. The original Air Quality Management Plan was submitted to the Secretary for approval on 21 December 2012. This Air Quality and Greenhouse Gas Management Plan was submitted to the Secretary 24 March 2016.
Schedule 2 Condition 6.1E(b)	describe the measures that would be implemented to ensure:	
	best management practice is being employed;	Section 3
	the air quality impacts of the development are minimised during adverse meteorological conditions and extraordinary events; and	Section 3.2 and Section 4.3

Condition No.	Condition of Consent	Where addressed
	compliance with the relevant conditions of this consent;	Section 1.9
Schedule 2 Condition 6.1E(c)	describe the proposed air quality management system;	Section 3
Schedule 2 Condition 6.1E(c)	include an air quality monitoring program that:	
	uses a combination of real-time monitors and supplementary monitors to evaluate the performance of the development;	Section 4
	adequately supports the proactive and reactive air quality management system;	Section 4
	includes PM2.5 monitoring;	Appendix C
	evaluates and reports on:	
	the effectiveness of the air quality management system; and	Section 4.5
	includes a protocol for determining any exceedances of the relevant conditions of this consent.	Section 6

Overview

The Northern Coal Services incorporates the Newstan Colliery Surface Site, the Cooranbong Entry Site, existing private haul roads and the Hawkmount Quarry. This Management Plan has been prepared to satisfy the conditions of consent for both the Newstan Colliery (DA 73-11-98) and the Northern Coal Services (SSD 5145), noting that the air quality requirements are consistent among the two development consents.

The sections below provide site specific information which supplements the information provided in the AQGHGMP around 'common' dust sources, mitigation and management measures.

Site specific sources of dust are identified. Dust mitigation and management measures which are specific to Northern Coal Services operations are also outlined and discussed.

The dust monitoring network around the Newstan Colliery Surface Site and Cooranbong Entry Site are also outlined. As discussed in the AQGHGMP, a short term and long term approach has been taken when preparing the dust monitoring program for Centennial operations. The short term monitoring has been prepared to satisfy the existing regulatory requirements. The long term program has been prepared as part of the regional management plan and may require a transitional period where changes from short term and long term are discussed with the relevant authorities, finalised and implemented.

Air Quality Conditions

Air quality criteria of DA 73-1198 and SSD 5145 are provided in Schedule 3 (Table 4) and are duplicated in **Section 1.9** of the AQGHGMP.

In addition to these criteria the following conditions are also provided in the specified approvals:

SSD 5145

Mitigation Measures

8. *If the development causes an exceedance of the air quality criteria in Table 4, the Applicant must, upon written request for air quality mitigation measures from the landowner, undertake air quality mitigation measures directed towards reducing the potential human health and amenity impacts of the development at a residence. These measures may include (for example):*
 - (a) air conditioning, including heating;*
 - (b) first flush water systems;*
 - (c) installation and regular replacement of water filters;*
 - (d) cleaning of rainwater tanks;*
 - (e) clothes dryers; and*
 - (f) regular cleaning of any residence and its related amenities, such as barbeque areas and swimming pools.*

Operating Conditions

9. *The Applicant must:*

(a) implement all reasonable and feasible measures to minimise the:

- Off-site odour and dust emissions from the development; and*
- Release of greenhouse gas emissions from the development;*

(b) minimise any visible air pollution generated by the development;

(c) minimise the surface disturbance of the site;

(d) operate a comprehensive air quality management system to ensure compliance with the relevant conditions of this consent; and

(e) minimise the air quality impacts of the development during adverse meteorological conditions and extraordinary events to the satisfaction of the Secretary.

In addition to the above conditions, SSD 5145 contains a statement of commitments:

“Northern Coal Services will continue the existing air quality monitoring program at Newstan Colliery Surface Site and Cooranbong Entry Site, which comprises:

- Newstan Colliery Surface Site – monitoring of dust deposition, TSP, PM₁₀ and PM_{2.5}; and*
- Cooranbong Entry Site – monitoring of dust deposition, TSP and PM₁₀.”*

DA 73-11-98

Greenhouse Gas Emissions

6.1B. *The Applicant shall implement all reasonable and feasible measures to minimise the release of greenhouse gas emissions from the site to the satisfaction of the Secretary.*

Operating Conditions

6.1D. *The Applicant shall:*

(a) implement best management practices to minimise the off-site odour and dust emissions of the development;

(b) operate a comprehensive air quality management system on site that uses a combination of predictive meteorological forecasting and real-time air quality monitoring data to guide the day to day planning of surface activities and the implementation of both proactive and reactive air quality mitigation measures to ensure compliance with the relevant conditions of this consent;

(c) minimise the air quality impacts of the development during adverse meteorological conditions and extraordinary events (see Note d to Tables 1-3)

(c) minimise the visible off-site air pollution; and

(d) minimise the surface disturbance of the site generated by the development, to the satisfaction of the Secretary.

Site specific dust sources

Cooranbong Entry Site

The following identified sources of dust emissions in the AQGHGMP are relevant for Cooranbong Entry Site operations:

- wind erosion from coal stockpiles;
- wind erosion from disturbed areas and coal stockpiles;
- wheel generated dust from vehicle movements;
- fugitive emissions from coal handling and processing (crushing, screening);
- coal transporting activities (haul road);
- operation of mobile equipment; and
- ventilation fans.

Newstan Colliery Surface Site

The following identified sources of dust emissions in the AQGHGMP are relevant for Newstan Colliery operations:

- wind erosion from coal stockpiles;
- wind erosion from disturbed areas and coal stockpiles;
- wheel generated dust from vehicle movements;
- fugitive emissions from coal handling and processing (crushing, wash plant);
- coal transporting activities (haul road, train loading, conveyors);
- operation of mobile equipment; and
- Ventilation fans.

Private Haul Roads

All private haul roads between operations are sealed and regularly swept, leading to negligible dust generation. Additionally, a truck wheel wash is installed at the Cooranbong Entry Site. There are no additional sources of dust specifically identified for Northern Coal Services operations.

Site specific dust mitigation and management measures

The Cooranbong Entry Site and the Newstan Colliery Surface Site implement dust mitigation in accordance with the mitigation measures outlined in **Section 3.1** of the AQGHGMP.

Key dust mitigation measures for include:

- signage to display speed limits on all unsealed roads in the surface facilities area;
-

- water sprays on unsealed areas during use or windy conditions;
- water sprays (sprinkler system) on the coal product stockpile during dry and windy conditions;
- shaping and orientation of coal stockpiles to minimise wind erosion;
- minimise drop heights when loading product as far as practicable;
- rehabilitation of disturbed areas as soon as practicable;

Additionally:

- Northern Coal Services will commit to automating the train loading operations aspect of the operations once it is proposed to export 5.5 Mtpa;
- water sprays will be installed on the transfer point of the train loading bin so as to minimise dust generation during the loading of trains;
- Northern Coal Services will undertake regular reviews of the air quality model for the site as the volume of coal increases; and
- Northern Coal Services will install automation in the coal handling operations between the CHPP and the rail loop stockpile as required to maintain compliance with air quality criteria and to meet operational efficiency requirements. Automatic water sprays on all new transfer points between the CHPP, the new product coal stockpile and the rail loop stockpile will be installed.

All mitigation measures identified in the AQGHGMP are utilised as required and implementation of appropriate dust controls are triggered by a range of methods, including:

- dust monitoring results, indicating an elevated level of dust beyond the site boundary;
- site inspections and observation of visible dust plumes; and
- meteorological data from Newstan Colliery weather station, indicating a high wind event.

Northern Coal Services operate in accordance with the Trigger Action Response Plan (TARP) provided in **Section 5.2** of the AQGHGMP.

Dust monitoring

The Statement of Commitments contained within SSD 5145 provides for existing dust monitoring to continue at Cooranbong Entry Site and Newstan Colliery Surface Site. Current dust monitoring consists of:

Cooranbong Entry Site

- two dust deposition gauges, collected monthly; and
- co-located PM₁₀ and TSP real-time monitors (TEOM), operating continuously.

Newstan Colliery Surface Site

- eight dust deposition gauges, collected monthly;
-

- two HVAS monitoring sites, each consisting of co-located PM_{2.5}, PM₁₀ and TSP units, operating on a 1-in-6 day cycle; and
- one real-time TEOM sampling PM₁₀, operating continuously.

A review of this dust monitoring network was undertaken in 2016. The aim of this review was to identify methods to improve the efficiency and value provided from the dust monitoring network. The review considered:

- changes in the regulatory requirements (SSD 5145);
- changes in operations and predicted dust impacts from environmental assessments;
- long term trends in monitoring data from Annual Reviews and monthly monitoring reports; and
- complaints relating to air quality.

The short term and long term monitoring programs are outlined below. The timing to implement the long term monitoring program depends on many factors, such as regulatory approvals, landholder consultation, procurement of equipment and installation.

Cooranbong Entry Site

Short term

The short term monitoring program will remain unchanged from what is currently undertaken.

Two dust gauges are operated around the Cooranbong Entry Site.

DG1 is located close to surface operations and is used as an indicator for dust generation close to operations, however is not a sensitive location.

DG4 is located to be representative of sensitive receptors toward Dora Creek, south of operations.

Two TEOM's were installed at Cooranbong Entry Site in 2013 to measure TSP and PM₁₀.

The short term dust monitoring network is shown in **Figure 1b**.

Long term

Following the review, DG1 was identified to add little value to the dust monitoring network. The long term trend in dust levels indicates lower levels than DG4, even though it is located close to surface operations. It is not located at a sensitive receiver and therefore cannot be used for compliance. A history of data collected at this site is sufficient for an established background dust level.

Concerning the co-located TSP and PM₁₀ real-time monitoring:

- historical data for daily PM₁₀ monitoring is consistently well below the criterion;
 - the annual average TSP is consistently well below the criterion. Monitoring and modelling data indicates that the risk of the TSP criterion being exceeded is extremely low;
 - having established a consistent TSP to PM₁₀ ratio over several annual cycles, the TSP TEOM may be removed following an EPL variation; and
-

- the ratio between TSP and PM₁₀ concentrations has been calculated from long term monitoring data to be **0.7**. The measured PM₁₀ annual average would therefore be divided by **0.7** to estimate the annual average TSP concentration¹.

The long term dust monitoring network will therefore consist of one dust deposition gauges and one real-time unit with PM₁₀ inlet.

The long term dust monitoring network is shown in **Figure 2b**.

This Management Plan forms part of the consultation process for moving from the short term monitoring program to the long term monitoring program. This management plan will need to be approved prior to the site moving to the long term monitoring program. If the Long term monitoring program is different to what is detailed in an EPL, then an EPL variation will also be sought prior to moving to the long term monitoring program.

A summary of the dust monitoring to be undertaken at Cooranbong Entry Site is provided in **Table 3** and **Table 4**.

Table 3 – Cooranbong Entry Site short term dust monitoring locations

Site ID	X (m)	Y (m)	Parameter	Instrument	Frequency	Purpose
DG1	359688	6341877	Dust deposition	DDG	Monthly	Ambient
DG4	360108	6340536	Dust deposition	DDG	Monthly	Compliance
Real-time	360334	6341046	PM ₁₀	TEOM	Continuous	Ambient
Real-time	360334	6341046	TSP	TEOM	Continuous	Ambient

Notes:

Ambient – the monitoring equipment is not at a sensitive receivers location. This monitoring location was selected to provide information regarding dust levels close to sources such as haul roads, ventilation fans or surface operations.

Background – the monitoring site is representative of ‘background’ levels since it is remote from dust generating activities.

Compliance – the monitoring site is at a sensitive receivers location and therefore used for compliance purposes.

Table 4 – Cooranbong Entry Site long term dust monitoring locations

Site ID	X (m)	Y (m)	Parameter	Instrument	Frequency	Purpose
---------	-------	-------	-----------	------------	-----------	---------

¹ Average ratio of PM₁₀ to TSP calculated over monitoring data from annual summary 2013 and 2014.

DG4	360108	6340536	Dust deposition	DDG	Monthly	Compliance
Real-time	360334	6341046	PM ₁₀	TEOM	Continuous	Ambient

Notes:

Ambient – the monitoring equipment is not at a sensitive receivers location. This monitoring location was selected to provide information regarding dust levels close to sources such as haul roads, ventilation fans or surface operations.

Background – the monitoring site is representative of ‘background’ levels since it is remote from dust generating activities.

Compliance – the monitoring site is at a sensitive receivers location and therefore used for compliance purposes.

Newstan Colliery Surface Site

Short term

The short term monitoring program will remain unchanged from what is currently undertaken.

Eight dust gauges are operated around Newstan Colliery.

Two HVAS monitoring sites are also in operation, located to be representative of sensitive receivers to the southeast and northwest, each consisting of co-located PM_{2.5}, PM₁₀ and TSP units, operating on a 1-in-6 day cycle.

One real-time TEOM PM₁₀ monitor is also located to be representative of sensitive receivers to the southeast.

The short term dust monitoring network is shown in **Figure 1a**.

Long term

The long term trend in monitoring data indicates low levels of dust deposition – all gauges were below 2 g/m²/month in 2014. Likewise, data trends indicate that the TSP annual average limit from the two HVAS locations is readily within compliance limits.

Following the review, a number of dust gauges were identified to add little value to the dust monitoring network. Six of the eight dust gauges are located within and around surface operations. Since they are not located at a sensitive receivers they cannot be used for compliance. Therefore, these dust gauges will be removed in the long-term, leaving two dust gauges, each representative of the nearest sensitive receivers.

Concerning the co-located TSP, PM₁₀ and PM_{2.5} HVAS:

- the annual average TSP is consistently well below the criterion. Monitoring and modelling data indicates that the risk of the TSP criterion being exceeded is extremely low; and

- having established a consistent TSP to PM₁₀ ratio over several annual cycles, the TSP HVA5 may be removed. This ratio can be used to estimate annual average TSP concentrations going forward.

Real-time PM₁₀ is the most useful tool for proactive management. The real-time PM₁₀ unit is located adjacent to the HVA5 units, however is more useful than the 1-in-6 day PM₁₀ HVA5. Therefore, at HVS2, the TSP and PM₁₀ HVA5 units will be removed. The PM_{2.5} HVA5 will continue on a 1-in-6 day cycle, alongside the real-time TEOM PM₁₀ unit.

The long term dust monitoring network will therefore consist of two dust deposition gauges, one real-time unit with PM₁₀ inlet, one HVA5 PM₁₀ and two HVA5 PM_{2.5}.

The long term dust monitoring network is shown in **Figure 2b**.

This Management Plan forms part of the consultation process for moving from the short term monitoring program to the long term monitoring program. This management plan will need to be approved prior to the site moving to the long term monitoring program. If the Long term monitoring program is different to what is detailed in an EPL, then an EPL variation will also be sought prior to moving to the long term monitoring program.

A summary of the dust monitoring to be undertaken at Newstan Colliery is provided in **Table 5** and **Table 6**.

Table 5 – Newstan Colliery short term dust monitoring locations

Site ID	X (m)	Y (m)	Parameter	Instrument	Frequency	Purpose
DG1	365687	6350884	Dust deposition	DDG	Monthly	Compliance
DG2	366285	6350893	Dust deposition	DDG	Monthly	Ambient
DG3	365675	6350572	Dust deposition	DDG	Monthly	Ambient
DG4	366656	6350067	Dust deposition	DDG	Monthly	Ambient
DG5	366947	6349953	Dust deposition	DDG	Monthly	Ambient
DG6	367339	6349864	Dust deposition	DDG	Monthly	Ambient
DG7	367397	6349669	Dust deposition	DDG	Monthly	Compliance
DG9	365589	6350153	Dust deposition	DDG	Monthly	Ambient
HVS1	365759	6351238	TSP, PM ₁₀ , PM _{2.5}	HVA5	1-in-6	Compliance
HVS2	367329	6349579	TSP, PM ₁₀ , PM _{2.5}	HVA5	1-in-6	Compliance

Site ID	X (m)	Y (m)	Parameter	Instrument	Frequency	Purpose
Real-time	367320	6349579	PM ₁₀	TEOM	Continuous	Compliance / proactive management

Notes:

Ambient – the monitoring equipment is not at a sensitive receivers location. This monitoring location was selected to provide information regarding dust levels close to sources such as haul roads, ventilation fans or surface operations.

Background – the monitoring site is representative of ‘background’ levels since it is remote from dust generating activities.

Compliance – the monitoring site is at a sensitive receivers location and therefore used for compliance purposes.

Table 6 – Newstan Colliery long term dust monitoring locations

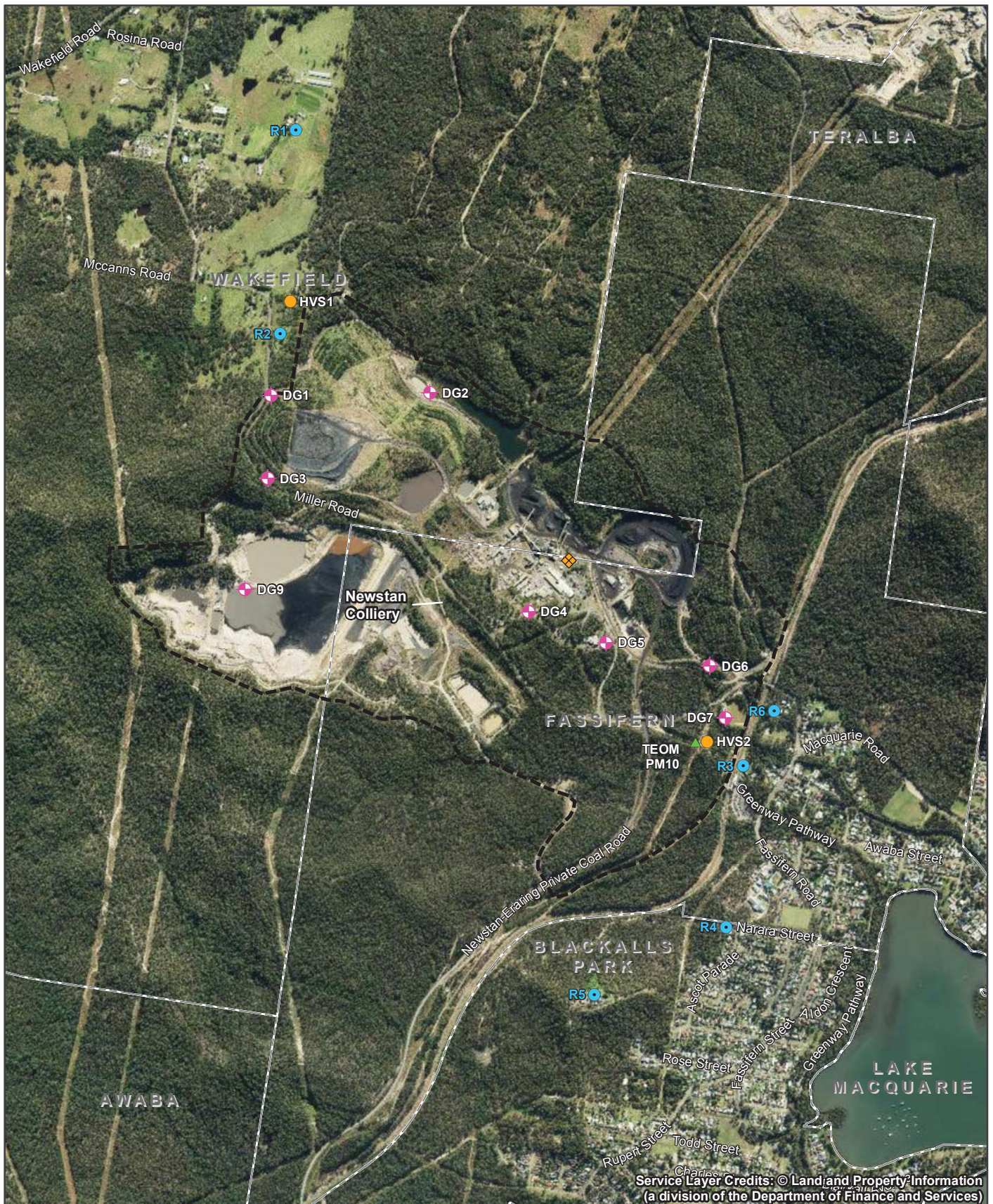
Site ID	X (m)	Y (m)	Parameter	Instrument	Frequency	Purpose
DG1	365687	6350884	Dust deposition	DDG	Monthly	Compliance
DG7	367397	6349669	Dust deposition	DDG	Monthly	Compliance
HVS1	365759	6351238	PM ₁₀ , PM _{2.5}	HVAS	1-in-6	Compliance
HVS2	367329	6349579	PM _{2.5}	HVAS	1-in-6	Compliance
Real-time	367320	6349579	PM ₁₀	TEOM	Continuous	Compliance / proactive management

Notes:

Ambient – the monitoring equipment is not at a sensitive receivers location. This monitoring location was selected to provide information regarding dust levels close to sources such as haul roads, ventilation fans or surface operations.

Background – the monitoring site is representative of ‘background’ levels since it is remote from dust generating activities.

Compliance – the monitoring site is at a sensitive receivers location and therefore used for compliance purposes.

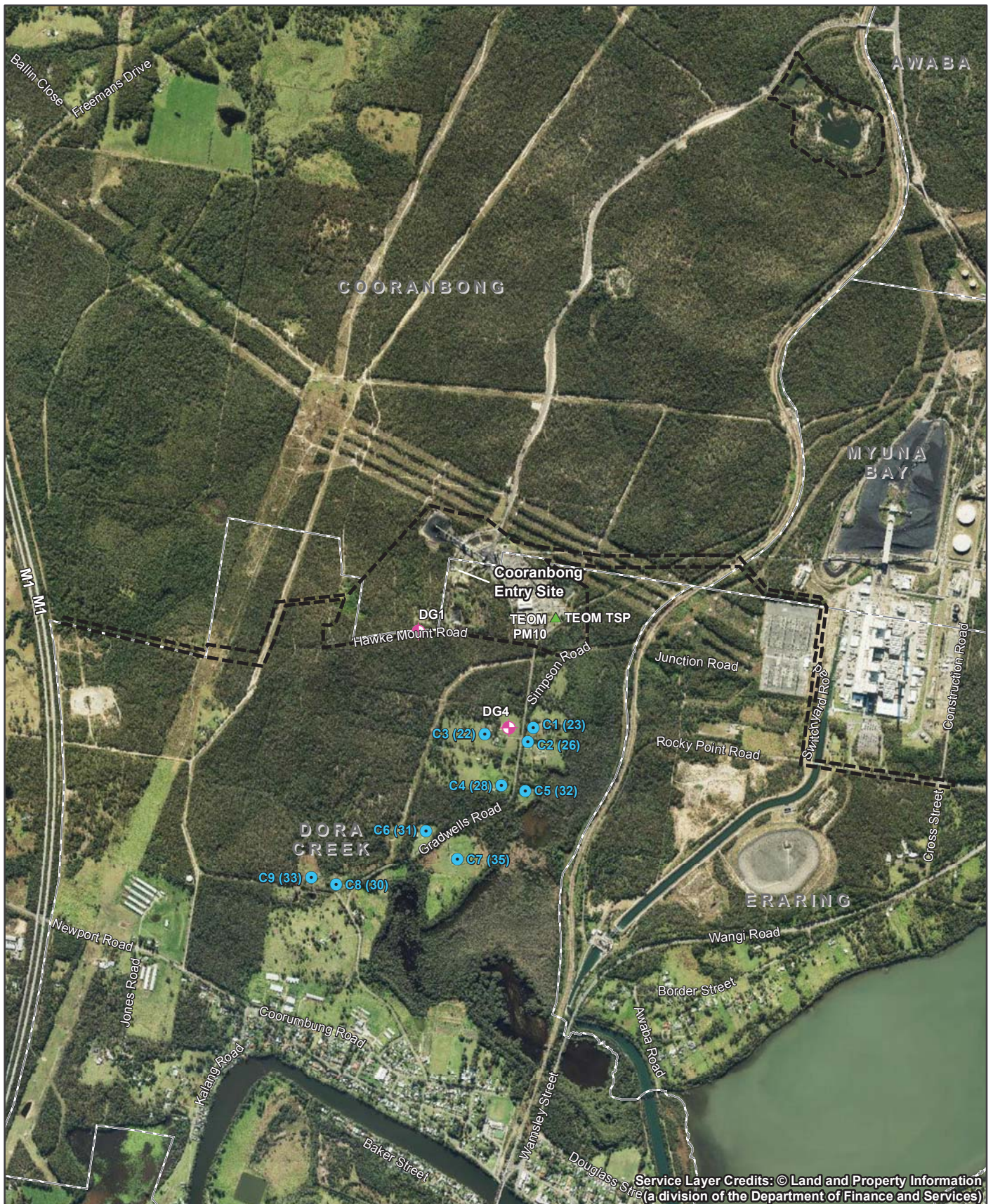


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1:20,000 for A4 0 85 170 340 510 680 Metres Map Projection: Universal Transverse Mercator Horizontal Datum: Geodetic Datum of Australia 1994 Grid: Map Grid of Australia, Zone 56		LEGEND Site boundary Suburb Dust gauge High volume sampler MET station Real-time monitor Sensitive receiver	
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LOCATION - DRAWN T.M CHECKED A.R APPROVED SCALE refer to scalebar		Centennial Coal DATE 18/03/2016 Figure 1a	

GIS Filename: G:\2218129\GIS\Maps\Deliverables\ShortTerm\2218129_NST002_ShortTerm_DDP_DustData_0.mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:tmorton

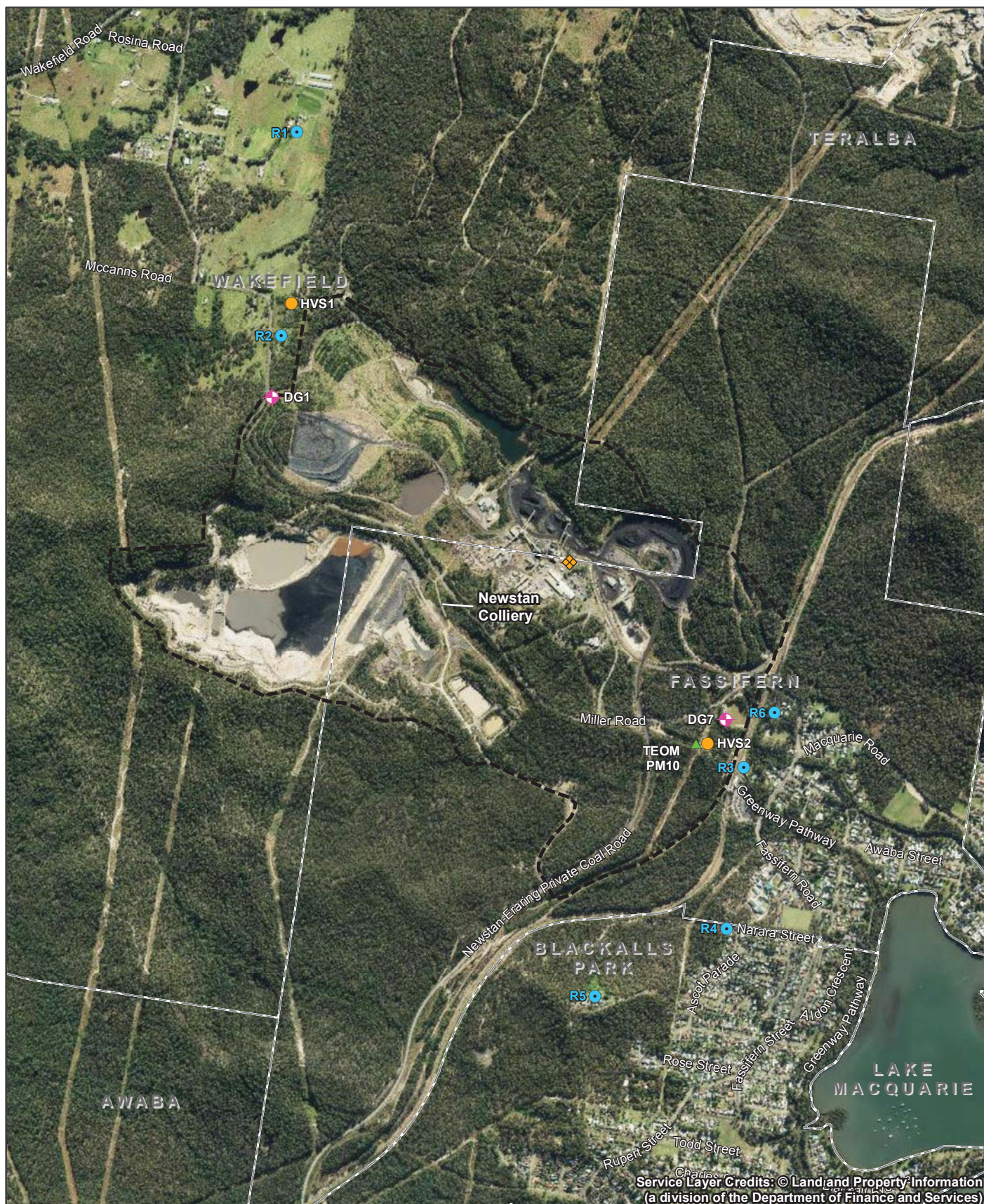


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1:25,000 for A4 0 105 210 420 630 840 Metres Map Projection: Universal Transverse Mercator Horizontal Datum: Geodetic Datum of Australia 1994 Grid: Map Grid of Australia, Zone 56		LEGEND Site boundary Sensitive receiver Dust gauge Real-time monitor Suburb	
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LOCATION - DRAWN T.M CHECKED A.R APPROVED SCALE refer to scalebar		Centennial Coal DATE 18/03/2016 Figure 1b	

GIS Filename: G:\2218129\GIS\Maps\Deliverables\ShortTerm\2218129_NST002_ShortTerm_DDP_DustData_0.mxd

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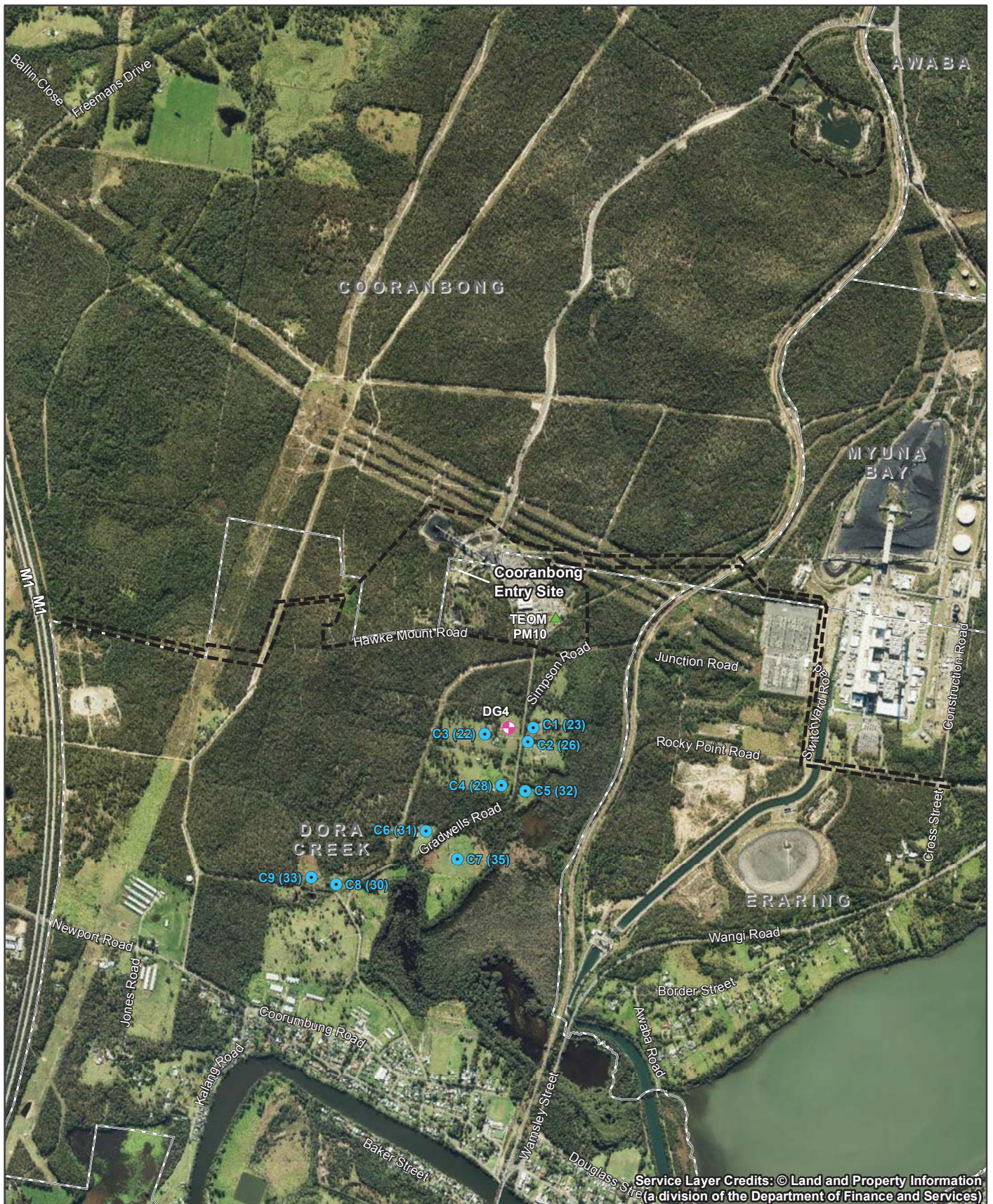


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1:20,000 for A4 0 85 170 340 510 680 Metres Map Projection: Universal Transverse Mercator Horizontal Datum: Geodetic Datum of Australia 1994 Grid: Map Grid of Australia, Zone 56		LEGEND Site boundary Suburb Dust gauge High volume sampler MET station Real-time monitor Sensitive receiver	
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Centennial Coal Northern Region Environmental Monitoring Newstan Colliery Long Term dust monitoring		Centennial Coal DATE 17/03/2016 Figure 2a	

GIS Filename: G:\2218129\GIS\Maps\Deliverables\LongTerm\2218129_NLT002_LongTerm_DDP_DustData_0.mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:tmorton



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1:25,000 for A4 0 105 210 420 630 840 Metres Map Projection: Universal Transverse Mercator Horizontal Datum: Geodetic Datum of Australia 1994 Grid: Map Grid of Australia, Zone 56		LEGEND Site boundary Sensitive receiver Dust gauge Real-time monitor Suburb	
© 2016. Whilst every care has been taken to prepare this map, Centennial Coal Company Limited and GHD (DATA CUSTODIAN) make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.		Centennial Coal Northern Region Environmental Monitoring Cooranbong Entry Site Long Term dust monitoring	
LOCATION - DRAWN T.M CHECKED A.R APPROVED SCALE refer to scalebar		Centennial Coal DATE 17/03/2016 Figure 2b	

GIS Filename: G:\2218129\GIS\Maps\Deliverables\LongTerm\2218129_NLT002_LongTerm_DDP_DustData_0.mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:tmorton

Meteorological monitoring

To satisfy Condition 11 of SSD 5145, meteorological data for Northern Coal Services is measured from the Newstan Colliery Surface Site meteorological station.

The following parameters are required to be monitored:

- temperature ;
- wind speed and direction;
- Sigma-theta; and
- rainfall/humidity;

Monitoring parameter are summarised in **Table 7**.

In addition, the weather station will be capable of continuous real-time measurement of the atmospheric stability category determined by the sigma theta method in accordance with the NSW Industrial Noise Policy.

Table 7 – Northern Coal Services meteorological monitoring

Site ID	X (m)	Y (m)	Parameter	Instrument	Frequency	Purpose
Newstan Colliery	366780	6350350	Temperature Humidity Barometric Pressure Wind – speed and direction Rainfall Solar radiation Sigma-theta	Automatic weather station	10 minute data intervals	Proactive monitoring Weather analysis during noise monitoring Rainfall information

Greenhouse Gas

GHG management and monitoring procedures are documented in **Section 3.2.2** of the AQGHGMP. There are no specific management or monitoring requirements for GHG for Northern Coal Services.

Appendix D – Consultation log

Consultation Date	Description
30 October 2015	Letter sent to the Department of Planning and Environment requesting approval to consolidate the Air Quality and Greenhouse Gas Management Plan into a regional Management Plan.
30 October 2015	Letter sent to the Department of Planning and Environment seeking the appointment of Tristan Gribble of GHD to prepare the Air Quality and Greenhouse Gas Management Plan.
2 November 2015	Letter from the Department of Planning and Environment approving the appointment of Tristan Gribble of GHD to prepare the Air Quality and Greenhouse Gas Management Plan.
17 November 2015	Meeting with the EPA (Sydney) discussed regional approach being undertaken for the development of the management plans.
19 November 2015	Approval received from the Department of Planning and Environment to consolidate the Management Plans into regional Management Plans.
26 November 2015	Meeting with EPA (Newcastle) to which included discussion on management plans.
23 February 2016	Draft Management Plan submitted to the EPA for review and comment.
2 March 2016	Feedback from EPA received. No issues with Management Plan.
24 March 2016	Management Plan submitted to DPE for review/approval.
31 May 2016	Feedback on Management Plan from DPE received.
6 July 2016	Revised Air Quality Management Plan re-submitted to DPE for approval
9 August 2016	Further feedback on Management Plan from DPE received
23 August 2016	Request submitted to DPE seeking approval to submit Management Plan on a staged basis for the Northern Coal Services Project construction activities
1 September 2016	Revised Air Quality Management Plan re-submitted to EPA for review and comment
12 September 2016	Approval from DPE to submit Management Plan on a staged basis for the Northern Coal Services Project construction activities

Consultation Date	Description
19 September 2016	Revised Management Plan re-submitted to DPE for approval
17 July 2017	Revised Management Plan submitted to DPE for approval following Mandalong consent modification & Annual Reviews.
18 May 2018	Revised following Northern Coal Services consent modification
7 June 2022	Revised Management Plan sent to the EPA for consultation.
22 July 2022	Response received from the EPA stating the EPA does not review of comment on management plans.
9 August 2022	Request for information received from the DPE regarding additional items to be addressed in the Management Plan.

DP&E Matters Raised and How Addressed

Description of Consultation	How Addressed in Management Plan
24/03/16 AQGHGMP submitted to DP&E for review/approval. DP&E responded on 31/05/16 by email raising the matters below. Centennial's response dated 6/07/16 is reproduced below.	
The AQGHGMP proposes short and long term monitoring programs (and a transitional period). In Section 4 please summarise the review undertaken by GHD and summarise the outcomes. The Department is generally accepting of removing or relocating monitoring locations that are ineffective, as long as the changes are justified and as long as data continuity is maintained. The Department requires additional information before it can approve the proposed monitoring programs.	Each site specific appendix details the review of the existing monitoring network undertaken with the 'long term' monitoring programme taking into consideration the results of this review. The review recommendations are summarised in the 'long term' monitoring section of each site specific Appendix. It is acknowledged in the site specific Appendix that the ability to assess compliance at the nearest sensitive receptors has not been compromised.

Description of Consultation	How Addressed in Management Plan
When is Centennial proposing to commence the long term monitoring program?	Section 1.4 of the Air Quality and Greenhouse Gas Management Plan acknowledges that to implement the long term strategy, some changes will take time and require discussions and approval from the relevant authorities. The time taken for discussion and approval from relevant authorities is not managed by Centennial, and how long this will take is unknown. Both the short term and long term monitoring programmes will continue to allow the operations to demonstrate compliance with the air quality criteria within the consent.
Has EPA been consulted with on the proposed long term monitoring program?	The consultation log provided as Appendix D to the AQGHGMP details the consultation undertaken with the EPA in relation to the management plan and the approach adopted within the management plan.
The notes on page 72 of the pdf would be better placed earlier in the document.	The notes on page 72 of the pdf have been duplicated under the respective tables for the Mandalong Mine in Appendix A of the AQGHGMP.
Appendix A: Please demonstrate why it is appropriate to reduce the number of monitoring locations at Mandalong and provide more justification than just stating they add little value to the dust monitoring network. Use Appendix B as an example as it sufficiently provides justification for the removal of DG2.	Further justification as to why the air quality monitoring network can be rationalised has been provided in the long term' monitoring section of the Mandalong Mine site specific Appendix.
Table 1: References to Section 0 need to be corrected.	The incorrect reference has been corrected.
Table 1: The wording of condition 10/10(a) does not match the consent, please correct.	The wording of Condition 10(a) in Table 1 of the Mandalong Mine site specific appendix has been corrected.

Description of Consultation	How Addressed in Management Plan
For Table 2 SoC's, please demonstrate if the commitments have been met and what were the outcomes.	Compliance with the statement of commitments is the role of the independent environmental audits required by the conditions of consent. The commitments made are detailed in the environmental management plan as a tool for identifying the management measures that are currently or are required to be implemented. It is not the role of the management plan to determine compliance with the commitments.
Appendices A-D, Table 1, please include the condition numbers.	The condition numbers have been included in the condition consent tables contained within the site specific appendices.
Appendix E, please include a copy of EPA's feedback dated 2 March 2016.	This appears in Appendix D.
AQGHGMP resubmitted to DP&E for review/approval. DP&E responded on 10/10/17 to conditionally accept the AQGHGMP subject to the minor comments below.	
Provide evidence of consultation with the EPA and the Department in relation to the AQGHGMP and indicate how any matters raised have been addressed.	Updates to Consultation Log and 'How addressed' tables in Appendix D.
Liaise with the EPA and seek a variation to the EPL to reduce the number of DDGs at the Delta Entry Site.	Centennial will seek a variation to the EPL as noted by the Department with the 'short term' air quality monitoring remaining in place until the variation is approved.
In Section 6.1 of the AQGHGMP, include a clear definition of what constitutes an air quality incident.	Section 6.1 has been updated accordingly to include a clear definition of what constitutes a air quality incident.
The AQGHGMP should include a table indicating the site-specific conditions of approval/consent that the plan has been prepared to address.	Additional text has been added to Section 1.7.1 to outline that the site-specific conditions of approval/consent are outlined in Appendices A-C.

EPA Matters Raised and How Addressed

Description of Consultation	How Addressed in Management Plan
17/11/15 Meeting with EPA (Sydney) Proposed approach to the development of regional management plans was discussed with the EPA (Sydney).	Development of this regional AQGHGMP.
26/11/15 Meeting with EPA (Newcastle) Proposed approach to the development of regional management plans was discussed with the EPA (Newcastle).	Development of this regional AQGHGMP.
23 February 2016 Letter to EPA requesting review and comment on the draft AQGHGMP.	No actions to be addressed.
2 March 2016 Letter from EPA stating <i>"The EPA has not reviewed these reports and accordingly offers no comments in relation to them"</i>.	No actions to be addressed.
1 September 2016 Letter to EPA requesting review and comment on the revised AQGHGMP.	No response to date and no actions to be addressed.

Appendix E – Awaba Colliery

Conditions of Consent – Awaba Colliery

This Air Quality and Greenhouse Gas Management Plan has been prepared to satisfy the conditions of consent for Awaba Colliery. The conditions of consent that relate to this Air Quality and Greenhouse Gas Management Plan and where they have been addressed is provided below.

Table 1 - Conditions of Consent – Awaba Colliery

Condition No.	Condition of Consent	Where addressed
Schedule 3 Condition 6(a)	The Proponent shall: (a) implement best practice air quality management on site, including all reasonable and feasible measures to minimise the off-site odour, and dust emissions generated by the project including those generated by any spontaneous combustion on site;	Appendix E
Schedule 3 Condition 6(b)	minimise any visible air pollution generated by the project;	Appendix E
Schedule 3 Condition 6(c)	regularly assess the air quality monitoring and meteorological forecasting data, and modify operations on site to ensure compliance with the relevant conditions of this approval, to the satisfaction of the Director-General.	Appendix E
Schedule 3 Condition 7	The Proponent shall prepare and implement an Air Quality & Greenhouse Gas Management Plan for the project to the satisfaction of the Director-General.	This Air Quality and Greenhouse Gas Management Plan was approved by the Secretary in 2011
	This plan must:	
Schedule 3 Condition 7 (a)	(a) be prepared in consultation with OEH, and submitted for approval to the Director-General within 6 months of this approval;	This Air Quality and Greenhouse Gas Management Plan was prepared in consultation with OEH in 2011.
Schedule 3 Condition 7 (b)	describe the measures that would be implemented to ensure compliance with the	Appendix E

Condition No.	Condition of Consent	Where addressed
	relevant conditions of this approval, including the proposed air quality management system;	
Schedule 3 Condition 7 (c)	describe the measures that would be implemented to minimise the release of greenhouse gas emissions from the site; and	Section 3.1 Appendix E
Schedule 3 Condition 7(d)	include an air quality monitoring program, that:	
Schedule 3 Condition 7(d)	uses a combination of high volume samplers and dust deposition gauges to evaluate the performance of the project; and,	Section 3 Appendix E
Schedule 3 Condition 7(d)	includes a protocol for determining exceedances with the relevant conditions of this approval.	Section 6

Overview

Awaba Colliery is a former underground coal mine located on the western side of Lake Macquarie approximately 30 km south-west of Newcastle. The mine was originally state owned, and began operating in 1947 supplying coal to Wangi Wangi Power Station for state-wide electricity generation. Coal production at Awaba Colliery ceased in March 2012. Awaba Colliery is now closed with all coal reserves exhausted. The mine is sealed and there is no access to the underground workings.

Monitoring of air quality has continued since closure. The Awaba Colliery Air Quality and Greenhouse Gas Management Plan 2011 was developed in consultation with OEH in 2011.

This Appendix within the Northern Region Air Quality and Greenhouse Gas Management Plan supersedes the Awaba Colliery Air Quality and Greenhouse Gas Management Plan 2011.

Air Quality Conditions

Air quality criteria of PA10_0038 Schedule 3 (Tables 2, 3 and 4) and are duplicated in **Section 1.9** of the AQGHGMP.

In addition to these criteria the following conditions are also provided in the specified approvals:

Odour

Schedule 3 Condition 3.

The Proponent shall ensure that no offensive odours, as defined under the POEO Act, are emitted from the site.

Greenhouse Gas Emissions

Schedule 3 Condition 4.

The Proponent shall implement all reasonable and feasible measures to minimise the release of greenhouse gas emissions from the site, to the satisfaction of the Director-General.

Site specific dust sources

The following identified sources of dust emissions in the AQGHGMP are relevant for Awaba Colliery operations:

- wind erosion from disturbed areas;
- wheel generated dust from vehicle movements; and
- rehabilitation activities.

There are no additional sources of dust specifically identified for Awaba Colliery.

Site specific dust mitigation and management measures

Awaba Colliery implements dust mitigation in accordance with the mitigation measures outlined in Section 3.1 of the AQGHGMP where relevant.

Key dust mitigation measures for Awaba Colliery operations include:

- signage to display speed limits on all unsealed roads in the surface facilities area
- maintaining buffer zone and surrounding vegetation to act as a filter of airborne dust

Awaba Colliery operates in accordance with the Trigger Action Response Plan (TARP) provided in **Section 5.2** of the AQGHGMP.

Site specific odour sources

Spontaneous combustion may occur within exposed coal seams, coal reject areas or product coal stockpiles. The potential for spontaneous combustion to occur depends on a range of factors including inherent coal properties, moisture content, coal sizing, stockpile configurations, the duration of stockpiling, and the exposure of stockpiles to high prevailing wind conditions.

Awaba Coal mine has ceased mining, has sealed access to the underground workings, and the workings are flooded. There are no stockpiles of coal material, and no reject areas at the site. The risk of spontaneous combustion at Awaba Colliery is considered to be low.

Dust monitoring program

Four dust gauges are operated around Awaba Colliery.

DG1, DG2 and DG4 are located close to historical surface operations and are used as an indicator for dust generation close to operations, however are not sensitive locations.

DG3 is located to be representative of sensitive receptors towards Awaba, north of historical surface operations.

One PM₁₀ HVAS is located at Awaba. Historic PM₁₀ data is being used to calculate the TSP concentrations. The ratio between TSP and PM₁₀ is 0.6. The measured PM₁₀ annual average, as per PA10_0038, will therefore be divided by 0.6 to estimate the annual average TSP concentration.

The dust monitoring network is shown in **Figure 1**.

A summary of the dust monitoring to be undertaken at Awaba Colliery is provided in **Table 3**.

Table 3 – Awaba Colliery dust monitoring locations

Site ID	Easting	Northing	Parameter	Instrument	Frequency	Purpose
DG1	363500	6345365	Dust deposition	DDG	Monthly	Ambient
DG2	363286	6345545	Dust deposition	DDG	Monthly	Ambient
DG3	363364	6345647	Dust deposition	DDG	Monthly	Compliance
DG4	363093	6344972	Dust deposition	DDG	Monthly	Ambient
HVAS	363250	6345986	PM ₁₀	HVAS	Every 6 days	Compliance

Notes:

Ambient – the monitoring equipment is not at a sensitive receiver's location. This monitoring location was selected to provide information regarding dust levels close to sources such as haul roads, ventilation fans or surface operations.

Background – the monitoring site is representative of 'background' levels since it is remote from dust generating activities.

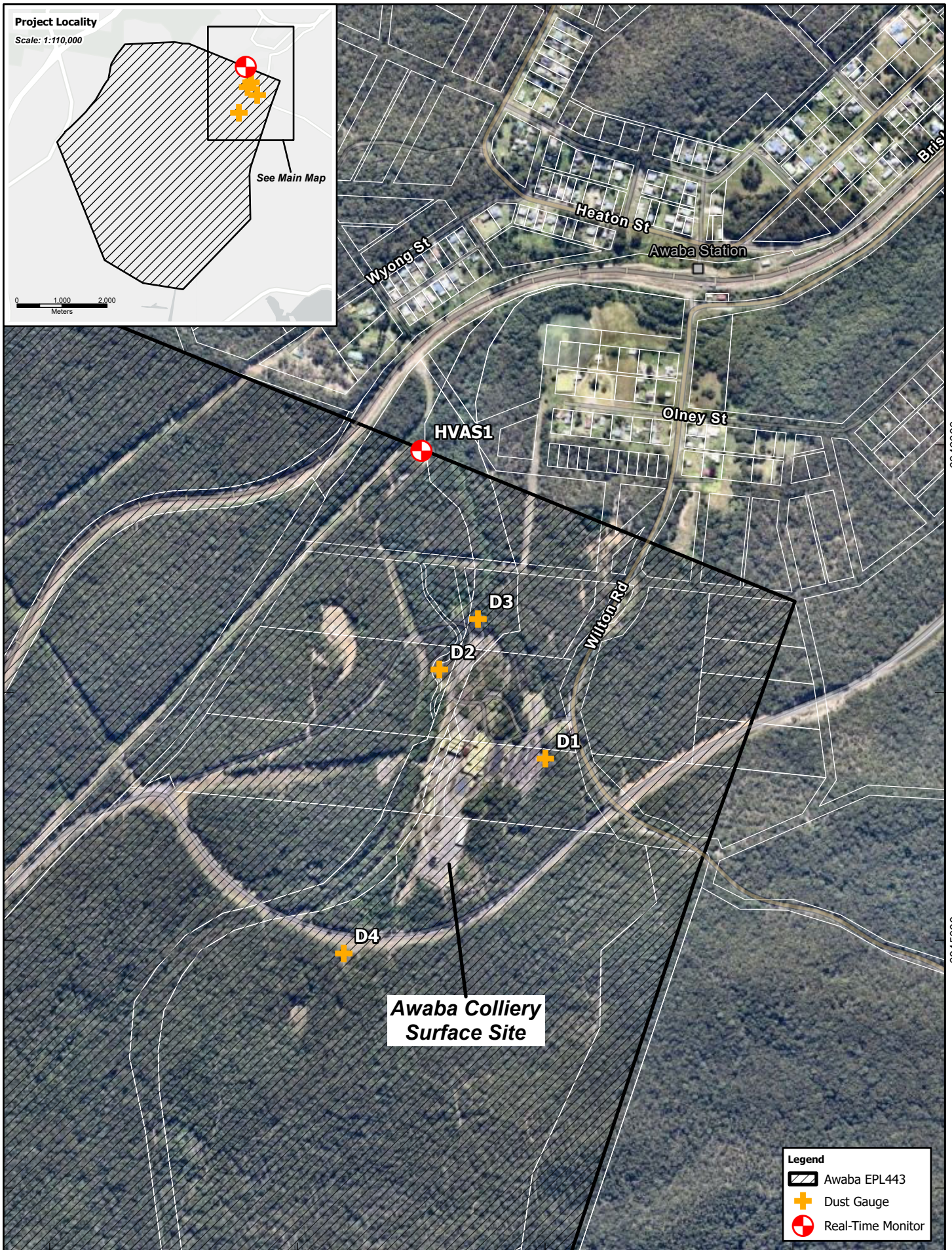
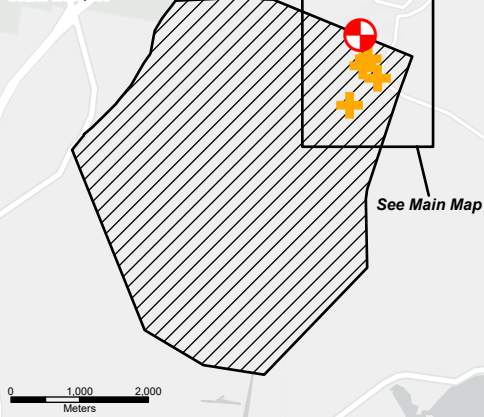
Compliance – the monitoring site is at a sensitive receiver's location and therefore used for compliance purposes.

363000

364000

Project Locality

Scale: 1:110,000

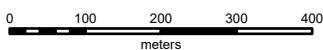
**Legend**

- Awaba EPL443
- Dust Gauge
- Real-Time Monitor

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Coordinate System: GDA2020 MGA Zone 56

LOCATION	Awaba
SEAM	N/A
DRAWN	D.MacBain
CHECKED	A.Ryan
APPROVED	A.Ryan
SCALE	1:10,000 @ A4

**Centennial Coal
Northern Region
Environmental Monitoring
Awaba Colliery
Short-Term Dust Monitoring**



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